Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Hingna Road, Wanadongri, Nagpur - 441 110
NAAC Accredited with 'A++' Grade
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Summary

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- POs, PSOs and COs

Y.C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR

Principal
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road,
NAGPUR - 441110

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Academic Regulations

Nagar Yuwak Shikshan Sanstha's

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ACADEMIC REGULATIONS

Prepared by Dean (Academic Matters) Approved by the

Principal Published by the Registrar

June 2022

Applicable for AY 2022-23 Onwards

		1.11
Principal	**Dean (Acad. Matters)**	**Version**

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Preamble

Yeshwantrao Chavan College of Engineering, Nagpur, the flagship institution of the Meghe Group was founded in 1984 by Nagar Yuwak Shikshan Sanstha under the Chairmanship of Hon'ble Shri. Dattaji Meghe, Member of Parliament. The institution recently celebrated its Silver Jubilee Year. The institution offers 12 undergraduate (B.Tech/BE) programmes with an intake capacity of 1260. The institution also offer 6 full time M.Tech. programs. All eligible programs are accredited by the National Board of Accreditation (NBA). All UG regular programmes are permanently affiliated with Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur. Besides, the Institution is a recognized centre by Rashtrasant Tukadoji Maharaj Nagpur University for Higher Learning and Research.

Over the past 38 years, the Institution has grown to become a centre of excellence in engineering education and a preferred destination for parents, students and leading software & core companies for recruitment of manpower. In the recent year the institution has emerged as highest placement opportunity provider for college students in coveted and core sectors. It is also amongst the select few well performing institutions chosen under Technical Education Quality Improvement Programme (TEQIP) of Govt. of India, funded by the World Bank. The Institution received financial aid to the tune of Rs. 8.42 Crores under first phase of TEQIP, which has been spent on creating state-of-art infrastructure, laboratories, computational facilities, library etc.

YCCE has been granted 'Autonomous Status' by Rashtrasant Tukadoji Maharaj Nagpur University on recommendations of University Grants Commission. YCCE started functioning as an Autonomous College from academic year 2010-11. The purpose of Grant of Autonomy is to promote Academic Excellence. As per National Knowledge commission report of Working group on Engineering Education (March 2008) provided sufficient guidelines for the structure, contents and base for curriculum development for undergraduate engineering education, the curriculum under Autonomy is designed and developed from the invaluable contributions from renowned subject experts from IITB, IITR, IITK, IITD, IISc– Bangalore, BITS Pilani–Goa, SVNIT –Surat, VNIT – Nagpur, MNIT – Jaipur, DAIICT – Gandhinagar and scientists of BARC – Mumbai, NEERI, Nagpur. The cutting edge technology, up-to-date syllabus content at par with current requirement of the industry, effective scheme of examination, gradation pattern and incorporation of New Education Policy (NEP 20) are some of the salient features of academic autonomy.

With recently accredited by NAAC with "A++" grade, YCCE is keen to play a significant role in providing excellence in education by adhering to the International benchmark and to become a role model for other Institution. Accordingly, an Academic Advisory Board comprising of renowned educationists, scientists and industrialists has been constituted. Inception of this Academic Advisory Board for the Institution is very positive step which demonstrates the desire of the Institution to play a key role in emerging global education paradigm in the next decade.

The Institution is also committed towards its social responsibilities by rendering services to the community under different programme. For last many years institution is also implementing 'Fee Waiver Scheme' for economically weaker section, women and physically handicapped meritorious students. The institute is striving to

produce globally competitive and locally relevant engineers and is expected to be a benchmark institute in the global perspective.

OUR VISION

To become the most preferred institution

providing innovative, research and value

based, professional education.

for the society at large.

OUR MISSION

YCCE is committed to:

- **Attract best talent and create learning ambience**
- **Practice Innovative teaching-learning & research**
- **Integrate Industry-Institute Collaborations**
- **Nurture students towards holistic Development and choicest career**

ACADEMIC REGULATIONS

Academic programs of this institution are governed by rules and regulations as approved by Academic Council, which is the highest academic body of the autonomous college. These academic rules and regulations are applicable to all students who are admitted to this college from academic session 2010-2011 onwards.

1.0 Abbreviations and Definitions

1.1 "Autonomous Institution/ College" means an institution / college designated as autonomous by Rashtrasant Tukadoji Maharaj Nagpur University.
1.2 "Academic Autonomy" means freedom in all aspects of conducting academic programs, granted by University for promoting excellence.
1.3 "AC" means Academic Council.
1.4 "AICTE" means All India Council for Technical Education.
1.5 "AIEEE" mean All India Engineering Entrance Examination.
1.6 "ATKT" means Allowed To Keep Terms.
1.7 "BoM" means Board of Management.
1.8 "BoS" means Board of Studies.
1.9 "Branch" means specialization in a program like B.Tech/B.E. in Civil Engineering or M.Tech. in CAD/CAM.
1.10 "CA" means Continuous Assessment.
1.11 "CGPA" means Cumulative Grade Point Average.
1.12 "CoE" means Controller of Examinations.
1.13 "Commission" or "UGC" means University Grants Commission.
1.14 "Course" or "Subject" means a theory/ practical/ other item mentioned in the Scheme of Examination, identified by the number and title.
1.15 "DAC" means Disciplinary Action Committee.
1.16 "DAM" means Dean (Academic Matters).
1.17 "DSA" means Dean (Students Activities).
1.18 "DTE" means Directorate of Technical Education, Government of Maharashtra.
1.19 "ESE" means End Semester Examination.
1.20 "FYC" means First Year Coordinator.
1.21 "GATE" means Graduate Aptitude Test in Engineering.
1.22 "Government" means Government of Maharashtra.
1.23 "Institution" or "College" or "YCCE" means Yeshwantrao Chavan College of Engineering, Nagpur unless indicated otherwise.
1.24 "M.E." means Master of Engineering by Research Program.
1.25 "MSBTE" means the Maharashtra State Board of Technical Education.
1.26 "MSE" means Mid Semester Examination.
1.27 "PTDP" means Bachelor of Engineering (B.E.) Part Time Degree Program.
1.28 "Post graduate or PG Program" means Master of Technology (M.Tech.) degree program.
1.29 "RRMC" means Result Review and Moderation Committee.
1.30 "SGPA" means Semester Grade Point Average.
1.31 "SoE" means Scheme of Examination.

1.32 "RTMNU " or "University" means Rashtrasant Tukadoji Maharaj Nagpur University

1.33 "TA" means Teachers Assessment.

1.34 "Undergraduate" or "UG" Program means Bachelor of Engineering (B.E.) or Bachelor of Technology (BTech) degree program.

1.35 "SM" means Student's mentor
Please be noted that where the words "he", "him", "his", occur, they also mean "she", "her" and "hers".

2.0 Programs offered

YCCE offers programs at UG, PG and doctoral level as per following

2.1 Following are the branches of study of UG program (Full Time):

- Civil Engineering
- Mechanical Engineering
- Electrical Engineering
- Electronics Engineering
- Electronics and Telecommunications Engineering
- Information Technology
- Computer Technology
- Computer Science & Engineering
- Artificial Intelligence and Data Science
- Computer Science and Design
- CSE (AIML)
- CSE (IoT)

2.2 Following are the branches of study of PG programs (Full Time):

Name of the department offering the Program	Title of Post Graduate Program
Civil Engineering	1. Structural Engineering 2. Environmental Engineering
Mechanical Engineering	CAD-CAM
Electrical Engineering	Integrated Power System
Electronics Engineering	
Electronics and Telecommunications Engineering	Communication Engineering
Computer Technology	Computer Science Engineering
Computer Science and Engineering	

2.3 The Institution also offers the Doctoral Program leading to degree of Ph.D. in the departments.

3.0 Admission to full time UG programme in Engineering

3.1 Admissions to the first year of all the programmes shall be made through the Maharashtra Combined Common Entrance Test (MHT-CET) conducted by the Government of Maharashtra or on the basis of performance in Joint JEE Mains All India Engineering Entrance Examination (AIEEE) conducted by Central Board of Secondary Education.

3.2 The intake capacity of each Programme, criteria for reservation, eligibility requirements shall be as decided by the AICTE/Government/ DTE directives.

3.3 The Institution shall also admit to first year of the programmes, a limited number of students at Institution Level as per the quota decided by Government.

3.4 The selected student will be admitted to the UG programme after he / she fulfills all admission requirements as indicated in the offer letter issued by the Competent Authority.

3.5 Candidates have to fulfill the medical standards required for admission as set out in the information brochure of MHTCET/JEE and/or RTMNU.

3.6 If at any time after admission, it is found that a candidate has not fulfilled all the requirements stipulated in the offer letter of admission, the Principal/ Director of the Institution may revoke the admission of the candidate and report the matter to the BoM and concerned government authorities as necessary.

4.0 Admission to Direct Second Year of UG Degree Program in Engineering

There shall be a lateral admission to all courses in the Second year for students having Diploma in Engineering in equivalent branches on merit basis through an admission process directly in accordance with the Rules and Regulations of DTE every year. The number of seats offered to students for admission is decided by the Government of Maharashtra every year. The admission process is conducted by the DTE, Maharashtra State.

5.0 Admission to Part Time Degree Programs in engineering

The section is deleted as the Part Time Program admissions are closed since academic session 2011-12

6.0 Admissions to PG engineering programs

The admission to PG programs will be offered to

a) The candidate who possesses a Bachelor's Degree in Engineering/Technology from educational institutions approved by AICTE/Government of India OR M.Sc. OR Candidate in final semester of program OR AMIE in respective discipline.

b) The candidate who has a valid GATE score as per requirements of RTMNU & DTE Maharashtra.

c) In case of non availability of sufficient number of GATE qualified candidates, the vacant seats will be offered to candidates without GATE score on the basis of their performance in entrance examination PG-CET conducted by

the Govt. of Maharashtra as per the inter-se merit.

A student should have obtained the eligibility certificate from the RTMNU if he has passed the qualifying examination from other than RTMNU.
The admissions will be done as per existing rules of Govt. of Maharashtra.

7.0 The eligibility for registration to ME by research program in engineering

The Clause is withdrawal as ME by Research Programme is discontinued by RTMNU

8.0 The eligibility for registration to doctoral degree in engineering

The candidates possessing educational qualifications as specified by the RTMNU can register for Doctoral Degree programs in engineering. The candidate's registration shall have to be confirmed by RTMNU.
A student should have obtained the eligibility certificate from the RTMNU if he has passed the qualifying examination from other than RTMNU.

9.0 The eligibility for registration to doctoral degree in science

The Clause is withdrawn as per the directions of RTMNU

10.0 Enrolment:

The students admitted to the programs offered by the Institution will be enrolled at RTMNU, soon after the admission, if he is not enrolled earlier. The candidature of the student will be provisional till his enrolment is accepted and an enrolment number is assigned by the RTMNU.

11.0 Duration of Degree Programs

11.1 Minimum Duration of the programs:

a) The full time UG Programme shall be of four years / eight semester duration. For those students who are admitted directly to Second Year of regular BE program, the minimum duration shall be of three years/ six semesters.

b) The full time PG Programmes shall be of two years / four semester duration.

c) The Doctoral Programmes shall be as per the directives of RTMNU.

12.0 Fees to be charged for the Under Graduate, Post Graduate and Research degree programs

12.1 For the UG (Full time & Part time) and PG programs, the tuition and other fees charged to students over the duration of programmes shall be as per the approval of the Competent Authority set up by the Government. The dates for payment of fees will be declared well in advance and intimated to the students through the website and other notices.

12.2 The tuition and other fees payable by the student will have to be deposited in the institution's office/bank as prescribed by the Competent Authority, as per the given dates in the calendar of activities. The dates for payment of fees will be declared well in advance and intimated to the students through the website and other notices.

12.3 For the doctoral degree programmes, the tuition and/or other fees charged to students over the duration of the programmes shall be as decided by the BoM.

13.0 Scheme of Examination

Every Programme has a prescribed course structure which, in general terms, is known as Scheme of Examination (SoE). It prescribes courses to be studied in each semester. The details of the SoE are as follows:

13.1. Every Programme shall have a SoE and course contents (Syllabi) for the courses recommended by the BoS and approved by the AC.

13.2. Composition of the SoE for

UG programs:

a) Basic Sciences, Basic Engineering Sciences, Humanities and Management, and related engineering courses.
b) Professional Core engineering courses related to the concerned discipline.
c) General Proficiency courses and Professional Development courses.
d) Professional Electives.
e) Free Electives / Open Electives / Experiential learning as per NEP 20
f) Seminars and Project.
g) Other requirements such as Industrial training/Industrial visits / Mandatory Learning Courses etc.

PG programs:

h) Professional Core engineering courses related to the concerned discipline.
i) Professional Electives
j) Seminars and Project/Dissertation

13.3. The Institution shall follow a semester system. The academic year is divided into two main semesters. Main semesters are for regular class work.

13.4. Each main semester shall be of 19 weeks duration inclusive of registration, course work, examinations, assessment etc.

13.5. Course Credit System/Structure

A student earns the credits for a particular course by fulfilling the academic requirements viz. attendance and evaluation. There are mainly two types of courses-Theory courses and Laboratory courses. Theory courses consist of Lecture (L) hours and some courses may have Laboratory Practical (P). In Laboratory courses (P) a student shall have to earn credits while working in a Laboratory/Drawing hall/Workshop/assigned place of learning. The total credits required for completing a program shall be between160 +, as per the guidelines of All India Council Of Technical Education (AICTE New Delhi); while for students admitted under lateral entry will have to earn around110 to 120 credits (The exact number shall be as mentioned in the SoE). The total number of credits in a Semester which a student shall register will be as prescribed in the SoE of the specific branch from SoE 2018-19 and SoE 22 onwards.

Number of credits for a course in any semester is generally calculated as follows.

Table 1

Sr.No	Course	hour / week	Credits for UG	Credits for PG
1	Lecture	1	1	2
2	Tutorial hour / week	1	1	2
3	Workshop / Laboratory/ Drawing hours / week	2	1	2
4	Seminar	1	1	2
5	Mini Project		4	14
6	Major Project		6	20

13.6 Medium of Instructions:
The medium of Instruction for all coursework, examination and all academic activities shall be English.

13.7. Mandatory Learning Courses
A student will be guided to register for number of Mandatory Learning Courses (MLC) during the entire UG Program. Students shall opt for MLC as per the directions of Academic Council.

Mandatory Learning Courses (MLC) shall not carry any credit but shall be a pre-requisite to successfully complete the same and shall be reflected in Grade Card as "MLC" and will be awarded "G" grade if student passes the course with minimum attendance and evaluation requirements. However, these will not be considered in the CGPA calculation.

If a student is unable to secure a "G" grade, he/she will be awarded "H" grade. For such cases, the student will either re-appear in examination or

re-register for the same course whenever the opportunity arises in subsequent semester.

13.8 Seminars

Seminar is a course requirement wherein under the guidance of a faculty member a student is expected to do in depth study in a specialized area by doing literature survey, understanding different aspects of the problem and arriving at a status report in that area. While undergoing a seminar course, the student is expected to learn investigation methodologies, study relevant research papers, correlate work of various authors/ researchers critically, study concepts, techniques, prevailing results etc., analyze it and present a seminar report. It is mandatory to give a seminar presentation before a panel constituted for the purpose.

13.9 Comprehensive viva

The Clause is withdrawn.

13.10 Projects/Dissertation

Project/ Dissertation is a mandatory course requirement, wherein, under the guidance of a faculty member, a final year student is required to do some innovative work with application of knowledge gained while undergoing various theory and laboratory courses of study. The Project/Dissertation may be related to a theoretical analysis, an experimental investigation, a proto-type design, a new correlation and analysis of data, fabrication and setup of new equipment. The student is expected to do literature survey and carry out development and/or experimentation. Through the project work, the student is expected to exhibit both the analytical and practical skills.

A student will carry out the Project/ Dissertation work under the guidance of the faculty supervisor from the same department unless specifically permitted by the Head of the Department for alternate arrangements. The registration for the Project/ Dissertation work is normally in two phases, each spread over a semester. The mini project shall commence in 7th semester and the major project shall commence in 8th semester. At the end of the first phase, the student is required to submit report of his work by a prescribed date to the Course Coordinator and present it to a Panel of Examiners. The major project name may be continued in the subsequent semester or the major project can be altogether different.

The student shall register the title along with Project/ Dissertation synopsis within a month from the date of registration by the date provided in the Academic Calendar. The change in title, if any, shall be allowed once, provided such request is received from student duly approved by the supervisor, Chairman BoS of respective Board and DAM.

The student will submit the report on Project/ Dissertation work in the format prescribed by the Institution.

The final project/dissertation report should be submitted by the prescribed date.

Generally there should not be any extension in the schedule for dissertation report. However, for genuine reasons (such as medical reasons (Accident and / or hospitalization of a student) or other emergency circumstances (death of immediate close relative i.e. father, mother, brother and sister), extension in submission of dissertation report beyond the date specified in the calendar for one month with permission from Chairman, BoS, may be granted. If the dissertation cannot be completed due to valid reasons, student will be temporarily awarded 'Z' grade at the time of finalization of grades. The 'Z' grade will be converted to a performance grade when such a student submits the report and undergo the oral examination. Further, if such late reports are not submitted, the 'Z' grade will be automatically converted to 'F'.

Re-registration for the Project/ Dissertation will be required in the following semester if a student secures "F" grade in a project/dissertation work. He may submit the project/dissertation immediately after re-registration, if desired.

SEMISTER LONG INTERNSHIP FOR FINAL PROJECT
Students who are undergoing semester long / year long internship will complete their project work at the Industry where he/she is doing the internship, provided the industry permits to do so. Otherwise the students has to complete major project under the guidance of allotted supervisor.

13.11 Practical / Industrial Training

Each department shall have the flexibility to specify Practical Training as a part of minimum requirement for award of degree. Practical training will be done in summer term following fourth/sixth semester of UG program. The minimum duration for practical training shall be five weeks. The training shall be done in industry or R&D institutions in India/abroad. The institution may offer the Campus Recruitment Training or other similar modules to students against this course in SoE.

The student will have to submit the documents of attendance and the report of training in the specified format. The evaluation of the training on the basis of report submitted by the student will be done in seventh semester of UG.

13.12 Work Visit

Some departments may prescribe work visit as part of the curriculum. Under this, the students will visit an industry/site to get exposure of various technologies employed in industry.

14.0 Course code and Course Numbering Scheme

Course Numbers are denoted by five digit unique alpha numeric characters. First two characters represent the department offering the course. The third character represents the level of course, 1 being the level of first year while 4 represents final year. The fourth and fifth character represents a sequential number assigned by the department offering the course. The numeric part of the course number indicates the level of the course.

Example: CV101 means a course offered by the department of Civil Engineering for First Year, the last two characters (01) represent the first course on the list of department. CV2--, CV3--, CV4-- for 2nd, 3rd and 4th year; CV5--, CV6--, CV7--, CV8-- for 1st, 2nd, 3rd and 4th year Part-time courses and CV9-- for PG courses.

For the scheme called "Autonomous 2014" applicable from 2014-15 to First Year Batches, the course code shall consist of six alpha numeric characters. First two characters represent the department offering the course. The third and fourth characters represent the level of course, 11 being the level of first year while 14 represents final year. The fourth and fifth character represents a sequential number assigned by the department offering the course.

For the new scheme called "Autonomous 2018" applicable from 2018-19 to First Year Batches, the course code shall consist of six alpha numeric characters. First two characters represent the department offering the course. The third and fourth characters represent the level of course, 21 being the level of first year while 24 represents final year. The fourth and fifth character represents a sequential number assigned by the department offering the course.

For new B.Tech scheme called "Autonomous 2022" applicable from 2022-23 to First Year Batches, the course code shall consist of seven alpha numeric characters. First two characters represent the year of commencement of SoE, next two/three characters represent programme depending upon UG/PG. The last three character represents course number depending upon year & semester of it's implementation. The fourth and fifth character represents a sequential number assigned by the department offering the course.

15.0 Change of Branch:

Students are eligible to apply for a change of branch only after successfully completing the first two semesters of UG. The rules/ guidelines shall be as per the following directives in place; issued by the Government.

15.1 Change of branch and /or shift shall be offered to the candidates, if clear vacancies exist.

15.2 Students must apply for change of branch/shift within 15 days after the declaration of the second semester result by stating their choices in order of preference.

15.3 All such transfers shall be permitted only at the beginning of the third semester.

16.0 Registration

16.1. Faculty Mentor (Mentor/ Mentee scheme)

A student or a group of students is assigned to a faculty mentor from the concerned department or from FY Department, who will mentor the student from his third semester to final of B.Tech/BE in the Institution. The students are expected to consult the faculty advisor on any matter relating to their academic performance and the courses they may take in various semesters. The Faculty Mentor is assigned to extend guidance to the students enabling them to complete their courses of study for the required degree in a smooth and timely manner. The Faculty Mentor is the person to whom the parents/guardians should contact for performance related issues of their ward. In view of the guidance to the students, the role of Faculty Mentor is outlined as below

16.1.1. Guidance about the rules and regulations of the courses of study for a particular degree.

16.1.2. Pay special attention to weaker students in coordination with course teacher.

16.1.3. Liaison with parents for the academic performances and other personal problems of their wards.

16.2 Registration for the First Two Semesters of UG

The students admitted to the First year of UG course will have to register for the courses as per the advice of Faculty Mentor. There are no requirements of accumulated credits for registration to first two semesters.

16.3 Registration for third and subsequent semesters of UG. (Second year onwards)

16.3.1. For registration in third semester of UG, a student must have earned a minimum of 60% credits of first two semesters. The students who are admitted under lateral entry scheme, there shall be no minimum credit requirement.

16.3.2. For registration at fifth semester of UG, a student must have earned all the credits of first two semesters and at least 60% credits of third and fourth semesters. For students admitted under lateral entry, a minimum of 60% credits must have earned for registration to fifth semester.

16.3.3. For registration at seventh semester of UG, a student must have earned all credits of first to fourth semesters and at least 60% Credits of fifth and sixth semesters. For students admitted under lateral entry, a student must have earned all credits of third and fourth semesters and at least 60% Credits of fifth and sixth semesters.

16.3.4 A student will be allowed to register for the courses only if he/she has cleared all financial dues of the previous year / semester of the Institution and/or Hostel.

16.3.5. A student will not be able to register for the courses if he has been debarred from registration on specific grounds.

16.4 Registration of PG students

16.4.1 There are no requirements of accumulated credits for registration to first two semesters of M. Tech. Degree Program

16.4.2 A student should have earned at least 75% of the stipulated credits for first two semesters for admission to third semester of the M.Tech. Degree Program.

16.4.3 In case the required credits as per above clause are in decimals, the value after the decimal point will be ignored. This means the required credits will be rounded off to lower integer value.

16.5 Each student shall be required to register for course work on the advice of Faculty Mentor at commencement of each semester on the day fixed for such registration and notified in academic calendar. Registration will involve filling up a registration form by stating the theory course / Laboratory / Workshop / Seminar / Project, etc.

16.6 Each student shall also register for the Group Discussions/Personality Development / Special courses as per direction of Academic Council.

16.7 Student who fails to register for course work on notified day may be permitted by the Department for late registration on another notified day after payment of additional fee fixed by the Institution.

16.8 If a student is not in a position to register during any semester, he shall obtain prior permission from the DAM; his admission to that semester will be cancelled.

16.9 A student shall re-register in all failed courses whenever they are offered.

16.10 Freedom to change the course during re-registration is offered only for electives.

16.11 A student will not be permitted to re-register for the courses they have already passed during the period of study.

16.12 A student whose CGPA is less than minimum threshold limit (5.0 for UG programs and 5.5 for PG programs), may be permitted to register for lesser number of courses in consultation with Faculty Mentor, but not below 16 credits in any case.

16.13 A student who has passed in all the course heads obtaining grades between 'A+' and 'D' will have the option to register for one or more courses to improve the CGPA.

16.14 Evaluation of the students admitted under Lateral Entry after Diploma

The students admitted shall have to register for the courses at the third semester of the Programme to which they are admitted; in consultation with the Faculty Mentor. Further, they shall undergo additional academic requirements, if any, as specified by the Academic Council.

16.15 Entry of Students from University Pattern to Autonomous Pattern

A student of this Institution studying under RTMNU pattern can be absorbed into autonomous pattern course to conditions mentioned below:

A student can be absorbed into autonomous pattern in any semester provided he has fully passed all previous semesters in University pattern.

When student switches over from university pattern to autonomous pattern, he shall be presumed to have earned credits of all courses offered in previous semesters of that programme in autonomous pattern. The SGPA of such student shall be calculated for each semester he has passed under RTM Nagpur University or equivalent university as per absolute grading system as.

SGPA= (% marks scored at the semester+7.5) /10 for percentage of marks scored by student up to and equal to 85% OR
SGPA= 9.25 for percentage of marks scored above 85%.

If a student has passed a semester in RTM Nagpur University or equivalent program, he shall be presumed to have earned all credits prescribed for equivalent semesters in autonomy.

16.16 A student who becomes ineligible for admission to the higher year/semester due to non-accumulation of required credits at the immediately lower semester/year and has thus been forced to discontinue for a year, then he may seek readmission to the said semester/year of the program. In such case of readmission, the courses passed by a student, credits, related grade and grade points obtained by the student from the courses in that semester shall be null and void. A student shall have to earn the credits from all the courses in the said semester/year afresh as per the existing scheme of examination and related syllabi content.

17.0 Course Completion:

A student will have to complete all the requirements for the courses at which he is registered. The HoD will report the names of students who failed to complete the stipulated requirements in course(s), if any, to CoE at least 07 days ahead of commencement of ESE. Such student will not be permitted to take the ESE for the courses where he has not completed the course requirements. He shall, however, be eligible to take the ESE in other courses where he has completed the course requirements satisfactorily.

18.0 Evaluation

The AC will decide from time to time on the system of examinations in each course in each semester. The current practice of Assessment is as follows:

18.1. A student is evaluated for theory courses through Teachers Assessment (TA), two mid semester examinations (MSE) and one End Semester Examination (ESE)

18.2. The relative weightage is 20% for TA, 30% for MSE, and 50% for ESE. The teacher shall announce the method of TA at the beginning of the semester. All MSE and ESE are compulsory for all students. The marking will be on absolute basis. The total marks are calculated in each course as per the weightage indicated above. No credits are awarded if the student remains absent in the ESE.

18.3. The laboratory courses will have Continuous Assessment (CA) which will be based on punctuality, turn to turn assessment of student's work, quality of records maintained, group discussions, overall understanding of the experiment and viva-voce examination (as per requirement of structure of course). The CA for laboratory courses shall be 60% and ESE may be on an experiment or viva or written test or a combination of these, and shall carry a weightage of 40%. Practical courses with 100% continuous evaluation will not have ESE. The student shall either successful complete the course or shall get I grade if the course work is not satisfactory.

18.4. The instructor shall announce the mode of evaluation and distribution of marks for CA at the beginning of the laboratory course. It is obligatory for students to maintain and submit laboratory journal, drawing sheets, prescribed documentation for the laboratory course, jobs in Workshop and reports, wherever necessary.

18.5. The MSE and ESE shall be conducted centrally as per the schedule announced in the academic calendar.

18.6. The ESE shall be conducted for the duration as given in SoE and will be held as per the schedule declared in the Academic calendar for that semester. The detailed time-table for this will be declared at least one week before the commencement of ESE by the CoE.

18.7 The question paper formats will be displayed on notice boards/ Institution website for information of the students.

18.8. All examinations and other modes of evaluations, under TA, announced by the teachers with the approval of HoD/ Chairman of BoS are compulsory.

18.9. Assessment of Seminars, Mini-projects, Major Projects, Dissertation etc:
Every student has to undertake Seminars/Projects of professional nature and interest. It will be evaluated on the basis of the quality of work carried out, the report submitted and presentation(s) during the Seminar. A panel of examiners shall evaluate the dissertation report and an oral examination shall be conducted in ESE. The assessment of the dissertation work shall be done on preliminary presentation; initiative, interest, effort and regularity shown and oral examination.

18.10 The assessment of the project will be as per the details given in the Scheme of Examination. The TA for the project Phases 1 and 2 will be based on the seminars, reports, technical achievements, analytical skills exhibited in solution to the problem and dissertation.

18.11 Project evaluation of PG:

Evaluation of dissertation will be taken up only after the student completes all the core as well as elective course requirements satisfactorily.

a. The dissertation work shall be evaluated by midterm seminar(s), quality of work carried out, dissertation report submission and the viva-voce examinations.
b. A panel of examiners shall evaluate the dissertation report and an oral examination shall be conducted in ESE. The assessment of the dissertation work shall be done on preliminary presentation; initiative, interest, effort and regularity shown and oral examination.
c. The examination of the Project/ Dissertation will be conducted by a panel of examiners consisting of the department committee and at least one external expert, preferably from an Industry.

18.12 Rescheduling of MSE-I and MSE-II

If a student misses to take the Mid Semester Examination, he can apply for RE-MSE as per the time table framed as per the time slot provided in Academic Calendar. The students is permitted to take RE-MSE only for the subject in which he/she was absent.

HoD will be the authority to grant permission, draw out Time table and run the tests. The case papers will have to be sent to DAM office for record.

18.13 Examination form submission

The students shall submit an examination form in order to be eligible for evaluation.

18.13.1 All the regular student shall submit an examination form for all the courses for which he has registered for the semester by date mentioned in the notice of examination published by the institution.

18.13.2 If a student has re-registered for one or more courses in the semester, he shall submit an examination form for all the courses for which he has re-registered in the semester.

18.13.3 An ex-student shall submit the form for the courses in which he has failed in earlier examinations and intends to take the ensuing examination.

18.13.4 A student shall pay the examination fee as decided by the competent authority.

18.14 Forego of Continuous Assessment marks:

18.14.1 The in-sem evaluation of the theory or lab course shall be carried for his first attempt as a regular student and if the student fails then in the subsequent re-sit examination of the same term. If the student does not pass the course and attempts the examination in such course again in any subsequent examination, then he/she shall exercise an option to forego the marks of in-sem

examination, if he/she wishes so, while applying for the examination.

18.14.2 If the marks of in-sem are foregone by the student, then his/her marks secured out of 50 in ESE shall be proportionately extrapolated to 100.

18.14.3 The decision to forego of continuous Assessment marks will be irrevocable.

18.14.4 The facility to forego of continuous assessment will not be applicable to Project in final Year of UG and PG programs.

19.0 The Grading System

19.1 The evaluation of students will be done on the basis of grades as detailed below

19.1.1 For every course, the students will be evaluated on the basis of the grading system. Table 2 shows the various grades that can be awarded to students.

19.1.2 For every course taken by a student, he will be assigned a grade based on his combined performance in all the assessments. The grade indicates a qualitative assessment of the student's performance and is associated with equivalent number called a grade point.

19.1.3 The academic performance of a student shall be graded on a ten-point scale. The grades and their equivalent grade points are listed in Table 3.

19.1.4 The Grades (up to D only) awarded to a student in all the courses shall be converted into a semester performance index and cumulative performance index called the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) respectively.

19.1.5 A student who has secured marks out of 100 and they are more than the minimum cut off as defined by Table No 2 (Statistical Method) or 4 (Absolute method) of AR, will be awarded suitable pass grade in that course only if he has scored at least 20% marks at ESE in that course. This provision will be applicable to students of UG and PG programs who are studying under "Autonomous 2014" scheme, "Autonomous 2018" scheme and , "Autonomous 2021" scheme, and Autonomous 2022 scheme.

19.2 Statistical Method for the Award of Grades

19.2.1 Award of Grades in a course

For the award of grades in a course, all component-wise evaluation shall be done in marks.

The marks of different components viz. Teachers Assessment (TA),

Mid-Semester Examinations (MSE), End-Semester-Examination (ESE), would be reduced to relative weightages of each component as given in Scheme of Examination. Marks so obtained would be converted to grades at the end of semester, as per the guidelines given below:

For 30 or more number of students in a course, the statistical method shall be used with marginal adjustment for natural cut-off. The mean (X) and the standard deviation (σ) of marks obtained of all the students in a course shall be calculated and the grades shall be awarded to a student depending upon the marks and the mean and the standard deviation as per Table 2 given below.

Whenever a course examination has less than 30 students, grades will be based on absolute marks and conversion will be done as per Table No. 4

If there are regular as well as ex-students at the examination, the grade cut off will be calculated on the basis of marks scored by regular students and will be applicable to all students.

Table 2 : Awards of Grade Using Statistical Method

Table showing method for conversion of marks into Grades			
RANGE OF MARKS			**GRADE**
>= X + 1.5 σ			A+
>= X + 1.0 σ	To	< X + 1.5σ	A
>= X + 0.5 σ	To	< X + 1.0 σ	B+
>= X	To	< X + 0.5 σ	B
>= X - 0.5 σ	To	< X	C+
>= X - 1.0 σ	To	< X - 0.5σ	C
>= X - 1.5 σ	To	< X - 1.0 σ	D
< X - 1.5 σ			F
Where X is arithmetic mean and σ is Standard deviation			

19.2.2 The award of grades will be subjected to the following process:

A) THEORY COURSES

If (X-1.5 σ) > 40 then grade calculation for C+ ,C, D& F shall be as given below , while that for A+,A,B+ & B shall be same as per Table 2 of the Academic Regulations

C+ = > X – (X – 40)/3,
C ≥ X – (X – 40) X 2/3,
D ≥ X – (X – 40) X 3/3,
F ≤ X – (X – 40) X 3/3

B) THEORY COURSES

If (X - 1.5 σ) < 40 for all those theory courses with passing marks of 40 then lower limit for award of D grade shall be reduced up to 35 marks step by step, so that failure % as calculated by formula, $\left(\frac{(Number\ of\ students\ having\ F\ Grades)}{(Total\ \text{Students - Detained Students})}\right)\times 100$ Should not exceed 15%.

C) PRACTICAL COURSES:

If (X-1.5 σ) < 50 then Cutoff for passing shall be 50.
But if (X - 1.5 σ) > 50 then grades calculation for C+, C, D & F shall be as given below, while that for A+, A,B+ & B shall be same as per Table 2 of the Academic Regulations

C+ = > X – (X – 50)/3 ,
C ≥ X – (X – 50) X 2/3 ,
D ≥ X – (X – 50) X 3/3 ,
F < X – (X – 50) X 3/3

19.2.3 The grades awarded to the students will be converted into the equivalent grade points according to the Table no. 3

Table 3: Grades, Equivalent Grade Points & Academic Performance

Academic Performance	Conversion of Grades into Grade Points	
	Grade	Grade Point
Outstanding	A+	10
Excellent	A	9
Very Good	B+	8.25
Good	B	7.5
Average	C+	6.75
Below Average	C	6
Marginal	D	5
Poor	F	0
Satisfactory completion of Audit Course	G	Nil
Non completion of Audit Course	H	Nil
Incomplete Course requirements	I	Nil
Revoking of Continuous Assessment marks	T	Nil

19.2.4 If the number of examinees at the examination is less than 30, in a particular course, then Table 4A will be used for theory courses while Table 4B will be used for Non Theory courses like Practicals, Seminars, Projects etc. for award of grades.

Table No.4 A

Range of Marks	Grades
Marks equal to or greater than 90 %	A+
Marks equal to or greater than 80 % but less than 90%	A
Marks equal to or greater than 72 % but less than 80%	B+
Marks equal to or greater than 64 % but less than 72%	B
Marks equal to or greater than 56 % but less than 64%	C+
Marks equal to or greater than 48 % but less than 56%	C
Marks equal to or greater than 40 % but less than 48%	D
Marks less than 40%	F

Table No.4 (B) (For Non Theory Courses)

Range of Marks	Grades
Marks equal to or greater than 90 %	A+
Marks equal to or greater than 80 % but less than 90%	A
Marks equal to or greater than 70 % but less than 80%	B+
Marks equal to or greater than 62 % but less than 70%	B
Marks equal to or greater than 58 % but less than 62%	C+
Marks equal to or greater than 54 % but less than 58%	C
Marks equal to or greater than 50 % but less than 54%	D
Marks less than 50%	F

19.2.5 Provided further, the calculation of arithmetic mean (X), Standard Deviation (σ), upper and lower cut offs of the various grades will be computed by using the marks scored by regular students at the examination for an individual course and the same values of grade cut-offs shall be used for processing the result of regular as well as ex-students appearing at the same examination. These cut off marks for the upper and lower limits of grades shall remain same for the re-sit examination of that term only. (i.e cutoff of ODDESE will be applicable to ODD RESIT and cutoff of EVEN ESE will be applicable to EVEN RESIT).

Students appearing for examination as Ex-Student, where there are no regular students, the grading will be done by absolute grading system. (e.g. In ODD ESE students of IV, VI, VIII semester appearing as Ex-Students will be awarded grades as per absolute grading table.)

In case of students appearing for examination in Summer Term, only absolute grading table will be used for awarding grade.

19.2.6 Explanation:

'F' Grades

A student who was awarded "F" grade in a core course has to repeat it compulsorily when it is offered next and until a passing grade is obtained.

For the elective courses in which 'F' grade has been obtained, the student may take the same course or any other course from the same category.

Further, 'F' grades secured in any course stay permanently on the grade card. The weightage of these grades is not counted in the calculation of the CGPA, however these are counted in the calculation of the SGPA.

'G' Grade

A student will be awarded "G" grade in a course if the student has registered for audit course only and provided that the student satisfies the attendance requirements as stipulated. This grade would carry no grade points and will not be used in computation of SGPA or CGPA. However, the grade sheet will show this course along with the grade "G".

'H' Grade

A student will be awarded "H" grade in a course if the student has registered for audit course only and he fails to satisfy the attendance requirements as stipulated. This grade would carry no grade points and will not be used in computation of SGPA or CGPA. However, the grade sheet will show this course along with the grade "H" and will remain permanently on the grade card.

'I' Grade

A student having attendance lower than 75% in a course, whatsoever may be the reason is prevented from appearing in the ESE for that course in that semester and the student will have to re-register for the course as and when it is offered. In such cases the student will be given "I" grade. The continuous assessment of

laboratory course shall be null and void in such cases and the student shall have to re-register for the laboratory course as and when it is offered.

'T' Grade

If a student is absorbed into autonomy from RTM Nagpur University, and has not completed the semester successfully, then he is subjected to the absorption scheme for that semester, prepared by the respective BoS. If he has done the term work for the university course previously, which is equivalent to autonomous course, a student will be granted term under autonomy also. A student has to take the examination of equivalent autonomous course in the institution. In such cases, a student shall be given "T" grade is such courses.

The "T" grade will also be shown in the courses where the student has failed in the course and has opted to forego the continuous assessment marks. This grade will later be converted into suitable pass grades according to performance of the student in the institutional examinations.

19.3 Grade Point Average

19.3.1 Calculation of Semester Grade Point Average (SGPA)

The performance of a student in a semester is indicated by a number called SGPA. The SGPA is the weighted average of the grade points obtained in all the courses registered by the student during the semester.

$$SGPA = \frac{\sum C_i P_i}{\sum C_i}$$

where,

C*i*= The number of credits for the i^{th} course of a semester for which SGPA is to be calculated

P*i* = Grade points earned in the i^{th} course

i = 1,2,.....,n represent the number of courses in which a student is registered in the concerned semester The SGPA is calculated to two decimal places.

19.3.2 Calculation of Cumulative Grade Point Average (CGPA)

An up to date assessment of the overall performance of a student from the time of his first registration is obtained by calculating a number called CGPA, which is weighted average of the grade points obtained in all the courses registered by the student since he entered the Institution.

$$CGPA = \frac{\sum C_j P_j}{\sum C_j}$$

Where,

C*j*= The number of credits for the *j*th course up to the semester for which CGPA is to be calculated

P*j* = Grade points earned in the jth course.

j = 1,2,....., m represent the number of courses in which a student is registered up to the semester for which the CGPA is to be calculated The CGPA is also calculated to two decimal places.

19.3.3 Students admitted under lateral entry scheme,

The CGPA of diploma holder students admitted to direct second year B.E. under autonomy shall be calculated from third semester of undergraduate program onwards.

19.4 Semester Grade Reports

19.4.1 The semester grade report reflects the performance of the student in that semester (SGPA) and also the cumulative performance (CGPA).

19.4.2 The semester grade card issued at the end of each semester/ summer term to each student, after the publication of result, duly signed by CoE will contain the following:

- Name and Identification of student.
- Month and year of appearance at examination
- Branch and Term of examination
- The credits for each course registered for that semester.
- The letter grade obtained in each course.
- The total number of credits earned by the student at the end of each semester.
- Grade point average of semester (SGPA) and Cumulative Grade Point Average (CGPA)

19.4.3 Semester grade card will not indicate class or division or rank.

19.4.4 The final semester grade sheet will show the performance of the student in all the semesters of degree program along with CGPA.

19.5 Scrutiny of Grades

A student may apply for scrutiny of grades to the Controller of Examinations on payment of prescribed fees, within three days from the date of display of grades / result. The RRMC may check the entry of the weightages from different components of evaluation and their addition, the addition of marks in the final answer scripts and unchecked questions, if any. The results of scrutiny may lead to either a change in grade due to mistake(s) in any of the aspects scrutinized by the committee or the grade may remain unchanged. The results will be intimated to the Academic section within three days from the date of receipt of an application.

The fee paid by the student will be refunded if the grades are revised to the higher grades.

19.6 The result of examination will be declared on institutional notice board and website. The gazette of result will be sent to RTMNU.

20.0 Transparency in written examinations:

The institution believes in full transparency in the evaluation process and committed to just and fair evaluation of all students.

a. The answer books of all written examinations will be shown to students immediately after the valuation has been done and the process is to be completed within seven days from the date of examination.

b. For MSE Examination, the student shall sign the cover page of answer book and return it to the teacher. For ESE Examination, the valued answer books shall be shown in ONLINE mode.

c. If the student is unsatisfied with the valuation of MSE, he can discuss the specific points with the course faculty where he thinks the valuation needs reconsideration. The matter will be placed before the departmental committee. The committee's decision shall be final and binding on all the concerned.

d. If his grievances remain unsolved, the student can approach the Grievances Redressal Committee.

e. If the student has the grievances regarding the valuation of the ESE or the grade allotment, he/she shall submit the application to CoE. In such cases, the complete revaluation of answerbook shall be done and the change in the marks will be incorporated only if the change is ±3 marks.

f. The students shall submit the grievances within the dates given in Academic Calendar.

g. The answer books once evaluated shall never be given into student's possession.

h. The marks of practical/non-theory courses of all programs shall be displayed on the notice board on the next day after completion of the examination of a particular course.

21.0 Re-sit Examination / Make-UP Examination:

The students, who have secured the "F" grade in a course, shall apply for the re-sit examination within seven days of declaration of result, by paying the prescribed examination fees. The re-sit examination for students shall be held within 30 days from the date of declaration of result of ESE of a particular semester.

A student shall be permitted to take the ESE as well as resit of ESE of his/her regular term. In case, student fails in both the ESE and its resit of regular term, in the subsequent semester, he/she shall be permitted to take the ESE only. But the resit examination will be offered to him/her, if there are regular students for those courses

in the ESE of a particular semester.

The Re-sit examination is names as MAKE-UP Examination for the evaluation of detained students who have registered through the Special Mentoring Scheme (SMS). For such students, the Make Up Examination will serve the purpose for their evaluation on absolute grading basis with all internal marks for-gone.

22.0 Class/Division

The academic performance of the student for the complete duration of program shall be classified as follows:

First Class with distinction:	CGPA 8.25 and above,
First Class:	CGPA 6.75 and above, but less than 8.25, and
Second Class:	CGPA less than 6.75

22.1 If a student needs to convert the performance index CGPA into equivalent percentage of marks, the following formula shall be used.

Percent marks = CGPA*10-7.5

22.2 For award for class/division, a condonation of up to 0.05 grade points will be admissible.

i) Students having CGPA 6.70 to less than 6.75 shall be presumed to have secured First Division

ii) Students having CGPA 8.20 to less than 8.25 shall be presumed to have secured Distinction Division

If the class/ division is awarded by above regulation, then their Grade Sheet for the Final Semester of the Program shall carry a remark " Division by Condonation" and their original academic record including CGPA will remain unchanged.

23.0 Award of ranks under autonomous scheme

23.1 Merit ranks will be declared only for those students who have

a. been directly admitted to a course in the Institution under autonomous regulations, and
b. completed the entire course in the Institution only within the minimum possible prescribed time limit, and
c. passed all courses prescribed for that program in first attempt only (i.e. he has not secured "F" grade in any course).

23.2 Academic performance will be the sole criterion for award of Merit Rank.

23.3 The students will be ranked on the basis of their performance in the last four semesters of the degree program.

24.0 Attendance

24.1. Regular 100% attendance is expected of all students for every registered course in theory, tutorials, laboratory and workshop.

24.2. A maximum of 25% absence in the attendance may be condoned only on valid grounds.

24.3 A student can seek further condonation of 15 % absence due to death in family or other emergency beyond student's control. However, students seeking condonation should inform the college authorities immediately and should seek sanction of the absence within a week after joining. The student should submit the documentary evidence to the college authority.

24.4 A student seeking sanction of leave on medical grounds should submit the medical certificate from registered medical practitioner on joining. This shall be approved by the DAM.

24.5 The students participating in Sports / Cultural event during a semester, shall be eligible for the maximum number of 10 days of absence. Any waiver in this context shall be on the approval of DSA and DAM. The DSA shall inform the concerned HoD in advance with a copy to the DAM. No cognizance shall be taken after the DAM announces the irregularity of the student. This, however, shall be within the limit of condonation of 40% of absence as mentioned in 24.2

24.6 The following activities shall be considered for condonation of attendance

- Sports and Games: Inter collegiate, Inter zonal, Inter University, State level, national level or Open tournaments
- Camps and expeditions of National Cadet Core
- National Social Service camps
- Cultural Programs promoted by University, or reputed organizations
- Seminar/ Symposia, paper presentation, Quiz competitions
- Leadership courses organized by authorized organizations
- Training programs
- Guest Lectures
- Students Association activities
- Projects in industries/ organizations
- Placement activities
- Any other; with the prior approval of the Principal

24.7 A student having attendance lower than 75% in a course(60% in case of special condonation), whatsoever may be the reason is prevented from appearing in the End-Semester Examination (ESE) for that course in that semester and the student will be given "I" grade. Such student will have to re-register for the course through Special Mentoring Scheme leading to Make-Up-Examination. The continuous assessment of theory and laboratory course shall be null and void in such cases and the student shall be evaluated solely based on Make Up Examination.

24.8 The attendance shall be computed from the date of commencement of classes as per academic calendar of the Institution.

25.0 Conduct and Discipline of the students

25.1 Introduction

25.1.1 Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity, which will tend to bring down the prestige of the Institution.

25.1.2 The following additional acts of omission and/or commission by the students within or outside the precincts of the College shall constitute gross violation of 'code of conduct' and will be punishable.

25.1.3 A student admitted to the UG/PG programme shall abide by the "Rules and Regulations" issued by the Institution from time to time. These standing orders shall deal with the discipline of the students in the Hostels, Departments, inside and outside of the Institution premises. The standing orders may also deal with such other matters as are considered necessary for the general conduct of the students, co-curricular and extra-curricular activities.

25.1.4 Students should be aware that any rule imposed by the institution, University and Government is binding on him/her.

25.2 Identification Documents

25.2.1 Every Student admitted will be issued a photo identification card which must be retained by the student while he or she is registered at Institution. The ID card will remain as the property of Institution. The student must possess the valid ID card while in the institution.

25.2.2 The valid ID card must be presented for identification purposes as and when demanded by authorities. Any student refusing to provide the ID card shall be subjected to disciplinary action.

25.2.3 Any student who alters or intentionally mutilates an ID card or who uses the ID cards of another student or allows his ID card to be used by another will be subjected to disciplinary action.

25.3 General Conduct within campus

25.3.1 Students are required to move silently through the corridors without disturbing the nearby classes and laboratories.

25.3.2 Nobody should sit on the corridor walls or steps of the buildings.

25.3.3 Give way to teachers, staff and visitors while moving in the corridors, on the staircases and other places in the campus.

25.3.4 Behave in such a manner that suits a cultured engineer.

25.4 Uniform

25.4.1 All the students are required to wear the college uniform on campus.

25.4.2 The sample of uniform is kept in the Suvidha Store for the convenience of the students.

25.4.3 The boys are required to tuck in their shirts.

25.4.4 The uniform should not have additional colors/ embroidery/ other complex designs etc.

25.4.5 On the occasions like interviews or other formal functions, all the students shall wear formal apparel.

25.5 Common Off / Absence

Remaining absent from the institution without prior permission of the authority is strictly prohibited.

25.5.1 The students involved in common off are liable to heavy fine, and punishment including expelling from the hostel as decided by the Institution from time to time.

25.5.2 The students involved in common off or having less attendance in class shall be liable for disciplinary action

25.5.3 If a student remains absent for a period of 05 days or more for a valid reason, he is required to apply to the DAM and take prior permission.

25.5.4 Decision about the absence of the student for genuine reasons is reserved with the DAM.

25.6 Seeking Guidance

25.6.1 In case of hostel related problems, the student shall contact the concerned warden/ rector first. For any additional help, he should contact the class teacher and HoD.

25.6.2 For any academic matters the student shall contact the course teacher first and then Faculty Advisor.

25.6.3 For any other personal grievances/ problems, student shall first contact faculty advisor and then HoD. The students should share their worries with their friends, teachers, staff and DSA.

25.6.4 For any specific problem the student can contact the DSA to seek the guidance.

25.7 Misbehavior

The students indulging in following acts shall be treated as misbehavior and will be liable for the punishment.

25.7.1 Lack of courtesy and decorum, as well as indecent behavior;

25.7.2 Submission of wrong/ false/ incorrect information at the time of admission or during the tenure in the Institution;

25.7.3 Infringement of instructions of security guard

25.7.4 Misbehaving with the faculty or staff of the Institution

25.7.5 Misbehaving in the hostel premises or Institution premises

25.7.6 Parking in unauthorized places

25.7.7 Willful damage of property of the Institution/Hostel/faculty/staff or of fellow students;

25.7.8 Use vehicles to move within the campus

25.7.9 Possession/consumption/distribution of alcoholic drinks and banned drugs;

25.7.10 Mutilation or unauthorized possession of library material, like Books, etc.;

25.7.11 Noisy and unseemly behavior, disturbing peace in the College/Hostel;

25.7.12 Hacking in computer systems, either hardware or software or both;

25.7.13 Using unfair means in the examinations;

25.7.14 Throwing the garbage outside the dustbins
25.7.15 Wasting Water and Electricity in the institution/hostel
25.7.16 Resorting to plagiarism;
25.7.17 Writing on benches, walls or doors or defacing the property of Institution/hostel
25.7.18 Any act of indiscipline of a student reported to the Dean (Students Activities)
25.7.19 Any other act which will damage the image of the Institution in the society.
25.7.20 Using Mobile phones for other than educational purpose during the Instructional hours and within the Institution Building, Library, Reading room etc.

25.8 Habits

Smoking/chewing tobacco, pan, pan masala, or derivatives of tobacco, spitting and drinking alcohol are strictly prohibited in campus and hostel building and premises. It is also a criminal offence as per the existing law provisions. All those who are found indulging in these activities will be charged as per the IPC rules and a strict action will be taken.

25.9 Action against ragging

25.9.1. As per due provision of Maharashtra prohibition of Ragging Act 1999 Ragging is a non-bailable cognizable offence. Whosoever indulges in ragging either-directly or indirectly shall be liable for punishment amounting to imprisonment up to 2 years and fine of Rs. 10,000/- along with dismissal from the institution.
25.9.2. Ragging within or outside of the institution is strictly prohibited.
25.9.3. Whosoever directly or indirectly commits, participates in, abets or propagates ragging within or outside the institution shall be liable for the punishment as per the existing provisions of law and act.
25.9.4. The cases of ragging reported to the Institution authorities shall be forwarded to the Special Anti-Ragging Committee constituted as per the directions of Hon. Supreme Court of India.
25.9.5. The AntiRagging Committee will investigate the matter and recommend the suitable action to be taken against the accused students.

25. 10 Disciplinary action

25.10.1 The student should strictly obey the rules and regulations given above. Violation of any of the above rules by the students shall be dealt with disciplinary action to the extent of even expelling him from the Institution and /or hostel.

25.10.2 The cases of indiscipline shall be reported to Disciplinary Action Committee (DAC). DAC shall enquire into the charges and recommend suitable action if the charges are substantiated.

25.10.3 The decision of Disciplinary Action Committee (DAC) shall be final and binding on the student and his parents.

25.10.4 If a student is found indulging in anti-national activities contrary to the provisions of acts and laws enacted by Government, he shall be liable to be expelled from the institution without any notice.

25.10.5 In case of severe and serious matters, if required, a separate Discipline Committee may be formed by the DSA and the Principal, depending on the nature of the matter.

26.0 Co-curricular and /or Extracurricular activities (for UG students):

These are courses, with multiple options, to be completed at convenience of UG students. The student shall complete Part-A (Value Education), and a total of at least 2 items from Part-B (with at least one from each of the two groups) described below:

26.1 Part A- Value Education Courses

Invited-Lectures / Group-Discussions / Formal-Course / Self-study will be arranged on Value Education, co-ordinated by the DSA. The student is required to participate in at least one such activity.

26.2 Part B- Other Co-curricular / Extra-curricular Activities

The Co-curricular/Extra-curricular Activities are compulsory degree requirements.

26.2.1 Co-Curricular Activities, which includes activities in professional societies like Institute of Electrical and Electronics Engineers (IEEE), Indian Society for Technical Education(ISTE), The Institution of Engineers (IEI), Computer Society of India (CSI), Department Associations, Lab Development, Participation in Paper Presentation, Model Building, etc.

26.2.2 Extra-Curricular Activities, such as National Social Service(NSS), National Cadet Core (NCC), Non Governmental Organizations(NGOs), Community Services, Social work, Yoga, Meditation, Language Course, Health Care Services, Activities in Alumni Association, Activities in Yash, Spandan, Pratikruti, TechFest, Participation in Sports, Games, Various Clubs of Institutions, Society for Promotion of Indian Classical Music and Culture Amongst Youth (SPICMACAY), etc.

On successful completion, a certificate regarding the activity that a student has participated in may be issued by the Faculty in-charge of that particular activity. With the recommendation of the Faculty in-charge of Co-Curricular / Extra-Curricular Activities, the DSA may

approve the Report of Satisfactory Completion of such Co-Curricular and Extra-Curricular Activities.

27.0 Temporary withdrawal from the programme. The clause is withdrawn.

28.0 Special Mentoring Scheme (SMS) & Make Up Examination for detained. students

28.1 The MAKEUP EXAM THROUGH SPECIAL MENTORING SCHEME (SMS) is meant only for Detained regular Students as per Detention Policy and not for Ex-Students. The maximum number of courses (including Theory & Laboratory) for registration under this policy shall be Three or less. In case if student doesn't fit in this criteria, he/she shall have to go for Re-Registration of entire semester as per existing norms. Prevailing eligibility criteria for promotion to higher semester will be applicable.

28.2 If, the student is detained, he/she will have to register the Theory / Laboratory course by paying prescribed fees and contact the teacher as a mentor as allotted by HoD under "MAKEUP EXAM THROUGH SPECIAL MENTORING SCHEME (SMS)" for carrying out guided self-study and submitting the assignments as per timetable given by the mentor.

28.3 The time-period for this scheme will be from date of detention to 7 days before the commencement make up examination. The dates as per guidelines issued by DAM office and the departmental coordinator shall be applicable. There will not be any MSE examination for this scheme and the final result will be declared on the basis of FOREGO MARKS i.e. on the basis of marks obtained in End Semester examination.

28.4 Registered student must contact minimum 12 & Maximum 18 times with mentor within date of detention to 14 days before the commencement of makeup examination, as per the timetable given by mentor. For laboratory courses, the students will visit the laboratory and complete all practical and submit the record as per the timetable provided by mentor. In theory course the student is mentored and permitted for submission of examination form on the basis of Course Completion Certificate by mentor whereas in laboratory course, the student must attend special 2 – 3 Laboratory session, perform all experiments, and submit the practical record and obtain Course Completion Certificate.

28.5 Mentor may or may not recommend the student and issue Course Completion certificate, to take exam depending on the performance/ response of the student.

28.6 By permission of HoD as per recommendation of mentor, student will have to submit the examination form along with Course Completion Certificate as per procedure by paying examination fees. Forego internal marks facility will be mandatorily applied while working under this scheme of registration.

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29.0 Transitory Regulations

These regulations are applicable to students who were discontinued for some reasons and rejoin the program, then he shall be governed by the scheme of examination, syllabi contents and the rules and regulations in force at the time of rejoining of student.

A candidate, who is detained or discontinued in the year/semester, will be admitted to the same semester on paying the prescribed fees. On readmission, he shall be required to pass in all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) he was originally admitted into.

30.0 Termination from the program

The admission of a student to the UG program may be terminated and the student may be asked to leave the institution if the student fails to satisfy the norms of discipline specified by the Institution from time to time.

31.0 Eligibility for award of Degree

A student shall be eligible for the award of the degree only if the student has

a. Passed all prescribed courses.

b. Satisfied minimum academic requirements.

c. Satisfied all requirement specified by the concerned department; if any.

d. Satisfied all requirements specified by the Academic Council and/or ordinances.

e. Paid all the dues to the institute, and

f. No pending case of indiscipline.

32.0 Betterment/ improvement of CGPA

32.1 A student who has completed all the requirements for award of degree but whose CGPA is less than minimum threshold limit for award of class / division may reappear for the End Semester Examination in any of the theory courses as and when conducted, for the purpose of improving the aggregate/ CGPA. He shall apply to the Institution for improvement of grades in theory courses within 45 days after the declaration of result which makes him eligible for award of degree. This reappearance shall be within a period of two academic years after becoming eligible for the award of the Degree.

32.2 However, this facility shall not be available to candidate who has been awarded the Degree. Candidates shall not be permitted to reappear either for Mid Semester Examinations or End Semester Examinations in

Practical courses (including Project Viva voce) for the purpose of improvement.

The student will be awarded the best of grades obtained at original attempt and second/subsequent attempt.

32.3 A revised Grade Card shall be issued to the candidate after incorporating the grades secured in subsequent improvements and on surrendering the original grade card.

33.0 Provisional Certificate:

The students, who have completed all requirements as set out in these rules and regulations, will be eligible for issue of "Provisional Certificate" from the institution, duly signed by the CoE.

34.0 Degree Certificate

34.1 After successful completion of the program at the Institution, the student will be eligible for award of degree in subsequent convocation of the RTMNU. The University Degree Certificates will be distributed from the Institution office to all successful candidates once received from the RTMNU.

34.2 A student can claim the degree certificate in person from the office of CoE after submitting the copies of grade sheets of all semesters and proving his identity. He shall produce either a photo identity card of the Institution, driving license with photo, passport, photo identity card issued by present employer or credit card of reputed bank bearing a photo.

34.3 A student can request the degree certificate through a messenger. In such case, a student should authorize the messenger to receive the degree certificate on his behalf. The above mentioned documents will, however, be mandatory for the messenger.

35.0 Issue of Transcripts

Candidates can apply for transcripts by submitting the photocopies of the grade sheets to the Office of Controller of Examinations and submitting the prescribed fees, if any.

The Transcripts, after attestation by the Registrar of the Institution, will be placed in sealed covers and will be handed over, in person, to the candidate. The transcripts can also be sent directly to the University, provided the candidate requests and furnishes envelopes with necessary postage stamps affixed along with the addresses of the Universities to which the transcripts are to be sent.

36.0 Merit List, Medals and Citations

Preparation of Merit/Rank List

36.1 The merit list shall be prepared for each programme offered under Autonomy, based on CGPA.

36.2 The merit list shall be declared from amongst the students satisfying following eligibility criteria

a. Student must have taken admission to entry level semester of the degree program under autonomy. No student absorbed from RTMNU will be considered.

b. Student must have completed the programme in minimum duration for the said programme.

c. Student must have successfully completed all the courses that are required for successful completion of the programme as per the Scheme of the Examination in **the first attempt**.

36.3 The merit list (provisional and final) shall be prepared by Tabulation committee and shall be notified by Controller of Examinations, on behalf of Examination Committee.

36.4 The merit list shall be prepared in two stages, the first stage being the provisional merit list.

36.5 The notified lists, provisional as well as final, shall be given wide publicity and shall be available on the college website and major departmental notice boards.

36.6 If anyone has any objection to the name(s) in the notified provisional merit list, the same shall be raised within 20 days after publishing the provisional merit list. The objections raised shall be submitted in writing giving the details in all respects, to the office of Controller of Examinations.

36.7 The Controller of Examinations shall scrutinize the objections received and direct the Tabulation Committee to incorporate the objections, if found correct. The amended merit list shall be called as Final Merit List and shall be published on the college website and notice boards.

Medals and Citations:

Awards of prizes, medals, scholarships or any other honours shall be based on the rank secured by the student consistent with the desire of donors, wherever applicable, and as per rules of the Institution.

37.0 Data verification

The organizations may need to verify the data of the students who graduated from the Institution for employment purposes / further education. Such requests shall be made on the letterheads of the organizations, which need the verification and shall state the personal and academic details of the student including the name, year of graduation and branch/ specialization of study. An

email from the official accounts of the organizations will also be allowed in lieu of letter.
The CoE shall verify the data and the verification report will be sent within five working days.
A processing fee of Rs. 1000/- will be charged for issue of verification report. The processing fee shall be waived in case of recruitments done on campus or for major employers, at the discretion of the Principal/Director.

38.0 Other Matters

38.1 The physically challenged candidates who have availed additional examination time during their Higher Secondary School Certificate/ MHT-CET examinations will be given additional examination time on production of relevant proof /documents as per existing rules.

38.2 The students who have temporary physical disability due to accident etc., may be allowed a writer and/or additional time during the examination provided the student submits the medical documents from competent authorities well in advance and acceptance of the report by the Institution.

39.0 Rules and regulations applicable to new programs that may be introduced in future

The rules and regulations published here will be applicable to the new programs that will be started by the Institution in the same categories in future. The Institution will add rules for the courses that will be started and not covered in these rules.

40.0 Amendments to Rules and Regulations:

The BoM may, from time to time, revise, amend, or change the rules and regulation, SoE, and Syllabi proposed by BoS and recommended by AC.

41.0 Interpretation of Regulations

In case of any dispute, difference of opinion in interpretation of these regulations or any other matter not covered in these regulations, the decision of the Chairman, Academic Council shall be final and binding.

42.0 Emergent Cases

Notwithstanding anything contained in the above regulations, the Chairman of the BoM/Academic Council may, in emergent situations take action on behalf of the BoM/Academic Council as he deems appropriate and report it to the next meeting of the BoM/Academic Council for its approval.

43.0 Grace Marks

43.1 Grace marks shall be awarded for enabling an examinee for passing an examination, for all the schemes under autonomy.

43.2 Maximum of 03 grace marks shall be awarded for the course, only if the grade changes to "D" from "F" grade.

43.3 The grace marks shall be awarded in maximum two courses of given examination

43.4 The grace marks shall not be awarded to audit courses.

43.5 The grace marks shall be awarded only when the result in the examination changes to "pass".

43.6 If total grace marks awardable result into fraction, it shall be converted to next higher integer.

43.7 The grace marks shall be shown by one asterisk with added mark(s) above the head or right side of the original marks in tabulation register. However in grade sheet the grade so awarded (D grade) shall be indicated in terms of one asterisk(viz *). The following sign with a note shall be printed at the bottom of the grade sheet.
"Note: (*) pass by grace marks vide Principal's Direction No 1 of 2017"

43.8 The examinee passing the examination with grace marks shall not be eligible for any medal(s), prizes or any other awards pertaining to that examination.

Pattern of the question Papers and course coverage
(for existing i.e. Autonomous 2018 and 22 scheme)
applicable to All Semesters BTech in AY 2022-23 onwards)

The following pattern will be adopted by all the paper setters for all courses. However, the format could be different in few courses. The format, if different than what is shown below, will be informed to students by the Head of department, at the start of semester.

1. Structure of the question paper for MSE1

1.1 The duration of MSE1 shall be of one and half hours.
1.2 The question paper shall be set for maximum marks of 30 to be finally converted to out of 15.
1.3 All the three questions shall be compulsory.
1.4 The question paper format shall be as below for MSE1

Q No	Description 1	Max Marks	CO
1 (Unit-1)	You may set sub-questions with any one combination of following options a. 2, 3, 5 marks b. 5, 5 marks c. 6, 4 marks d. 7, 3 marks e. 10 marks (only for Analysis & design based courses)	10	
2 (Unit-2)	You may set sub-questions with any one combination of following options a. 2, 3, 5 marks b. 5, 5 marks c. 6, 4 marks d. 7, 3 marks e. 10 marks (only for Analysis & design based courses)	10	
3 (Unit-3)	You may set sub-questions with any one combination of following options a. 2, 3, 5 marks b. 5, 5 marks c. 6, 4 marks d. 7, 3 marks e. 10 marks (only for Analysis & design based courses)	10	

2. Structure of the question paper for MSE 2

2.1 The duration of MSE2 shall be of one and half hours.
2.2 The question paper shall be set for maximum marks of 30 to be finally converted to out of 15.
2.3 All the three questions shall be compulsory.
2.4 The question paper format shall be as below for MSE2

Q No	Description	Max Marks	CO
1 (Unit-4)	You may set sub-questions with any one combination of following options a. 2, 3, 5 marks b. 5, 5 marks c. 6, 4 marks d. 7, 3 marks e. 10 marks (only for Analysis & design based courses)	10	
2 (Unit-5)	You may set sub-questions with any one combination of following options a. 2, 3, 5 marks b. 5, 5 marks c. 6, 4 marks d. 7, 3 marks e. 10 marks (only for Analysis & design based courses)	10	
3 (Unit-6)	You may set sub-questions with any one combination of following options a. 2, 3, 5 marks b. 5, 5 marks c. 6, 4 marks d. 7, 3 marks e. 10 marks (only for Analysis & design based courses)	10	

3. Structure of the question paper for RE-MSE

3.1 The duration of RE-MSE shall be of one and half hours.

3.2 The question paper shall be set for maximum marks of 30 to be finally converted to out of 15.

3.3 All the three questions shall be compulsory.

3.4 The question paper format shall be as below for RE-MSE

Q No	Description	Max Marks	CO
1 (Unit-1+Unit-4)	You may set sub-questions with any one combination of following options a. 2, 3, 5 marks b. 5, 5 marks c. 6, 4 marks d. 7, 3 marks e. 10 marks (only for Analysis & design based courses)	10	
2 (Unit-2+Unit-5)	You may set sub-questions with any one combination of following options a. 2, 3, 5 marks b. 5, 5 marks c. 6, 4 marks d. 7, 3 marks e. 10 marks (only for Analysis & design based courses)	10	
3 (Unit-3+Unit-6)	You may set sub-questions with any one combination of following options a. 2, 3, 5 marks b. 5, 5 marks c. 6, 4 marks d. 7, 3 marks e. 10 marks (only for Analysis & design based courses)	10	

4. Structure of the question paper for ESE (For syllabus having 6 units)

4.1 The duration of ESE shall be as mentioned in the SoE.
4.2 The question paper shall be set for maximum marks of 50.
4.3 All the six questions shall be compulsory.
4.4 Every sub-question shall have a distinctly different number.
4.5 Structure of question paper shall be as follows:

UG ESE Question Paper Format

ESE Question Paper Format Effective from ODD/EVEN SEM ESE of Session 2022-23

Maximum Marks 50

Note:

1. **Max marks for any 4 questions will be 8 and for other two questions max marks will be 9. Other combination of sub questions can be used with approval of HoD**
2. **Question paper duration shall be of THREE hours / as per SoE and all examinations shall be PHYSICAL / OFFLINE.**
3. **All questions are compulsory, and no internal choice is to be exercised.**
4. **The question paper is to be framed strictly as per the Bloom's Taxonomy and specific instructions from Dean (OBE) shall be followed.**

Q No	Sub Question	Remarks	Max Marks	CO Bloom's level
1 (Unit -1)	A, B	You may set sub-questions with any one combination of following options a. 8 or 9 marks b. 3, 5 or 4, 4 for 8 marks or 4, 5 or, 3,6 for 9 marks	8 or 9	
2 (Unit -2)	A, B	You may set sub-questions with any one combination of following options a. 8 or 9 marks b. 3, 5 or 4, 4 for 8 marks or 4, 5 or, 3,6 for 9 marks	8 or 9	
3 (Unit -3)	A, B	You may set sub-questions with any one combination of following options a. 8 or 9 marks b. 3, 5 or 4, 4 for 8 marks or 4, 5 or, 3,6 for 9 marks	8 or 9	
4 (Unit -4)	A, B	You may set sub-questions with any one combination of following options a. 8 or 9 marks b. 3, 5 or 4, 4 for 8 marks or 4, 5 or, 3,6 for 9 marks	8 or 9	
5 (Unit -5)	A, B	You may set sub-questions with any one combination of following options a. 8 or 9 marks b. 3, 5 or 4, 4 for 8 marks or 4, 5 or, 3,6 for 9 marks	8 or 9	
6 (Unit -6)	A, B	You may set sub-questions with any one combination of following options a. 8 or 9 marks b. 3, 5 or 4, 4 for 8 marks or 4, 5 or, 3,6 for 9 marks	8 or 9	

Changes made in original version: as per decision of AC #8 and 9

	Before revision	After revision
Added: AR 16.16	Nil	A student who becomes ineligible for admission to the higher year/semester due to non-accumulation of required credits at the immediately lower semester/year and has thus been forced to discontinue for a year, then he may seek readmission to the said semester/year of the program. In such case of readmission, the courses passed by a student, credits, related grade and grade points obtained by the student from the courses in that semester shall be null and void. A student shall have to earn the credits from all the courses in the said semester/year afresh as per the existing scheme of examination and related syllabi content."
AR29	29.0 Transitory Regulations A candidate, who is detained or discontinued in the year/semester, will be admitted to the same semester on paying the prescribed fees. On readmission, he shall be required to pass in all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) he was originally admitted into.	29.0 Transitory Regulations These regulations are applicable to students who were discontinued for some reasons and rejoin the program, then he shall be governed by the scheme of examination, syllabi contents and the rules and regulations in force at the time of rejoining of student. A candidate, who is detained or discontinued in the year/semester, will be admitted to the same semester on paying the prescribed fees. On readmission, he shall be required to pass in all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) he was originally admitted into.
AR 33	33.0 Passing **Certificate:** The students, who have completed all	33.0 Provisional Certificate: The students, who have completed all requirements as set out in these rules and regulations, will be eligible for issue of

	requirements as set out in these rules and regulations, will be eligible for issue of "Passing Certificate" from the institution, duly signed by the CoE.	"Provisional Certificate" from the institution, duly signed by the CoE.
AR 28.7	Students will not be permitted to register for more than ten credits in the Summer Term.	Students will not be permitted to register for more than sixteen credits in the Summer Term.
AR 6.0	Programs offered	Added: UG programs II Shift: Electrical Engineering PG Programs II Shift: Very Large Scale Integration Design II Shift: Computer Science Engineering
AR36	Medal and Citations	The subtitle changes to Merit List, Medals and Citations The following topics added to AR 36 The rules for declaring merit List under autonomy The merit list shall be prepared for each programme offered under Autonomy, based on CGPA. The merit list shall be declared from amongst the students satisfying following eligibility criteria Student must have taken admission to entry level semester of the degree program under autonomy. No student absorbed from RTMNU will be considered Student must have completed the programme in minimum duration for the said programme. Student must have successfully completed all the courses that are required for successful completion of the programme as per the Scheme of the Examination in first attempt. The merit list (provisional and final) shall be

		prepared by Tabulation committee and shall be notified by Controller of Examinations, on behalf of Examination Committee. The merit list shall be prepared in two stages, the first stage being the provisional merit list. The notified lists, provisional as well as final, shall be given wide publicity and shall be available on the college website and major departmental notice boards. If anyone has any objection to the name(s) in the notified provisional merit list, the same shall be raised within 20 days after publishing the provisional merit list. The objections raised shall be submitted in writing giving the details in all respects, to the office of Controller of Examinations. The Controller of Examinations shall scrutinize the objections received and direct the Tabulation Committee to incorporate the objections, if found correct. The amended merit list shall be called as Final Merit List and shall be published on the college website and notice boards.
	Structure of question paper format for ESE	It has been done more explicit as per decision of AC Meet #9

<table>
<tr>
<td>AR19.2.4</td>
<td>Table No 4</td>
<td>As per decision of AC#15

The number of Table is revised to Table No. 4A (its contents remaining same) and Table No. 4B added for awarding grades in non-theory courses such as practicals, Seminars, projects etc. where the number of examinees at the examination is less than 30.

Table No.4 (B) (For Non Theory Courses)
<table>
<tr><th>Range of Marks</th><th>Grades</th></tr>
<tr><td>Marks equal to or greater than 90 %</td><td>A+</td></tr>
<tr><td>Marks equal to or greater than 80 % but less than 90%</td><td>A</td></tr>
<tr><td>Marks equal to or greater than 70 % but less than 80%</td><td>B+</td></tr>
<tr><td>Marks equal to or greater than 62 % but less than 70%</td><td>B</td></tr>
<tr><td>Marks equal to or greater than 58 % but less than 62%</td><td>C+</td></tr>
<tr><td>Marks equal to or greater than 54 % but less than 58%</td><td>C</td></tr>
<tr><td>Marks equal to or greater than 50 % but less than 54%</td><td>D</td></tr>
<tr><td>Marks less than 50%</td><td>F</td></tr>
</table>
</td>
</tr>
<tr>
<td>AR19.2.5</td>
<td>19.2.5 Provided further, the calculation of arithmetic mean (X), Standard Deviation (σ), upper and lower cut offs of the various grades will be computed by using the marks scored by regular students at the examination for an individual course and the same values of grade cut-offs shall be used for processing the result of regular as well as ex-students (repeaters who are taking the examination for Second or more number of times in that course) appearing at the same examination. These cut off marks for the upper and lower limits of grades shall remain same for the subsequent re-sit examination.</td>
<td>As per AC#15, the provision has been made more explicit.

Provided further, the calculation of arithmetic mean (X), Standard Deviation (σ), upper and lower cut offs of the various grades will be computed by using the marks scored by regular students at the examination for an individual course and the same values of grade cut-offs shall be used for processing the result of regular as well as ex-students appearing at the same examination. These cut off marks for the upper and lower limits of grades shall remain same for the re-sit examination of that term only. (i.e cutoff of Odd ESE will be applicable to Odd Resit and cutoff of Even ESE will be applicable to Even Resit).

Students appearing for examination as Ex-Student, where there are no regular students, the grading will be done by absolute grading system. (e.g. In Odd ESE students of IV, VI, VIII semester appearing as Ex-Students will be awarded grades as per absolute grading table.)

In case of students appearing for examination in Summer Term, only absolute grading table will be used for awarding grade.</td>
</tr>
</table>

AR36	Medals and Citations	As per direction of AC#15. If there is more than one student who secure the same rank, then the tie will not be broken. Each one of them shall be awarded the same medal.

Changes made in original version: as per decision of Standing Committee AC

	Before revision	After revision
AR27	Temporary Withdrawal from the Programme	The clause is withdrawn due to revision in the government policy. The decision taken by Standing Committee Academic Council Dt. 24.03.2017.

Changes made in original version: as per decision of AC #17 and 18

	Before revision	After revision
AR43		As per direction of AC#17. **Grace Marks** 1. Grace marks shall be awarded for enabling an examinee for passing an examination, for all the schemes under autonomy. 2. Maximum of 03 grace marks shall be awarded for the course, only if the grade changes to "D" from "F" grade. 3. The grace marks shall be awarded in maximum two courses of given examination 4. The grace marks shall not be awarded to audit courses. 5. The grace marks shall be awarded only when the result in the examination changes to "pass". 6. If total grace marks awardable result into fraction, it shall be converted to next higher integer. 7. The grace marks shall be shown by one asterisk with added mark(s) above the head or right side of the original marks in tabulation register. However in grade sheet the grade so awarded (D grade) shall be indicated in terms of one asterisk(viz *). The following sign with a note shall be printed at the bottom of the grade sheet. "Note: (*) pass by grace marks vide Principal's Direction No 1 of 2017" 8. The examinee passing the examination with grace marks shall not be eligible for any medal(s), prizes or any other awards pertaining to that examination.

Changes made in original version: as per decision of AC #24

	Before revision	After revision
AR 18.2	The relative weightage is 10% for TA, 30% from any two better of three MSE, and 60% for ESE. The teacher shall announce the method of TA at the beginning of the semester. All MSE and ESE are compulsory for all students. The marking will be on absolute basis. The total marks are calculated in each course as per the weightage indicated above. No credits are awarded if the student remains absent in the ESE.	The relative weightage is 30% for TA (for Theory : 20 marks on lecture quizzes, 8 marks on assignments, 2 marks on class performance), 30% from any two better of three MSE, and 40% for ESE. The teacher shall announce the method of TA at the beginning of the semester. All MSE and ESE are compulsory for all students. The marking will be on absolute basis. The total marks are calculated in each course as per the weightage indicated above. No credits are awarded if the student remains absent in the ESE.
AR 18.3	The laboratory courses will have Continuous Assessment (CA) which will be based on punctuality, turn to turn assessment of student's work, quality of records maintained, group discussions, overall understanding of the experiment and viva-voce examination (as per requirement of structure of course). The CA for laboratory courses shall be 40% and ESE may be on an experiment or viva or written test or a combination of these, and shall carry a weightage of 60%. Practical Courses with 100% continuous evaluation will not have ESE. The student shall either successfully complete the course or shall get I grade if the course work is not satisfactory	The laboratory courses will have Continuous Assessment (CA) which will be based on punctuality, turn to turn assessment of student's work, quality of records maintained, group discussions, overall understanding of the experiment and viva-voce examination (as per requirement of structure of course). The CA for laboratory courses shall be 60% and ESE may be on an experiment or viva or written test or a combination of these, and shall carry a weightage of 40%. Practical Courses with 100% continuous evaluation will not have ESE. The student shall either successfully complete the course or shall get I grade if the course work is not satisfactory

Changes made in original version: as per decision of AC #26

	Before revision	After revision
AR 18.1	MSE-1 - 15 Marks (Based on Unit 1 & 2) MSE-2 -15 Marks (Based on Unit 3 & 4) MSE-3 -15 Marks (Based on Unit 5 & 6)	MSE-1 - 15 Marks (Based on Unit 1 & 2 & 3) MSE-2 - 15 Marks (Based on Unit 4 & 5 & 6) RE-MSE -15 marks (Based on unit 1 to 6) MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activities decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities TA** = for Practical : MSPA will be 15 marks each
AR 44	Not applicable	Ph.D. Rules & Regulations of YCCE as per Annexure-A

Changes made in original version: as per decision of AC #28

	Before revision	After revision
AR 18.2	The relative weightage is 30% for TA (for Theory : 20 marks on lecture quizzes, 8 marks on assignments, 2 marks on class performance), 30% from any two better of three MSE, and 40% for ESE. The teacher shall announce the method of TA at the beginning of the semester. All MSE and ESE are compulsory for all students. The marking will be on absolute basis. The total marks are calculated in each course as per the weightage indicated above. No credits are awarded if the student remains absent in the ESE.	The relative weightage is 20% for TA (as per the guidelines issued by DAM office for PC,PE,OE,HM courses), 30% from any two MSE, and 50% for ESE. The teacher shall announce the method of TA at the beginning of the semester. All MSE and ESE are compulsory for all students. The marking will be on absolute basis. The total marks are calculated in each course as per the weightage indicated above. No credits are awarded if the student remains absent in the ESE.
AR29	29.0 Transitory Regulations These regulations are applicable to students who were discontinued for some reasons and rejoin the program, then he shall be governed by the scheme of examination, syllabi contents and the rules and regulations in force at the time of rejoining of student. A candidate, who is detained or	29.0 Transitory Regulations The requirement of Attendance and proposed Detention Policy of YCCE is based on rules and regulations of UGC and of Rashtrasant Tukdoji Maharaj Nagpur University (RTMNU), Nagpur vide their DIRECTION NO. 14 of 2022, 'NORMS FOR OF ACADEMIC AUTONOMY - DIRECTION, 2022, • A student must have an overall (average)

	discontinued in the year/semester, will be admitted to the same semester on paying the prescribed fees. On readmission, he shall be required to pass in all the courses in the curriculum prescribed for such batch of students in which the student joins subsequently. However, exemption will be given to those candidates who have already passed in such courses in the earlier semester(s) he was originally admitted into.	75% attendance of total number of classes actually engaged including lectures/ tutorials and practical. • Condonation of attendance can only be considered in case the overall (average) attendance of the student is minimum 60%, that the deficiency in attendance was due to circumstances beyond the control of the student. • For availing such condonation, a student will have to apply to the Head of concerned department along with requisite proofs / documents. However, the decision in this matter will be finally taken by the DAM & Principal on the recommendation of HoD/FYC. • The detained students shall have to re-register (re-admitted) in the appropriate semester in next academic year and fulfil the attendance criteria as per the Academic Regulations of YCCE. The detention of student shall attract a loss of ONE ACADEMIC YEAR for a particular student. • Student who is not permitted to appear for the end semester examinations due to shortfall in attendance in a course shall be awarded 'I' grade in that course. This grade shall appear on the Grade Card till the successful completion of course requirements in that semester. It is therefore proposed to Academic Council to permit," MODIFICATION OF CLAUSE No 24 OF ACADEMIC REGULATION RELATED TO ATTENDANCE". The clause shall be modified by making necessary changes befitting to RTMNU and UGC rules and regulations related to attendance of student.
28.00	**Summer Term** 28.1 The Institution may offer an additional Term in May–June termed as Summer Term. Courses offered in the Summer Term will be treated as equivalent to a regular semester (odd / even) for all	**Special mentoring scheme** 1. The proposed **MAKEUP EXAM THROUGH SPECIAL MENTORING SCHEME (SMS)** is meant only for Detained regular Students as per newly proposed Detention Policy and not for Ex-Students. The maximum number of courses (including Theory & Laboratory) for registration

	assessment purposes. 28.2 Summer Term is to provide opportunity to students to clear their backlogs and also courses dropped or the courses which he / she could not register for some reason. The Institution may use this semester to arrange add-on courses for regular students and/or for deputing them for practical training. 28.3 Those students who are willing to join the Summer Term will submit the "Willingness to join" in the prescribed format 15 days before the commencement of the Summer Term. 28.4 The students who were detained for the poor attendance can opt for the Summer Term. 28.5 Those students who have secured the "F" grade in ESE examinations but will like to learn the course once again and/or wish to revise their marks of continuous assessment can also be permitted to register for the Summer Term. 28.6 The students who have earlier taken an ESE and register afresh for the Summer Term will sign an undertaking to revoke the CA marks secured by them in their regular/ earlier attempt in the same course. Once revoked, the students shall not seek restoration of the CA marks. 28.7 Students will not be permitted to register for courses not exceeding sixteen credits in the Summer Term. 28.8 Summer Term will be at an accelerated pace and will be at double the rate of normal semester e.g. one credit of course shall require two hours/week so that the total contact hours are maintained same as in normal semester. 28.9 Student shall register for the Summer Term as per the schedule given in academic calendar. 28.10 A student will have to pay an additional fee, if any, prescribed by the Institution within the stipulated	under this policy shall be Three or less. In case if student doesn't fit in this criteria, he/she shall have to go for Re-Registration of entire semester as per existing norms. Prevailing eligibility criteria for promotion to higher semester will be applicable. 2. If, the student is detained, he/she will have to register the Theory / Laboratory course by paying fees Rs 5000/- Per course and contact the teacher as a mentor as allotted by HoD under "**MAKEUP EXAM THROUGH SPECIAL MENTORING SCHEME (SMS)**" for doing self-study and submitting the assignments as per timetable given by the mentor. The ESE examination fees as applicable i.e. minimum Rs. 1000/- and maximum Rs. 2000/- shall be paid separately by registered students. 3. The time-period for this scheme will be from date of detention to 7 days before the commencement make up examination. The dates as per guidelines issued by DAM office and the departmental coordinator shall be applicable. There will not be any MSE examination for this scheme and the final result will be declared on the basis of **FOREGO MARKS** i.e. on the basis of marks obtained in End Semester examination. 4. Registered student must contact minimum 12 & Maximum 18 times with mentor within date of detention to 14 days before the commencement of makeup examination, as per the timetable given by mentor. For laboratory courses, the students will visit the laboratory and complete all practical and submit the record as per the timetable provided by mentor. In theory course the student is mentored and permitted for submission of examination form on the basis of Course Completion Certificate by mentor whereas in laboratory course, the student must attend special 2 – 3 Laboratory session, perform all experiments, and submit the practical record and obtain Course Completion Certificate. 5. Mentor may or may not recommend the student and issue Course Completion certificate, to take exam depending on the

	time. 28.11 Once registered, students will not be allowed to withdraw from a summer term. 28.12 Summer Term is a special semester and students cannot demand it as a matter of right. 28.13 It is optional for a student to make use of summer semester.	performance/ response of the student. 6. By permission of HoD as per recommendation of mentor, student will have to submit the examination form along with Course Completion Certificate as per procedure by paying examination fees. Forego internal marks facility will be mandatorily applied while working under this scheme of registration.
13.10	**Projects/Dissertation** Generally there should not be any extension in the schedule for dissertation report. However, for genuine reasons (such as medical reasons (Accident and / or hospitalization of a student) or other emergency circumstances (death of immediate close relative i.e. father, mother, brother and sister), extension in submission of dissertation report beyond the date specified in the calendar for **one month** with permission from Chairman, BoS, may be granted. If the dissertation cannot be completed due to valid reasons, student will be temporarily awarded 'Z' grade at the time of finalization of grades. The 'Z' grade will be converted to a performance grade when such a student submits the report and undergo the oral examination. Further, if such late reports are not submitted, the 'Z' grade will be automatically converted to 'F'.	**Projects/Dissertation** Generally there should not be any extension in the schedule for dissertation report. However, for genuine reasons (such as medical reasons (Accident and / or hospitalization of a student) or other emergency circumstances (death of immediate close relative i.e. father, mother, brother and sister), extension in submission of dissertation report beyond the date specified in the calendar for **Three month** with permission from Chairman, BoS, may be granted. However these students on evaluation shall be provided **one grade less** than obtained grade. If the dissertation cannot be completed due to valid reasons, student will be temporarily awarded 'Z' grade at the time of finalization of grades. The 'Z' grade will be converted to a performance grade when such a student submits the report and undergo the oral examination. Further, if such late reports are not submitted, the 'Z' grade will be automatically converted to 'F'.

++++end++++

Scheme of Examinations

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CV-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						47				
				Third Semester										
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3
2	3	PC	CV2201	Strength of Materials	T	3	0	0	3	3	30	20	50	3
3	3	PC	CV2202	**Lab:-** Strength of Materials	P	0	0	2	2	1		60	40	
4	3	PC	CV2203	Geotechnical Engineering	T	3	0	0	3	3	30	20	50	3
5	3	PC	CV2204	**Lab:-** Geotechnical Engineering	P	0	0	2	2	1		60	40	
6	3	PC	CV2205	Fluid Mechanics	T	3	0	0	3	3	30	20	50	3
7	3	PC	CV2206	**Lab:-** Fluid Mechanics	P	0	0	2	2	1		60	40	
8	3	PC	CV2207	Water Supply Engineering	T	3	0	0	3	3	30	20	50	3
9	3	PC	CV2208	**Lab:-**Water Supply Engineering	P	0	0	2	2	1		60	40	
				TOTAL		**15**	**0**	**8**	**23**	**19**				
				Fourth Semster										
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	20	50	3
2	4	PC	CV2251	Concrete Technology	T	3	0	0	3	3	30	20	50	3
3	4	PC	CV2252	**Lab:-** Concrete Technology	P	0	0	2	2	1		60	40	
4	4	PC	CV2253	Surveying	T	3	0	0	3	3	30	20	50	3
5	4	PC	CV2254	**Lab:-** Surveying	P	0	0	2	2	1		60	40	
6	4	PC	CV2255	Structural Analysis	T	4	0	0	4	4	30	20	50	3
7	4	PC	CV2256	**Lab:-** Structural Analysis	P	0	0	2	2	1		60	40	
8	4	PC	CV2257	Transportation Engineering	T	3	0	0	3	3	30	20	50	3
9	4	PC	CV2258	**Lab:-** Transportation Engineering	P	0	0	2	2	1		60	40	
				TOTAL		**16**	**0**	**8**	**24**	**20**				
				Audit Courses										
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	A	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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SoE No. CV-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	20	50	3
2	5	PC	CV2301	Reinforced Concrete Structures	**T**	3	0	0	3	3	30	20	50	4
3	5	PC	CV2302	Advanced Structural Analysis	**T**	3	0	0	3	3	30	20	50	3
4	5	PC	CV2303	**Lab:-** Analysis and Design Studio	**P**	0	0	2	2	1		60	40	
5	5	PE-I		Professional Elective-I	**T**	3	0	0	3	3	30	20	50	3
6	5	PE-I		**Lab:-** Professional Elective -I	**P**	0	0	2	2	1		60	40	
7	5	OE-I		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3
8	5	OE-I		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3
					TOTAL	**18**	**0**	**4**	**22**	**20**				

Professional Elective - I

1	5	PE-I	CV2311	PE-I : Advanced Surveying
	5	PE-I	CV2312	**PE-I Lab :** Advanced Surveying
2	5	PE-I	CV2313	PE-I : Computer Applications in Civil Engineering
	5	PE-I	CV2314	**PE-I Lab :** Computer Applications in Civil Engineering
3	5	PE-I	CV2315	PE-I : Building Construction and Materials
	5	PE-I	CV2316	**PE-I Lab :** Building Construction and Materials
4	5	PE-I	CV2317	PE-I : Matrix Analysis of Structures
	5	PE-I	CV2318	**PE-I Lab :** Matrix Analysis of Structures
5	5	PE-I	CV2319	PE-I : Advanced Concrete Technology
	5	PE-I	CV2320	**PE-I Lab :** Advanced Concrete Technology
6	5	PE-I	CV2321	PE-I : Water Treatment
	5	PE-I	CV2322	**PE-I Lab :** Water Treatment
7	5	PE-I	CV2323	PE-I : Environmental Management
	5	PE-I	CV2324	**PE-I Lab :** Environmental Management
8	5	PE-I	CV2325	PE-I : Soil Characterization & Identification
	5	PE-I	CV2326	**PE-I Lab :** Soil Characterization & Identification
9	5	PE-I	CV2327	PE-I : Geographical Information Systems
	5	PE-I	CV2328	**PE-I Lab :** Geographical Information Systems

Open Electives -I

1	5	OE-I	CV2331	OE-I : Building Services Engineering
2	5	OE-I	CV2332	OE-I : Construction Techniques
3	5	OE-I	CV2333	OE-I : Introduction to Environmental Management
4	5	OE-I	CV2334	OE-I : Basics of Transportation Engineering
5	5	OE-I	CV2335	OE-I : Basics of Water Resource Engineering
6	5	OE-I	CV2336	OE-I : Elements of Water Power Engineering

Open Electives -II

1	5	OE-II	CV2341	OE II : Elements of Earthquake Engineering
2	5	OE-II	CV2342	OE II : Introduction to Finite Element Method
3	5	OE-II	CV2343	OE II : Air Pollution and Solid Waste Management
4	5	OE-II	CV2344	OE-II : Environmental & Social Impact Assessment
5	5	OE-II	CV2345	OE II : Disaster Management

Audit Courses											
1	5	HS	AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CV-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	**3**
2	6	PC	CV2351	Steel Structures	**T**	3	0	0	3	3	30	20	50	4
3	6	PC	CV2352	**Lab:-** Building Design Drawing	**P**	0	0	2	2	1		60	40	
4	6	PC	CV2353	Hydraulic Engineering	**T**	3	0	0	3	3	30	20	50	3
5	6	PC	CV2354	**Lab:-** Hydraulic Engineering	**P**	0	0	2	2	1		60	40	
6	6	PC	CV2355	Foundation Engineering	**T**	3	0	0	3	3	30	20	50	3
7	6	PE-II		Professional Elective -II	**T**	3	0	0	3	3	30	20	50	3
8	6	OE-II		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3
9	6	OE-IV		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3
10	6	STR	CV2360	Industry Visit and its report	**P**	0	0	0	0	1		100		
					TOTAL	**21**	**0**	**4**	**25**	**24**				
Audit Courses														
1	6	HS	AU2128	YCCE Communication Aptitude Preparation (YCAP6.1) for CV,EL	**A**	3	0	0	3	0				

Professional Elective - II

1	6	PE-II	CV2361	PE-II : Building Services
2	6	PE-II	CV2362	PE-II : New Engineering Materials
3	6	PE-II	CV2363	PE-II : Construction Management And Machinery
4	6	PE-II	CV2364	PE-II : Earthquake Engineering
5	6	PE-II	CV2365	PE-II : Optimization Techniques
6	6	PE-II	CV2366	PE-II : Introduction to Remote Sensing
7	6	PE-II	CV2367	PE-II : Environmental Geotechniques
8	6	PE-II	CV2368	PE-II : Traffic Engineering
9	6	PE-II	CV2369	PE-II : Water Transmission and Distribution Systems
10	6	PE-II	CV2370	PE-II : Construction Management

Open Electives -III

1	VI	OE-III	CV2371	OE-III : Building Services Engineering
2	VI	OE-III	CV2372	OE-III : Construction Techniques
3	VI	OE-III	CV2373	OE-III : Introduction to Environmental Management
4	VI	OE-III	CV2374	OE-III : Basics of Transportation Engineering
5	VI	OE-III	CV2375	OE-III : Basics of Water Resource Engineering
6	VI	OE-III	CV2376	OE-III : Elements of Water Power Engineering

Open Electives -IV

1	VI	OE-IV	CV2381	OE-IV : Elements of Earthquake Engineering
2	VI	OE-IV	CV2382	OE-IV : Introduction to Finite Element Method
3	VI	OE-IV	CV2383	OE-IV : Air Pollution and Solid Waste Management
4	VI	OE-IV	CV2384	OE-IV : Environmental & Social Impact Assessment
5	VI	OE-IV	CV2385	OE-IV : Disaster Management

Coursera Electives

1	6	PE-II	CV2377	PE-II : Construction Management Technicques
2	5	PE-I	CV2329	PE-I : Mastering bitumen for better roads and innovative applications
	5	PE-I	CV2330	**PE-I : Lab** Mastering bitumen for better roads and innovative applications

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TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05
Chairperson	Dean (Acad. Matters)	Date of Release	Version

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Yeshwantrao Chavan College of Engineering

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SoE No. CV-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	CV2401	Estimating & Costing	**T**	3	0	0	3	3	30	20	50	3
2	7	PC	CV2402	**Lab:-** Estimating &Costing	**P**	0	0	2	2	1		60	40	
3	7	PC	CV2403	Wastewater Engineering	**T**	3	0	0	3	3	30	20	50	3
4	7	PC	CV2404	Hydrology and Water Resources Engineering	**T**	3	0	0	3	3	30	20	50	3
5	7	PE-III		Professional Elective -III	**T**	3	0	0	3	3	30	20	50	3
6	7	PE-IV		Professional Elective -IV	**T**	3	0	0	3	3	30	20	50	3
7	7	PE-V		Professional Elective -V	**T**	3	0	0	3	3	30	20	50	3
8	7	STR	CV2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	CV2410	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**18**	**0**	**6**	**24**	**23**				

Professional Elective - III

1	7	PE-III	CV2411	PE-III : Prestressed Concrete
2	7	PE-III	CV2412	PE-III : Advanced RCC
3	7	PE-III	CV2413	PE-III : Numerical Methods and Computational Techniques
4	7	PE-III	CV2414	PE-III : Environmental Impact Assessment
5	7	PE-III	CV2415	PE-III : Energy Conversion and Management
6	7	PE-III	CV2416	PE-III : Geotechnical Investigation & Ground Improvement Techniques
7	7	PE-III	CV2417	PE-III : Earth and Earth Retaining Structures
8	7	PE-III	CV2418	PE-III : Urban Transportation Planning
9	7	PE-III	CV2419	PE-III : Advanced Hydraulics

Professional Elective - IV

1	7	PE-IV	CV2421	PE-IV : Natural Resources Management
2	7	PE-IV	CV2422	PE-IV : Finite Element Method
3	7	PE-IV	CV2423	PE-IV : Introduction to Structural Dynamics
4	7	PE-IV	CV2424	PE-IV : Wastewater Treatment
5	7	PE-IV	CV2425	PE-IV : Environmental Legislation and Management System
6	7	PE-IV	CV2426	PE-IV : Advanced Foundation Engineering
7	7	PE-IV	CV2427	PE-IV : Geosynthetics
8	7	PE-IV	CV2428	PE-IV : Advanced Transportation Engineering
9	7	PE-IV	CV2429	PE-IV : Watershed Management
10	7	PE-IV	CV2430	PE-IV : Advanced Fluid Mechanics and Hydraulic Machines

Professional Elective - V

1	7	PE-V	CV2431	PE-V : Maintenance and Rehabilitation Engineering
2	7	PE-V	CV2432	PE-V : Project Planning and Management
3	7	PE-V	CV2433	PE-V : Modern Surveying Technique
4	7	PE-V	CV2434	PE-V : Advanced Steel Design
5	7	PE-V	CV2435	PE-V : Design of Bridge Structures
6	7	PE-V	CV2436	PE-V : Industrial Waste Water Treatment and Reuse
7	7	PE-V	CV2437	PE-V : Finite Element methods in Geotechnical Engineering
8	7	PE-V	CV2438	PE-V : Pavement Design
9	7	PE-V	CV2439	PE-V : Water Power Engineering
10	7	PE-V	CV2440	PE-V : Structural Engineering Practices

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TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CV-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	CV2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	CV2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
					TOTAL	**0**	**0**	**12**	**12**	**10**				
					GRAND TOTAL	**88**	**0**	**42**	**130**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. ME-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						47				
				Third Semester										
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3
2	3	PC	ME2201	Material Science & Metallurgy	T	3	0	0	3	3	30	20	50	3
3	3	PC	ME2202	**Lab:-** Material Science & Metallurgy	P	0	0	2	2	1		60	40	
4	3	PC	ME2203	Machining Process	T	3	0	0	3	3	30	20	50	3
5	3	PC	ME2204	**Lab:-** Machining Process	P	0	0	2	2	1		60	40	
6	3	PC	ME2205	Mechanics of Material	T	4	0	0	4	4	30	20	50	3
7	3	PC	ME2206	**Lab:-** Mechanics of Material	P	0	0	2	2	1		60	40	
8	3	PC	ME2207	Kinematics of Machines	T	3	0	0	3	3	30	20	50	3
9	3	PC	ME2208	Fluid Mechanics	T	4	0	0	4	4	30	20	50	3
10	3	PC	ME2209	**Lab:-** Fluid Mechanics	P	0	0	2	2	1		60	40	
				TOTAL		**20**	**0**	**8**	**28**	**24**				
				Fourth Semster										
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	20	50	3
2	4	PC	ME2251	Design of Machine Elements	T	3	0	0	3	3	30	20	50	3
3	4	PC	ME2252	Engineering Thermodynamics	T	3	0	0	3	3	30	20	50	3
4	4	PC	ME2253	**Lab:-** Machine Drawing	P	0	0	2	2	1		60	40	
5	4	PC	ME2254	Manufacturing Process-II	T	3	0	0	3	3	30	20	50	3
6	4	PC	ME2255	**Lab:-** Manufacturing Process-II	P	0	0	2	2	1		60	40	
7	4	PC	ME2256	Mechanical measurement & Metrology	T	4	0	0	4	4	30	20	50	3
8	4	PC	ME2257	**Lab:-** Mechanical measurement & Metrology	P	0	0	2	2	1		60	40	
				TOTAL		**16**	**0**	**6**	**22**	**19**				
				Audit Courses										
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	A	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

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Yeshwantrao Chavan College of Engineering

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SoE No. ME-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	20	50	3
2	5	PC	ME2301	Heat Transfer	**T**	3	0	0	3	3	30	20	50	3
3	5	PC	ME2302	**Lab:-** Heat Transfer	**P**	0	0	2	2	1		60	40	
4	5	PC	ME2303	Dynamics of Machines	**T**	3	0	0	4	3	30	20	50	3
5	5	PC	ME2304	**Lab:-** Dynamics of Machines	**P**	0	0	2	2	1		60	40	
6	5	PC	ME2305	Production Management	**T**	3	0	0	3	3	30	20	50	3
7	5	OE-I		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3
8	5	OE-II		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3
9	5	STR	ME2310	**Industry Visit and its report**	**P**	0	0	0	0	1		100		
					TOTAL	**18**	**0**	**4**	**23**	**21**				

Open Electives -I

1	5	OE-I	ME2331	OE I : Operations Research Techniques
2	5	OE-I	ME2332	OE I : Automobile Engineering
4	5	OE-I	ME2334	OE I : Control System Engineering
5	5	OE-I	ME2335	OE I: Robotics and Subtractive Manufacturing

Open Electives -II

1	5	OE-II	ME2341	OE II : Total Quality Management
2	5	OE-II	ME2342	OE II : Reliability Engineering
3	5	OE-II	ME2343	OE II : Power Generation Engineering
4	5	OE-II	ME2344	OE II : Project Evaluation & Management

Audit Courses											
1	5	HS	AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0	

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Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	3
2	6	PC	ME2351	Fluid Machines	**T**	3	0	0	3	3	30	20	50	3
3	6	PC	ME2352	**Lab:-** Fluid Machines	**P**	0	0	2	2	1		60	40	
4	6	PC	ME2353	Computer Aided Design (CAD LAB)	**P**	0	0	2	2	1		60	40	
5	6	PC	ME2354	Design of Mechanical Drives	**T**	3	0	0	3	3	30	20	50	3
6	6	PE-I		Professional Elective I	**T**	3	0	0	3	3	30	20	50	3
7	6	PE-I		**Lab:- Professional Elective I**	**P**	0	0	2	2	1		60	40	
8	6	OE-III		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3
9	6	OE-IV		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3
				TOTAL		**18**	**0**	**6**	**24**	**21**				

*** Refure list Open Elective- I & II**

**** Refure list Open Elective- III & IV**

Audit Courses														
1	6	HS	AU2129	YCCE Communication Aptitude Preparation (YCAP6.2)for ME, EE,ETC	**A**	3	0	0	3	0				

List of Professional Electives-I

1	**6**	PE-I	ME2361	PE I : Finite Element Methods
	6	PE-I	ME2362	PE I : Lab:- Finite Element Methods
2	**6**	PE-I	ME2363	PE I : Computer Graphics
	6	PE-I	ME2364	PE I : Lab:- Computer Graphics
3	**6**	PE-I	ME2365	PE I : I.C. Engines
	6	PE-I	ME2366	PE I : Lab:- I.C. Engines
4	**6**	PE-I	ME2367	PE I : Refrigeration & Cryogenics
	6	PE-I	ME2368	PE I : Lab:- Refrigeration & Cryogenics
5	**6**	PE-I	ME2369	PE I : Computer Integrated Manufacturing
	6	PE-I	ME2370	PE I : Lab:- Computer Integrated Manufacturing
6	**6**	PE-I	ME2371	PE I : Mechatronics
	6	PE-I	ME2372	PE I : Lab:- Mechatronics
7	**6**	PE-I	ME2373	PE I: Data Structure and Algorithm
	6	PE-I	ME2374	PE I : Lab:Data Structure and Algorithm
8	**6**	PE-I	ME2375	PE I: Management Information System
	6	PE-I	ME2376	PE I : Lab: Management Information System
9	**6**	PE-I	ME2377	PE I :Industrial Fluid Power
	6	PE-I	ME2378	PE I : Lab:- Industrial Fluid Power
10	**6**	PE-I	ME2379	PE I: Thermal Engineering Systems
	6	PE-I	ME2380	PE I : Lab:Thermal Engineering Systems
11	6	PE-I	ME2387	PE I : Advance Welding Techniques
	6	PE-I	ME2388	PE I : Lab: Advance Welding Techniques
12	6	PE-I	ME2389	PE I : Control Systems Engineering
	6	PE-I	ME2390	PE I : Lab: Control Systems Engineering

Coursera Electives				
1	6	PE-I	ME2385	PE I : Supply Chain Management
	6	PE-I	ME2386	PE I : Lab:- Supply Chain Management
2	7	PE-IV	ME2450	PE IV: Aerial Robotics and Mobility

Open Electives -III

1	6	OE-III	ME2381	OE III : Operations Research Techniques
2	6	OE-III	ME2382	OE III : Automobile Engineering
3	6	OE-III	ME2383	OE III : Control System Engineering
4	6	OE-III	ME2384	OE-III : Robotics and Subtractive Manufacturing
Open Electives -IV				
5	6	OE-IV	ME2391	OE IV : Total Quality Management
6	6	OE-IV	ME2392	OE IV : Reliability Engineering
7	6	OE-IV	ME2393	OE IV : Power Generation Engineering
8	6	OE-IV	ME2394	OE IV : Project Evaluation & Management

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SoE No. ME-202.1

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(Revised Scheme of Examination w.e.f. 2022-23 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	ME2401	Automation In Production	**T**	3	0	0	3	3	30	20	50	3
2	7	PC	ME2402	**Lab:-** Automation In Production	**P**	0	0	2	2	1		60	40	
3	7	PE		Professional Elective II	**T**	3	0	0	3	3	30	20	50	3
4	7	PE		Professional Elective III	**T**	3	0	0	3	3	30	20	50	3
5	7	PE		**Lab:-** Professional Elective III	**P**	0	0	2	2	1		60	40	
6	7	PE		Professional Elective IV	**T**	3	0	0	3	3	30	20	50	3
7	7	PE		Professional Elective V	**T**	3	0	0	3	3	30	20	50	3
8	7	STR	ME2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	ME2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				
Professional Electives -II														
1	7	PE-II	ME2411	PE II : Tool Design										
2	7	PE-II	ME2412	PE II : Additive Manufacturing										
3	7	PE-II	ME2413	PE II : Fuel Cell Technology										
4	7	PE-II	ME2414	PE II : Refrigeration and Air Conditioning										
5	7	PE-II	ME2415	PE II : Material Handling Systems										
6	7	PE-II	ME2416	PE II : Reliability Engineering										
7	7	PE-II	ME2417	PE II : Advanced Manufacturing Techniques										
8	7	PE-II	ME2418	PE II : Optimization Techniques										
Professional Electives -III														
9	7	PE-III	ME2421	PE III : Vibration										
10	7	PE-III	ME2422	PE III : Lab:- Vibration										
11	7	PE-III	ME2423	PE III : Comuter Aidded Design and Manufacturing										
12	7	PE-III	ME2424	PE III : Lab:- Comuter Aidded Design and Manufacturing										
13	7	PE-III	ME2425	PE III : Vehicle Engineering										
14	7	PE-III	ME2426	PE III : Lab:- Vehicle Engineering										
15	7	PE-III	ME2427	PE III : Solar Energy and It'S Utilisation										
16	7	PE-III	ME2428	PE III : Lab:- Solar Energy and It'S Utilisation										
17	7	PE-III	ME2429	PE III : CNC & Robotics										
18	7	PE-III	ME2430	PE III : Lab:- CNC & Robotics										
19	7	PE-III	ME2433	PE III :Pipe Design Engineering										
20	7	PE-III	ME2434	PE III : Lab:- Pipe Design Engineering										
21	7	PE-III	ME2435	PE III : Earth Moving Equipments										
22	7	PE-III	ME2436	PE III : Lab:- Earth Moving Equipments										
Professional Electives -IV														
23	7	PE-IV	ME2441	PE IV : Sysnthesis of Mechanism										
24	7	PE-IV	ME2442	PE IV : Design for Manufacturing & Assembly										
25	7	PE-IV	ME2443	PE IV : Renewable Energy System										
26	7	PE-IV	ME2444	PE IV : Engineering of Plastics										
27	7	PE-IV	ME2445	PE IV : Finance & Cost Management										
28	7	PE-IV	ME2446	PE IV : Artificial Intelligence										
29	7	PE-IV	ME2447	PE IV : Maintenance Management										
30	7	PE-IV	ME2448	PE IV : Total Quality Management										
31	7	PE-IV	ME2449	PE IV : Project Evaluation & Management										
Professional Electives -V														
32	7	PE-V	ME2461	PE V : Stress Analysis										
33	7	PE-V	ME2462	PE V : Product Design and Development										
34	7	PE-V	ME2463	PE V : Power Plant Engineering										
35	7	PE-V	ME2464	PE V : Value Engineering										
36	7	PE-V	ME2465	PE V : Design of Experiments and Taguchi Methods										
37	7	PE-V	ME2466	PE V : Industrial Safety										
38	7	PE-V	ME2467	PE V : Control System Engineering										
39	7	PE-V	ME2468	PE V : Tribology										
40	7	PE-V	ME2469	PE V : Turbines										

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SoE No. ME-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	ME2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	ME2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**87**	**0**	**44**	**132**	**163**				

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B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
TOTAL FIRST & SECOND SEM										47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	EL2201	Analog Electronics	T	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	EL2202	Lab. : Electronics Engineering Workshop	P	0	0	2	2	1		60	40	
4	3	PC	EL2203	Electrical Machines	T	4	0	0	4	4	30	20	50	3 Hours
5	3	PC	EL2204	Lab.:Electrical Machines	P	0	0	2	2	1		60	40	
6	3	PC	EL2205	Network Analysis	T	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	EL2206	Lab.:Computer Programming	P	0	0	2	2	1		60	40	
8	3	PC	EL2207	Electrical Measurement & Instrumentation	T	3	0	0	3	3	30	20	50	3 Hours
9	3	PC	EL2208	Lab.:Electrical Measurement & Instrumentation	P	0	0	2	2	1		60	40	
				TOTAL		**16**	**0**	**8**	**24**	**20**				
Fourth Semster														
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	EL2251	Electrical Machines in Power System	T	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	EL2252	Lab.:Electrical Machines in Power System	P	0	0	2	2	1		60	40	
4	4	PC	EL2253	Electrical Energy Generation System	T	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	EL2254	Lab.:Renewable Energy System	P	0	0	2	2	1		60	40	
6	4	PC	EL2255	Electric & Magnetic Fields	T	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	EL2256	Lab.:Electrical Engineering Workshop	P	0	0	2	2	1		60	40	
8	4	PC	EL2257	Microprocessor	T	3	0	0	3	3	30	20	50	3 Hours
9	4	PC	EL2258	Lab.:Microprocessor	P	0	0	2	2	1		60	40	
10	4	PC	EL2259	Signals & Systems	T	4	0	0	4	4	30	20	50	3 Hours
				TOTAL		**19**	**0**	**8**	**27**	**23**				
List of Audit Courses														
1	3	HS	GE2121	Env Studies for 3 Sem. EL,ET,CT	A	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2125	YCCE Communication Aptitude Preparation (YCAP4.2) for EL,EE,ET	A	3	0	0	3	0				

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SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	EL2301	Power Electronics	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	EL2302	Lab.:Power Electronics	**P**	0	0	2	2	1		60	40	
4	5	PC	EL2303	Fundamentals of Power System	**T**	3	0	0	3	3	30	20	50	3 Hours
5	5	PC	EL2304	Electrical Drives	**T**	3	0	0	3	3	30	20	50	3 Hours
6	5	PC	EL2305	Lab.:Electrical Drives	**P**	0	0	2	2	1		60	40	
7		OE		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3 Hours
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3 Hours
					TOTAL	**18**	**0**	**4**	**22**	**20**				
Audit Courses														
1	5	HS	AU2127	YCCE Communication Aptitude Preparation (YCAP5.2) for EL,EE,ET	**A**	3	0	0	3	0				

Open Electives -I

1	5	OE	EL2311	OEI:Renewable Energy Generation System
2	5	OE	EL2312	OEI:Electrical Machines and their Applications
3	5	OE	EL2313	OEI:Testing and Maintenance of Electrical Machines
4	5	OE	EL2314	OEI: Solar power plant design and Installation

Open Electives -II

4	5	OE	EL2321	OEII:Electrical Energy Audit and Safety
5	5	OE	EL2322	OEII:Utilization of Electrical Energy
6	5	OE	EL2323	OEII:Power System Engineering

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Electrical Engineering

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						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	EL2351	Control System	**T**	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	EL2352	Lab.:Control System	**P**	0	0	2	2	1		60	40	
4	6	PC	EL2353	Power System Analysis	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PE		**Professional Elective I**	**T**	3	0	0	3	3	30	20	50	3 Hours
6	6	PE	EL2354	**Lab.**:Simulation of Power Electronics & Power System	**P**	0	0	2	2	1		60	40	
7	6	OE		**Open Elective III ***	**T**	3	0	0	3	3	30	20	50	3 Hours
8	6	OE		**Open Elective IV ***	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	PC	EL2355	Lab.:Substation Design	**P**	0	0	2	2	1		60	40	
10	5/6	STR	EL2360	**Industry Visit and its report**	**P**	0	0	0	0	1		60	40	
					TOTAL	**18**	**0**	**6**	**24**	**22**				

Professional Electives -I

1	6	PE	EL2361	**PEI:**Advanced Power Electronics
2	6	PE	EL2362	**PEI**:Electrical Distribution in Power System
3	6	PE	EL2363	**PEI:**Illumination Engineering (MOOC)
4	6	PE	EL2364	**PEI:**Electric Vehicles
5	6	PE	EL2365	**PEI**:Electric Power Utilization

Open Electives -III

6	6	OE	EL2371	**OEIII**:Renewable Energy Generation System
7	6	OE	EL2372	**OEIII**:Electrical Machines and their Applications
8	6	OE	EL2373	**OEIII**:Testing and Maintenance of Electrical Machines
9	6	OE	EL2374	**OEIII**:Solar power plant design and Installation

Open Electives -IV

10	6	OE	EL2381	**OEIV:**Electrical Energy Audit and Safety
11	6	OE	EL2382	**OEIV**:Utilization of Electrical Energy
12	6	OE	EL2383	**OEIV**:Power System Engineering

Audit Courses

1	6	HS	AU2128	YCCE Communication Aptitude Preparation (YCAP6.1) for CV,EL	**A**	3	0	0	3	0	

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		June 2022	**1.05**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EL-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	EL2401	Switchgear & Protection	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	EL2402	Lab.:Switchgear & Protection	**P**	0	0	2	2	1		60	40	
3	7	PC	EL2403	High Voltage Engineering	T	3	0	0	3	3	30	20	50	3 Hours
4	7	PC	EL2404	Lab.:High Voltage Engineering	**P**	0	0	2	2	1		60	40	
5	7	PE		**Professional Elective II**	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		**Professional Elective III**	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		**Professional Elective IV**	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	EL2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	EL2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -II

1	7	PE	EL2411	**PEII:** Fundamentals of Power Quality
2	7	PE	EL2412	**PEII:**Electrical Installation Design
3	7	PE	EL2413	**PEII:**Electrical Machine Design
4	7	PE	EL2421	**PEII:** Power System Operation and Control
5	7	PE	EL2422	**PEII:** Sensors and Actuators

Professional Electives -III

5	7	PE	EL2422	**PEIII**:FACTS Devices
6	7	PE	EL2423	**PEIII**: Electrical Energy Management and Audit
7	7	PE	EL2424	**PEIII:**Advanced Control System
8	7	PE	EL2425	**PEIII:**Artificial Intelligence Based System

Professional Electives -IV

9	7	PE	EL2431	**PEIV:**Advanced Electrical Drives
10	7	PE	EL2432	**PEIV**:Fundamentals of Smart Grid
11	7	PE	EL2433	**PEIV**:Computer Methods in Power System
12	7	PE	EL2434	**PEIV**:EHVAC-HVDC Transmission

Coursera Electives				
1	6	PE	EL2366	**PEI**:Energy Production, Distribution and Safety
1	7	PE	EL2435	**PEIV**: Power Electronics Specialization

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2020	**1.04**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2020-21 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EL-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	EL2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	EL2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**86**	**0**	**46**	**132**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
TOTAL FIRST & SECOND SEM										47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	EE2201	Electronic Devices	T	3	1	0	4	4	30	20	50	3 Hours
3	3	PC	EE2202	**Lab:**Electronic Devices	P	0	0	2	2	1		60	40	
4	3	PC	EE2203	Signal and Systems	T	3	0	0	3	3	30	20	50	3 Hours
5	3	PC	EE2204	**Lab**:Programming Language	P	0	0	2	2	1		60	40	
6	3	PC	EE2205	Digital Logic Design	T	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	EE2206	**Lab:** Digital Logic Design	P	0	0	2	2	1		60	40	
8	3	PC	EE2207	Network Analysis	T	3	0	0	3	3	30	20	50	3 Hours
9	3	PC	EE2208	**Lab:**Network Analysis	P	0	0	2	2	1		60	40	
					TOTAL	**15**	**1**	**8**	**24**	**20**				
Fourth Semster														
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	EE2251	Electronic Circuits	T	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	EE2252	**Lab:**Electronic Circuits	P	0	0	2	2	1		60	40	
4	4	PC	EE2253	Microcontroller and its Applications	T	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	EE2254	**Lab:** Microcontroller and its Applications	P	0	0	2	2	1		60	40	
6	4	PC	EE2255	Analog Communication	T	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	EE2256	**Lab**.: Analog Communication	P	0	0	2	2	1		60	40	
8	4	PC	EE2257	Electromagnetic Fields	T	3	1	0	4	4	30	20	50	3 Hours
9	4	PC	EE2258	**Lab**: Simulation Lab/Workshp Lab	P	0	0	2	2	1		60	40	
					TOTAL	**15**	**1**	**8**	**24**	**20**				
Audit Courses														
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	A	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2125	YCCE Communication Aptitude Preparation (YCAP4.2) for EL,EE,ET	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	June 2022	1.05
		Date of Release	Version

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(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	EE2301	Digital Signal Processing	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	EE2302	**Lab:** Digital Signal Processing	**P**	0	0	2	2	1		60	40	
4	5	PC	EE2303	Analog Integrated Circuit & its Application	**T**	3	0	0	3	3	30	20	50	3 Hours
5	5	PC	EE2304	**Lab:** Analog Integrated Circuit & its Application	**P**	0	0	2	2	1		60	40	
6	5	PE		Professional Elective-I	**T**	3	0	0	3	3	30	20	50	3 Hours
7	5	PE		Lab.: Professional Elective-I	**P**	0	0	2	2	1		60	40	
8	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3 Hours
10	5	STR	EE2310	**Industry Visit and its report**	**P**	0	0	0	0	1		100		
				TOTAL		**18**	**0**	**6**	**24**	**22**				

List of Audit Courses														
1	5	HS	AU2127	YCCE Communication Aptitude Preparation (YCAP5.2) for EL,EE,ET	**A**	3	0	0	3	0				

Professional Electives -I

1	5	PE-I	EE2311	PE-I:Computer Communication Network
2	5	PE-I	EE2312	**Lab:**PE-I:Computer Communication Network
3	5	PE-I	EE2313	PE-I:Embedded System
4	5	PE-I	EE2314	**Lab:**PE-I:Embedded System
5	5	PE-I	EE2315	PE-I:Algorithm & Data Structure
6	5	PE-I	EE2316	**Lab:**PE-I:Algorithm & Data Structure
7	5	PE-I	EE2317	PE-I: Applied Machine Learning
8	5	PE-I	EE2318	**Lab:**PE-I:Applied Machine Learning

Open Electives -I

1	5	OE-I	EE2331	OE I : Fuzzy Logic & Neural Network
2	5	OE-I	EE2332	OE I : Basics of Analog and Digital Communication
3	5	OE-I	EE2333	OE I : Biomedical Instrumentation

Open Electives -II

1	5	OE-II	EE2341	OE II : Data Acquisition & Signal Conditioning
2	5	OE-II	EE2342	OE II : Microprocessor Programming
3	5	OE-II	EE2343	OE II : Consumer Electronics

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

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TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05	Applicable for AY 2022-23 Onwards
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SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	EE2351	Control System Engineering	**T**	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	EE2352	Transmission Lines and Waveguides	**P**	0	0	2	2	1		60	40	
4	6	PC	EE2353	Digital Communication	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PC	EE2354	**Lab:**Digital Communication	**T**	3	0	0	3	3	30	20	50	3 Hours
6	6	PE		Professional Elective-II	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PE		Lab.: Professional Elective-II	**P**	0	0	2	2	1		60	40	
8	6	OE		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	OE		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3 Hours
				TOTAL		**21**	**0**	**4**	**25**	**23**				

Professional Electives -II

1	6	PE II	EE2361	PE II:Internet of Things
	6	PE II	EE2362	**Lab:** PE II:Internet of Things
2	6	PE II	EE2363	PE II:Digital CMOS Circuits
	6	PE II	EE2364	**Lab:** PE II:Digital CMOS Circuits
3	6	PE II	EE2365	PE II:Digital Image Processsing
	6	PE II	EE2366	**Lab:**PE II:Digital Image Processsing
4	6	PE II	EE2367	PE II:Object Oriented Programming
	6	PE II	EE2368	**Lab:**PE II:Object Oriented Programming

Open Electives -III

1	6	OE-III	EE2381	OE III : Fuzzy Logic & Neural Network
2	6	OE-III	EE2382	OE III : Basics of Analog and Digital Communication
3	6	OE-III	EE2383	OE III : Biomedical Instrumentation
Open Electives -IV				
4	6	OE-IV	EE2391	OE IV : Data Acquisition & Signal Conditioning
5	6	OE-IV	EE2392	OE IV : Microprocessor Programming
6	6	OE-IV	EE2393	OE IV : Consumer Electronics

Audit Courses											
1	6	HS	AU2129	YCCE Communication Aptitude Preparation (YCAP6.2) for ME, EE, ETC	**A**	3	0	0	3	0	

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SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	EE2401	Digital System Design	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	EE2402	**Lab.**: Digital System Design	**P**	0	0	2	2	1		60	40	
3	7	PE		Professional Elective-III	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE		Professional Elective-IV	**T**	3	0	0	3	3	30	20	50	3 Hours
5	7	PE		Lab. : Professional Elective-IV	**P**	0	0	2	2	1		60	40	
6	7	PE		Professional Elective-V	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		Professional Elective-VI	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	EE2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	EE2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -III

1	7	PE III	EE2411	PE III: Switching Theory & Finite Automata
2	7	PE III	EE2412	PE III :Power Electronics
3	7	PE III	EE2413	PE III: Wireless Sensor Network
4	7	PE III	EE2414	PE III: VLSI Signal Processing

Professional Electives -IV

1	7	PE IV	EE2421	PE IV: Wireless Communication
	7	PE IV	EE2422	**Lab:** PE IV:Wireless Communication
2	7	PE IV	EE2423	PE IV: RF and Microwave
	7	PE IV	EE2424	**Lab:** PE IV: RF and Microwave
3	7	PE IV	EE2425	PE IV: Analog VLSI Design
	7	PE IV	EE2426	**Lab. :** PE IV: Analog VLSI Design
4	7	PE IV	EE2427	PE IV: Operating Systems
	7	PE IV	EE2428	**Lab:** PE IV:Operating Systems

Professional Electives -V

1	7	PE V	EE2431	PE V: Industrial Automation
2	7	PE V	EE2432	PE V: Nano Electronics
4	7	PE V	EE2433	PE V: Optical Communication
5	7	PE V	EE2434	PE V: RF Circuit Design

Professional Electives -VI

1	7	PE-VI	EE2441	PE-VI: E-Commerce and Data Analytics
2	7	PE-VI	EE2442	PE-VI: Micro Electro Mechanical Systems (MEMS)
3	7	PE-VI	EE2443	PE-VI: Biomedical Instrumentation
4	7	PE-VI	EE2444	PE-VI: Computer Organization
5	7	PE-VI	EE2445	PE VI : Introduction to Remote Sensing and Image Analysis

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

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Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	EE2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	EE2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**84**	**2**	**46**	**132**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

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SoE No. ET-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
				Third Semester										
1	3	BS	GE2201	Engineering Mathematics III	**T**	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	ET2201	Electronic Devices and Circuits	**T**	3	1	0	4	4	30	20	50	3 Hours
3	3	PC	ET2202	Lab: Electronic Devices and Circuits	**P**	0	0	2	2	1		60	40	
4	3	PC	ET2203	Digital Circuits and Fundamentals of Microprocessor.	**T**	3	0	0	3	3	30	20	50	3 Hours
5	3	PC	ET2204	**Lab:** Digital Circuits and Fundamentals of Microprocessor.	**P**	0	0	2	2	1		60	40	
6	3	PC	ET2205	Electronic Measurement and Instrumentation	**T**	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	ET2206	Lab: Electronic Measurement and Instrumentation	**P**	0	0	2	2	1		60	40	
8	3	PC	ET2207	Network Analysis	**T**	3	0	0	3	3	30	20	50	3 Hours
				TOTAL THIRD SEM		**15**	**1**	**6**	**22**	**19**				
				Fourth Semster										
1	4	BS	GE2204	Advance Mathematical Techniques	**T**	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	ET2251	Electromagnetic Fields	**T**	3	1	0	4	4	30	20	50	3 Hours
3	4	PC	ET2252	Microcontroller and Interfacing	**T**	3	0	0	3	3	30	20	50	3 Hours
4	4	PC	ET2253	Lab: Microcontroller and Interfacing	**P**	0	0	2	2	1		60	40	
5	4	PC	ET2254	Analog Communication	**T**	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	ET2255	Lab: Analog Communication	**P**	0	0	2	2	1		60	40	
7	4	PC	ET2256	Control Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	ET2257	Lab.: Control Systems	**P**	0	0	2	2	1		60	40	
				TOTAL FOURTH SEM		**15**	**1**	**6**	**22**	**19**				
List of Audit Courses														
1	3	HS	GE2121	Env Studies for 3 Sem. EL,ET,CT	**A**	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
3	4	HS	AU2125	YCCE Communication Aptitude Preparation (YCAP4.2) for EL,EE,ET	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
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(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	ET2301	Analog Integrated circuits	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	ET2302	Lab: Analog Integrated circuits	**P**	0	0	2	2	1		60	40	
4	5	PC	ET2303	Fields & Radiating Systems	**T**	3	1	0	4	4	30	20	50	3 Hours
5	5	PC	ET2304	Signals & Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
6	5	PC	ET2305	Lab. :Signals & Systems	**P**	0	0	2	2	1		60	40	
7	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3 Hours
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5		ET2306	Lab.: Electronics Workshop	**P**	0	0	2	2	1		60	40	
10	**5/6**	**STR**	**ET2310**	**Industry Visit and its report**	**P**	0	0	0	0	1		100		
				TOTAL FIFTH SEM		**18**	**1**	**6**	**25**	**23**				

Audit Courses														
1	5	HS	AU2127	YCCE Communication Aptitude Preparation (YCAP5.2) for EL,EE,ET	**A**	3	0	0	3	0				

Open Electives -I

1	5	OE 1	ET2311	OE I : Microcontroller & Embedded Systems
2	5	OE 1	ET2312	OE I : Principles of Communication Engineering
3	5	OE 1	ET2313	OE I : Fundamentals of Image Processing
4	5	OE 1	ET2314	OE I : Fundamentals of IoT

Open Electives -II

1	5	OE 2	ET2321	OE II : Soft computing
2	5	OE 2	ET2322	OE II : Industrial Instrumentation
3	5	OE 2	ET2323	OE II : Medical Electronics
4	5	OE 2	ET2324	OE II : Display Technology & Applications
5	5	OE 2	ET2325	OE II : PLCs and SCADA

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

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SoE No. ET-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	ET2351	Digital Signal Processing	**T**	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	ET2352	Lab: Digital Signal Processing	**P**	0	0	2	2	1		60	40	
4	6	PE		Professional Elective I	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PE		Lab. : Professional Elective I	**P**	0	0	2	2	1		60	40	
6	6	PE		Professional Elective II	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PE		Lab. : Professional Elective II	**P**	0	0	2	2	1		60	40	
8	6	OE		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	OE		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3 Hours
TOTAL SIXTH SEM						**18**	**0**	**6**	**24**	**21**				

Professional Electives -I

1	6	PE I	ET2361	PE I : Object Oriented Programming
2	6	PE I	ET2362	PE I : Lab. Object Oriented Programming
3	6	PE I	ET2363	PE I : Discrete Structures
4	6	PE I	ET2364	PE I : Lab. Discrete Structures
5	6	PE I	ET2365	PE I : Microprocessors and Peripherals
6	6	PE I	ET2366	PE I : Lab. Microprocessors and Peripherals
7	6	PE I	ET2367	PE I : Electronic Instrumentation
8	6	PE I	ET2368	PE I :Lab Electronic Instrumentation
9	6	PE I	ET2371	PE I : Fundamentals of Computing
10	6	PE I	ET2372	PE I : Lab Fundamentals of Computing
11	6	PE I	ET2373	PE I : Algorithms and data structures
12	6	PE I	ET2374	PE I :Lab Algorithms and data structures

Professional Electives -II

1	6	PE II	ET2377	PE II : Antenna Theory & Design
2	6	PE II	ET2378	PE II : Lab. Antenna Theory & Design
3	6	PE II	ET2379	PE II : Digital system Design
4	6	PE II	ET2380	PE II : Lab. Digital system Design
5	6	PE II	ET2381	PE II : Internet of Things (IoT)
6	6	PE II	ET2382	PE II : Lab. Internet of Things (IoT)
7	6	PE II	ET2383	PE II : Optical Communication
8	6	PE II	ET2384	PE II : Lab. Optical Communication
9	6	PE II	ET2385	PE II :Principles of image processing
10	6	PE II	ET2386	PE II : Lab. Principles of image processing
11	6	PE II	ET2387	PE II : TV & Video Engineering
12	6	PE II	ET2388	PE II : Lab. TV & Video Engineering

Open Electives -III

1	6	OE 3	ET2391	OE III : Microcontroller & Embedded Systems
2	6	OE 3	ET2392	OE III : Principles of Communication Engineering
3	6	OE 3	ET2393	OE III : Fundamentals of Image Processing
4	6	OE 3	ET2394	OE III : Fundamentals of IoT

Open Electives -IV

4	6	OE 4	ET2396	OE IV : Soft computing
5	6	OE 4	ET2397	OE IV : Industrial Instrumentation
6	6	OE 4	ET2398	OE IV : Medical Electronics
7	6	OE 4	ET2399	OE IV : Display Technology & Applications
7	6	OE 4	ET2400	OE IV : PLCs & SCADA

Audit Courses

1	6	HS	AU2129	YCCE Communication Aptitude Preparation (YCAP6.2) for ME, EE, ETC	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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SoE No. ET-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	ET2401	RF & Microwave	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	ET2402	Lab: RF & Microwave	**P**	0	0	2	2	1		60	40	
3	7	PC	ET2403	Digital Communication	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PC	ET2404	Lab: Digital Communication	**P**	0	0	2	2	1		60	40	
5	7	PE		Professional Elective III	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		Professional Elective IV	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		Professional Elective V	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	PE		Professional Elective VI	**T**	3	0	0	3	3	30	20	50	3 Hours
9	7	STR	ET2409	Mini Project	**P**	0	0	4	4	2		60	40	
10	7	STR	ET2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
				TOTAL SEVENTH SEM		**18**	**0**	**8**	**26**	**24**				

Professional Electives -III

1	7	PE	ET2411	PE III : Power Electronics
2	7	PE	ET2412	PE III : Data Compression & Encryption
3	7	PE	ET2413	PE III : Analog VLSI
4	7	PE	ET2414	PE III : Error Correcting Codes
5	7	PE	ET2415	PE III : Wireless Mobile Communication Systems

Professional Electives -IV

6	7	PE	ET2421	PE IV : Satellite Communication & RADAR Engineering
7	7	PE	ET2422	PE IV : Embedded System
8	7	PE	ET2423	PE IV : Switching Theory
9	7	PE	ET2424	PE IV : Topics in Machine Learning
10	7	PE	ET2425	PE IV : Multimedia Communications

Professional Electives -V

11	7	PE	ET2431	PE V : Display Technology
12	7	PE	ET2432	PE V : Biomedical Instrumentation
13	7	PE	ET2433	PE V : Fuzzy Logic & Neural Network
14	7	PE	ET2434	PE V : Wireless Sensor Networks
15	7	PE	ET2435	PE V : RF Circuit Design

Professional Electives -VI

16	7	PE	ET2441	PE VI : CMOS VLSI Design
17	7	PE	ET2442	PE VI : Digital Image Analysis for Remote Sensing
18	7	PE	ET2443	PE VI : Microwave Integrated circuits
19	7	PE	ET2444	PE VI : Communication Networks
20	7	PE	ET2445	PE VI : Computer Architecture and Organization
21	7	PE	ET2446	PE VI : PLCs & SCADA

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Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	ET2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	ET2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**84**	**3**	**44**	**131**	**163**				

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B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	**T**	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CT2201	Computer Architecture & Organisation	**T**	4	0	0	4	4	30	20	50	3 Hours
3	3	PC	CT2202	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	CT2203	Lab: Object Oriented Programming	**P**	0	0	2	2	1		60	40	
5	3	PC	CT2204	Data Structures	**T**	4	0	0	4	4	30	20	50	3 Hours
6	3	PC	CT2205	Lab: Data Structures	**P**	0	0	2	2	1		60	40	
7	3	PC	CT2206	Lab: Python Programming	**P**	0	0	2	2	1		60	40	
8	3	PC	CT2207	Lab: Web Technology	**P**	0	0	2	2	1		60	40	
				TOTAL		**14**	**0**	**8**	**22**	**18**				
Fourth Semster														
1	4	BS	GE2206	Discrete Mathematics and Probability Theory	**T**	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CT2251	Operating Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CT2252	Lab:Operating Systems	**P**	0	0	2	2	1		60	40	
4	4	PC	CT2253	Advanced Data Structures	**T**	4	0	0	4	4	30	20	50	3 Hours
5	4	PC	CT2254	Lab: Advanced Data Structures	**P**	0	0	2	2	1		60	40	
6	4	PC	CT2255	Mathematical Foundations for Data Analysis	**T**	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	CT2256	Lab: Mathematical Foundations for Data Analysis	**P**	0	0	2	2	1		60	40	
8	4	PC	CT2257	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
9	4	PC	CT2258	Lab: Database Management Systems	**P**	0	0	2	2	1		60	40	
				TOTAL		**16**	**0**	**8**	**24**	**20**				
Audit Courses														
1	3	HS	GE2121	Env Studies for 3 Sem. EL,ET,CT	**A**	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
3	4	HS	AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0				

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Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamentals of Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	CT2301	Computer Networks	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	CT2302	Lab: Computer Networks	**P**	0	0	2	2	1		60	40	
4	5	PC	CT2303	Theoretical Foundations of Computer Science	**T**	4	0	0	4	4	30	20	50	3 Hours
5	5	PE		Professional Elective-I	**T**	3	0	0	3	3	30	20	50	3 Hours
6	5	PE		Lab: Professional Elective-I	**P**	0	0	2	2	1		60	40	
7	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3 Hours
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3 Hours
9	**5/6**	**STR**	**CT2310**	**IND VISIT and its report**	**P**	**0**	**0**	**0**	**0**	**1**		100		
					TOTAL	**19**	**0**	**4**	**23**	**22**				

Professional Electives -I

1	5	PE-I	CT2311	PE I: Randomized Algorithm
	5	PE-I	CT2312	PE I: Lab Randomized Algorithm
2	5	PE-I	CT2313	PE I: Mobile Operating System
	5	PE-I	CT2314	PE I: Lab: Mobile Operating System
3	~~5~~	PE-I	CT2315	PE I: Advanced Web Technologies
	5	PE-I	CT2316	PE I: Lab: Advanced Web Technologies
4	5	PE-I	CT2317	PE I: Introduction to Geographical Information System
	5	PE-I	CT2318	PE I: Lab: Introduction to Geographical Information System
5	5	PE-I	CT2319	PE I: Computer Graphics
	5	PE-I	CT2320	PE I: Lab: Computer Graphics
6	5	PE-I	CT2321	PE I: Realtime Systems
	5	PE-I	CT2322	PE I: Lab:Realtime Systems
7	5	PE-I	CT2323	PEI : Privacy and Security in Online Social Networks
	5	PE-I	CT2324	PEI : Lab: Privacy and Security in Online Social Networks

Open Electives -I

1	5	OE-I	CT2325	OE I: Introduction to DBMS
2	5	OE-I	CT2326	OE I: Essentials of IT
3	5	OE-I	CT2327	OE I: Image Processing
4	5	OE-I	CT2328	OE I: Operating System Concepts
5	5	OE-I	CT2329	OE-I Introduction to Salesforce

Open Electives -II

1	5	OE-II	CT2331	OE II: Soft Computing
2	5	OE-II	CT2332	OE II: Software Testing
3	5	OE-II	CT2333	OE II: Internet Technology
4	5	OE-II	CT2334	OE II: Multimedia and Animation
5	5	OE-II	CT2335	OE II: Current Trends and Technologies

Audit Courses											
1	5	HS	AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0	

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Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamentals of Management	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	CT2351	Design & Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	CT2352	Lab: Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
4	6	PC	CT2353	Language Processor	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PC	CT2354	Lab: Language Processor	**P**	0	0	2	2	1		60	40	
6	6	PC	CT2355	Software Engineering	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PC	CT2356	Lab: Software Engineering	**P**	0	0	2	2	1		60	40	
8	6	PE		Professional Elective-II	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	PE		Lab: Professional Elective-II	**P**	0	0	2	2	1		60	40	
10	6	OE		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3 Hours
11	6	OE		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3 Hours
					TOTAL	**21**	**0**	**8**	**29**	**25**				

Professional Electives -II

1	6	PE-II	CT2361	PE II: Digital Image Processing
	6	PE-II	CT2362	PE II: Lab: Digital Image Processing
2	6	PE-II	CT2363	PE II: Internet of Things
	6	PE-II	CT2364	PE II: Lab: Internet of Things
3	6	PE-II	CT2365	PE II: Business Intelligence
	6	PE-II	CT2366	PE II: Lab: Business Intelligence
4	6	PE-II	CT2367	PE II: Introduction to Natural Language Processing
	6	PE-II	CT2368	PE II: Lab:Introduction to Natural Language Processing
5	6	PE-II	CT2369	PE II: Customer Relationship Management
	6	PE-II	CT2370	PE II: Lab: Customer Relationship Management

Open Electives -III

1	6	OE-III	CT2371	OE III: Introduction to DBMS
2	6	OE-III	CT2372	OE III: Essestials of IT
3	6	OE-III	CT2373	OE III: Image Processing
4	6	OE-III	CT2374	OE III: Operating System Concepts
5	6	OE-III	CT2375	OE III: Introduction to Salesforce

Open Electives -IV

1	6	OE-IV	CT2381	OE IV: Soft Computing
2	6	OE-IV	CT2382	OE IV: Software Testing
3	6	OE-IV	CT2383	OE IV: Internet Technology
4	6	OE-IV	CT2384	OE IV: Multimedia and Animation
5	6	OE-IV	CT2385	OE IV: Current Trends and Technologies

Audit Courses

1	6	HS	AU2130	YCCE Communication Aptitude Preparation (YCAP6.3) for CT, IT, CSE	**A**	3	0	0	3	0	

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Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	CT2401	Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	CT2402	Lab: Artificial Intelligence	**P**	0	0	2	2	1		60	40	
3	7	PC	CT2403	Network Security	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE		Professional Elective-III	**T**	3	0	0	3	3	30	20	50	3 Hours
5	7	PE		Professional Elective-IV	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		Lab:Professional Elective-IV	**P**	0	0	2	2	1		60	40	
7	7	PE		Professional Elective-V	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	CT2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	CT2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -III

1	7	PE-III	CT2411	PE III: Neural Network & Fuzzy Logic
2	7	PE-III	CT2412	PE III: Adhoc Wireless Network
3	7	PE-III	CT2413	PE III: Information Retrival System
4	7	PE-III	CT2414	PE III: Human Computer Interaction
5	7	PE-III	CT2415	PE III: Business Intelligence and Applications

Professional Electives -IV

1	7	PE-IV	CT2421	PE IV: Pattern Recognization
	7	PE-IV	CT2422	PE IV: Lab: Pattern Recognization
2	7	PE-IV	CT2423	PE IV: Cyber Forensic
	7	PE-IV	CT2424	PE IV: Lab: Cyber Forensic
3	7	PE-IV	CT2425	PE IV: Machine Learning
	7	PE-IV	CT2426	PE IV: Lab: Machine Learning
4	7	PE-IV	CT2427	PE IV: Design Patterns
	7	PE-IV	CT2428	PE IV: Lab: Design Patterns
5	7	PE-IV	CT2429	PE IV: Mobile Communication
	7	PE-IV	CT2430	PE IV: Lab: Mobile Communication
6	7	PE-IV	CT2431	PE IV: Software Project Management
	7	PE-IV	CT2432	PE IV: Lab: Software Project Management
7	7	PE-IV	CT2433	PE IV: Numerical Computing
	7	PE-IV	CT2434	PE IV: Lab: Numerical Computing

Professional Electives -V

1	7	PE-V	CT2435	PE V: Cloud Computing
2	7	PE-V	CT2436	PE V: Parallel Programming
3	7	PE-V	CT2437	PE V: Data Mining
4	7	PE-V	CT2438	PE V: Embedded Systems
5	7	PE-V	CT2439	PE V: Operations Research
5	7	PE-V	CT2440	PE V: Bioinformatics

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CT-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	CT2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	CT2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
					TOTAL	**0**	**0**	**12**	**12**	**10**				
					GRAND TOTAL	**85**	**0**	**48**	**133**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

SoE No. IT-202.1

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
				Third Semester										
1	3	BS	GE2201	Engineering Mathematics III	**T**	3	0	0	3	3	30	20	50	3
2	3	PC	IT2201	Digital Circuits & Microprocessors	**T**	3	0	0	3	3	30	20	50	3
3	3	PC	IT2202	Digital Circuits & Microprocessors Lab	**P**	0	0	2	2	1		60	40	
4	3	PC	IT2203	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3
5	3	PC	IT2204	Object Oriented Programming Lab	**P**	0	0	2	2	1		60	40	
6	3	PC	IT2205	Data Structures and Program Design-I	**T**	4	0	0	4	4	30	20	50	3
7	3	PC	IT2206	Data Structures and Program Design-I Lab	**P**	0	0	2	2	1		60	40	
8	3	PC	IT2207	Computer Architecture & Organization (Self -Learning-Online)	**T**	3	0	0	3	3	30	20	50	3
9	3	PC	IT2208	Software Lab	**P**	0	0	2	2	1		60	40	
				TOTAL THIRD SEM		**16**	**0**	**8**	**24**	**20**				
				Fourth Semster										
1	4	BS	GE2206	Discrete Mathematics and Probability Theory	**T**	3	0	0	3	3	30	20	50	3
2	4	PC	IT2251	Data Structures and Program Design-II	**T**	3	0	0	3	3	30	20	50	3
3	4	PC	IT2252	Data Structures and Program Design-II Lab	**P**	0	0	2	2	1		60	40	
4	4	PC	IT2253	Computer Networks	**T**	4	0	0	4	4	30	20	50	3
5	4	PC	IT2254	Computer Networks Lab	**P**	0	0	2	2	1		60	40	
6	4	PC	IT2255	Operating Systems	**T**	3	0	0	3	3	30	20	50	3
7	4	PC	IT2256	Operating Systems Lab	**P**	0	0	2	2	1		60	40	
8	4	PC	IT2257	Theory of Computation	**T**	3	0	0	3	3		60	40	
				TOTAL FOURTH SEM		**16**	**0**	**6**	**22**	**19**				
				Audit Courses										
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	**A**	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
3	4	HS	AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0				

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		June 2022	**1.05**
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Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

SoE No. IT-202.1

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Fifth Semester														
1	5	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	3
2	5	PC	IT2301	Data Base Management Systems	**T**	3	0	0	3	3	30	20	50	3
3	5	PC	IT2302	**Lab :** Data Base Management Systems	**P**	0	0	2	2	1		60	40	
4	5	PC	IT2303	Software Engineering (Self -Learning-Online)	**T**	3	0	0	3	3	30	20	50	3
5	5	PE		**Professional Elective - I**	**T**	3	0	0	3	3	30	20	50	3
6	5	PE		**Lab : Professional Elective-I**	**P**	0	0	2	2	1		60	40	
7	5	OE		**Open Elective-I**	**T**	3	0	0	3	3	30	20	50	3
8	5	OE		**Open Elective-II**	**T**	3	0	0	3	3	30	20	50	3
9	5	STR	IT2310	**Industrial Visit and Learning**	**P**	0	0	0	0	1		100		
				TOTAL FIFTH SEM		**18**	**0**	**4**	**22**	**21**				

Professional Electives -I

1	5	PE-1	IT2311	PE I: Web Programming
	5	PE-1	IT2312	PE I: Lab.: Web Programming
2	5	PE-1	IT2313	PE I: Data Analysis and Statistics
	5	PE-1	IT2314	PE I: Lab.: Data Analysis and Statistics
3	5	PE-1	IT2315	PE I: Customer Relationship Management
	5	PE-1	IT2316	PE I: Lab. Customer Relationship Management
4	5	PE-1	IT2317	PE I: Mobile Operating System
	5	PE-1	IT2318	PE I: Lab. Mobile Operating System

Open Electives -I

1	5	OE I	IT2321	OE I: Industry 4.0
2	5	OE I	IT2322	OE I: Core JAVA
3	5	OE I	IT2323	OE I: Introdcution to Data Science

Open Electives -II

1	5	OE-II	IT2331	OE II: Introduction to Machine Learning
2	5	OE-II	IT2332	OE II: Information Security
3	5	OE-II	IT2333	OE II: Concepts in Web Programming

Audit Courses											
1	5	HS	AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0	

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		June 2022	**1.05**
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Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No.
IT-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Sixth Semester														
1	6	HS	GE2311	Fundamentals of Management	**T**	3	0	0	3	3	30	20	50	3
2	6	PC	IT2351	Design & Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3
3	6	PC	IT2352	**Lab:** Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
4	6	PC	IT2353	Principles of Compiler Design	**T**	3	0	0	3	3	30	20	50	3
5	6	PC	IT2354	**Lab:** Principles of Compiler Design	**P**	0	0	2	2	1		60	40	
6	6	PE		**Professional Elective - II**	**T**	3	0	0	3	3	30	20	50	3
7	6	PE		**Lab : Professional Elective-II**	**P**	0	0	2	2	1		60	40	
8	6	OE		**Open Elective-III**	**T**	3	0	0	3	3	30	20	50	3
9	6	OE		**Open Elective-IV**	**T**	3	0	0	3	3	30	20	50	3
				TOTAL SIXTH SEM		**18**	**0**	**6**	**24**	**21**				

List of Professional Electives-I & II

Professional Electives -II				
1	6	PE-2	IT2361	PE II::Machine Learning
	6	PE-2	IT2362	PE II:Machine Learning Lab
2	6	PE-2	IT2363	PE II: Business Intelligence
	6	PE-2	IT2364	PE II: Lab.: Business Intelligence
3	6	PE-2	IT2365	PE II: Internet of Things
	6	PE-2	IT2366	PE II: Lab.: Internet of Things
4	6	PE-2	IT2367	PE II: Big Data Analytics
	6	PE-2	IT2368	PE II: Lab. Big Data Analytics

Open Electives -III

1	6	OE-III	IT2371	OE-III : Industry 4.0
2	6	OE-III	IT2372	OE-III : Core JAVA
3	6	OE-III	IT2373	OE-III : Introdcution to Data Science

Open Electives -IV

1	6	OE-IV	IT2381	OE-IV: Introduction to Machine Learning
2	6	OE-IV	IT2382	OE-IV: Information Security
3	6	OE-IV	IT2383	OE-IV: Concepts in Web Programming

Audit Courses											
1	6	HS	AU2130	YCCE Communication Aptitude Preparation (YCAP6.3) for CT, IT, CSE	**A**	3	0	0	3	0	

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TA = for Practical : MSPA will be 15 marks each**

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Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. IT-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Seventh Semester														
1	7	PC	IT2401	Data Mining	**T**	3	0	0	3	3	30	20	50	3
2	7	PC	IT2402	Lab.: Data Mining	**P**	0	0	2	2	1		60	40	
3	7	PC	IT2403	Principles of Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3
4	7	PE		Professional Elective III	**T**	3	0	0	3	3	30	20	50	3
5	7	PE		Professional Elective IV	**T**	3	0	0	3	3	30	20	50	3
6	7	PE		Lab.: Professional Elective IV	**P**	0	0	2	2	1		60	40	
7	7	PE		Professional Elective V	**T**	3	0	0	3	3	30	20	50	3
8	7	PE		Professional Elective VI	**T**	3	0	0	3	3	30	20	50	3
9	7	STR	IT2409	Mini Project	**P**	0	0	4	4	2		60	40	
10	7	STR	IT2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
				TOTAL SEVENTH SEM		**18**	**0**	**8**	**26**	**24**				

List of Professional Electives-III, IV,V & VI

Professional Electives -III				
1	7	PE-3	IT2411	PE III: Cloud Computing
2	7	PE-3	IT2412	PE III:Real Time Systems
3	7	PE-3	IT2413	PE III: Network Security
4	7	PE-3	IT2414	PE III: Information Retrieval
Professional Electives -IV				
1	7	PE-4	IT2421	PE IV: Neural Network and Fuzzy Logic
	7	PE-4	IT2422	PE IV: Lab.: Neural Network and Fuzzy Logic
2	7	PE-4	IT2423	PE IV: Ethical Hacking and Cyber Forensics
	7	PE-4	IT2424	PE IV:Lab:Ethical Hacking and Cyber Forensics
3	7	PE-4	IT2425	PE IV: Human Computer Interaction
	7	PE-4	IT2426	PE IV: Lab:Human Computer Interaction
4	7	PE-4	IT2427	PE IV: Parallel Computing
	7	PE-4	IT2428	PE IV: Lab: Parallel Computing
Professional Electives - V				
1	7	PE-5	IT2431	PE V: Digital Image Processing
2	7	PE-5	IT2432	PE V: Distributed Systems
3	7	PE-5	IT2433	PE V: Coding Standardand and Technical Documentation
4	7	PE-5	IT2434	PE V: Introduction to Deep Learning
5	7	PE-5	IT2435	PE V: Wireless Sensor Network

Professional Electives - VI				
1	7	PE-6	IT2441	PE VI: Advanced Computer Architecture
2	7	PE-6	IT2442	PE VI: Mobile Communication
3	7	PE-6	IT2443	PE VI: E-commerce
4	7	PE-6	IT2444	PE VI: Natural Language Processing

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

SoE No.
IT-202.1

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
TOTAL FIRST & SECOND SEM										**47**				
Eighth Semester														
1	8	STR	IT2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	IT2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
TOTAL EIGHTH SEM						**0**	**0**	**12**	**12**	**10**				
GRAND TOTAL						**86**	**0**	**44**	**130**	**162**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

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TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
TOTAL FIRST & SECOND SEM										47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CSE2201	Computer Architecture and Organisation	T	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	CSE2202	Object Oriented Programming	T	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	CSE2203	Lab: Object Oriented Programming	P	0	0	2	2	1		60	40	
5	3	PC	CSE2204	Data Structures I	T	3	0	0	3	3	30	20	50	3 Hours
6	3	PC	CSE2205	Lab: Data Structures I	P	0	0	2	2	1		60	40	
7	3	PC	CSE2206	Lab: Software Laboratory	P	0	0	2	2	1		60	40	
				TOTAL		12	0	6	18	15				
Fourth Semster														
1	4	BS	GE2207	Discrete Mathematics & Graph Therory	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CSE2251	Operating Systems	T	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CSE2252	Lab:Operating Systems	P	0	0	2	2	1		60	40	
4	4	PC	CSE2253	Data Structures II	T	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	CSE2254	Lab: Data Structures II	P	0	0	2	2	1		60	40	
6	4	PC	CSE2255	Introduction to Data Analysis	T	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	CSE2256	Lab: Introduction to Data Analysis	P	0	0	2	2	1		60	40	
8	4	PC	CSE2257	Theory of Computation	T	4	0	0	4	4	30	20	50	3 Hours
				TOTAL		16	0	6	22	19				
Audit Courses														
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT, CSE	T	2	0	0						
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE	A	3	0	0	3	0				

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TA = for Practical : MSPA will be 15 marks each**

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Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamentals of Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	CSE2301	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	CSE2302	Lab: Database Management Systems	**P**	0	0	2	2	1		60	40	
4	5	PC	CSE2303	Design & Analysis of Algorithms	**T**	4	0	0	4	4	30	20	50	3 Hours
5	5	PC	CSE2304	Lab: Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
6	5	PE		Professional Elective-I	**T**	3	0	0	3	3	30	20	50	3 Hours
7	5	PE		Lab: Professional Elective-I	**P**	0	0	2	2	1		60	40	
8	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3 Hours
10	**5/6**	**STR**	**CSE2310**	**Seminar**	**P**	**0**	**0**	**0**	**0**	**1**		100		
					TOTAL	**19**	**0**	**6**	**25**	**23**				

Professional Electives -I

1	5	PE-I	CSE2311	PE I: Business Intelligence
	5	PE-I	CSE2312	PE I: Lab: Business Intelligence
2	~~5~~	PE-I	CSE2313	PE I: Web Technologies
	5	PE-I	CSE2314	PE I: Lab: Web Technologies
3	5	PE-I	CSE2315	PE I: Introduction to Geographical Information System
	5	PE-I	CSE2316	PE I: Lab: Introduction to Geographical Information System
4	5	PE-I	CSE2317	PE I: Mobile Operating System
	5	PE-I	CSE2318	PE I: Lab: Mobile Operating System

Open Electives -I

1	5	OE-I	CSE2331	OE I: Database System Essentials
2	5	OE-I	CSE2332	OE I: Introduction to Image Processing
3	5	OE-I	CSE2333	OE I: Programming with Python

Open Electives -II

1	5	OE-II	CSE2341	OE II: Software Testing for Beginners
2	5	OE-II	CSE2342	OE II: Introduction to Cloud Computing
3	5	OE-II	CSE2343	OE II: Introduction to Web Technology

Audit Courses

1	5	HS	AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0	

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		June 2022	1.01
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Yeshwantrao Chavan College of Engineering

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SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamentals of Management	T	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	CSE2351	Computer Networks	T	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	CSE2352	Lab: Computer Networks	P	0	0	2	2	1		60	40	
4	6	PC	CSE2353	Compilers	T	3	0	0	3	3	30	20	50	3 Hours
5	6	PC	CSE2354	Lab: Compilers	P	0	0	2	2	1		60	40	
6	6	PC	CSE2355	Software Engineering	T	3	0	0	3	3	30	20	50	3 Hours
7	6	PC	CSE2356	Lab: Software Engineering	P	0	0	2	2	1		60	40	
8	6	PE		Professional Elective-II	T	3	0	0	3	3	30	20	50	3 Hours
9	6	PE		Lab: Professional Elective-II	P	0	0	2	2	1		60	40	
10	6	OE		Open Elective - III **	T	3	0	0	3	3	30	20	50	3 Hours
11	6	OE		Open Elective - IV **	T	3	0	0	3	3	30	20	50	3 Hours
					TOTAL	21	0	8	29	25				

Professional Electives -II

1	6	PE-II	CSE2361	PE II: Digital Image Processing
	6	PE-II	CSE2362	PE II: Lab:Digital Image Processing
2	6	PE-II	CSE2363	PE II: Internet of Things
	6	PE-II	CSE2364	PE II: Lab: Internet of Things
3	6	PE-II	CSE2365	PE II: Neural Network and applications
	6	PE-II	CSE2366	PE II: Lab Neural Network and applications

Open Electives -III

1	6	OE-III	CSE2371	OE III: Database System Essentials
2	6	OE-III	CSE2372	OE III: Introduction to Image Processing
3	6	OE-III	CSE2373	OE III: Programming with Python

Open Electives -IV

1	6	OE-IV	CSE2381	OE IV: Software Testing for Beginners
2	6	OE-IV	CSE2382	OE IV: Introduction to Cloud Computing
3	6	OE-IV	CSE2383	OE IV: Introduction to Web Technology

Audit Courses											
1	6	HS	AU2130	YCCE Communication Aptitude Preparation (YCAP6.3) for CT, IT, CSE	A	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	CSE2401	Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	CSE2402	Lab: Artificial Intelligence	**P**	0	0	2	2	1		60	40	
3	7	PC	CSE2403	Cryptography and Network Security	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE		Professional Elective-III	**T**	3	0	0	3	3	30	20	50	3 Hours
5	7	PE		Professional Elective-IV	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		Lab:Professional Elective-IV	**P**	0	0	2	2	1		60	40	
7	7	PE		Professional Elective-V	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	CSE2409	Mini Project	**P**	0	0	4	4	2		100		
9	7	STR	CSE2410	CRT	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -III

1	7	PE-III	CSE2411	PE III:Software Project Management
2	7	PE-III	CSE2412	PE III: Adhoc Wireless Network
3	7	PE-III	CSE2413	PE III: Information Retrival System
4	7	PE-III	CSE2414	PE III: Natural Language Processing

Professional Electives -IV

1	7	PE-IV	CSE2421	PE IV: Cyber Forensic
	7	PE-IV	CSE2422	PE IV: Lab: Cyber Forensic
2	7	PE-IV	CSE2423	PE IV: Machine Learning Techniques
	7	PE-IV	CSE2424	PE IV: Lab: Machine Learning Techniques
3	7	PE-IV	CSE2425	PE IV: Parallel Programming
	7	PE-IV	CSE2426	PE IV: Lab Parallel Programming
4	7	PE-IV	CSE2427	PE IV : Data Mining & Data Warehousing
	7	PE-IV	CSE2428	PE IV : Lab. Data Mining & Data Warehousing

Professional Electives -V

1	7	PE-V	CSE2441	PE V: Cloud Computing
2	7	PE-V	CSE2442	PE V: Distributed System
3	7	PE-V	CSE2443	PE V: Human Computer Interaction
4	7	PE-V	CSE2444	PE V: Real Time System

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TA = for Practical : MSPA will be 15 marks each**

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SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	CSE2451	Major Project	P	0	0	12	12	9		60	40	
2	8	STR	CSE2452	Extra Curricular Activity Evaluation	P	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**83**	**0**	**46**	**129**	**160**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Civil Engineering)

B. Tech in Civil Engineering

SoE No. 22CV-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER															
1	1	BS	GE/MTH	22CV101	Calculus and Vector	T	3	1	0	4	4	30	20	50	3 Hrs
2	1	BS	GE/CHE	22CV102	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3 Hrs
3	1	BS	GE/CHE	22CV103	Lab: Engineering Chemistry	P	0	0	2	2	1		60	40	
4	1	HS	GE/HUM	22CV104	Professional Communication	T	3	0	0	3	3	30	20	50	3 Hrs
5	1	BES	CV/CV	22CV105	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3 Hrs
6	1	BES	CV/CV	22CV106	Lab: Engineering Mechanics	P	0	0	2	2	1		60	40	
7	1	BES	EE/EE	22CV107	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3 Hrs
8	1	BES	IT/IT	22CV108	Programming for Problem Solving	T	3	0	0	3	3	30	20	50	3 Hrs
9	1	BES	IT/IT	22CV109	**Lab:** Programming for Problem Solving	P	0	0	2	2	1		60	40	
						TOTAL	**18**	**1**	**6**	**25**	**22**				
List of Mandatory Learning Course (MLC)															
1	1	HS	GE/HUM	GE2131	Universal Human Value	**A**	2	0	0	2	0				
2	1	HS	GE/T&P	MLC2121	YCAP1-Get Set Go	**A**	2	0	0	2	0				
SECOND SEMESTER															
1	2	BS	GE/MTH	22CV201	Differential Equation, matrices and Statistics	T	3	1	0	4	4	30	20	50	3 Hrs
2	2	BS	GE/PHY	22CV202	Engineering Physics	T	3	0	0	3	3	30	20	50	3 Hrs
3	2	BS	GE/PHY	22CV203	Lab: Engineering Physics	P	0	0	2	2	1		60	40	
4	2	HS	GE/HUM	22CV204	Social Science	T	3	0	0	3	3	30	20	50	3 Hrs
5	2	BES	ME/ME	22CV205	Engineering Graphics	T	1	0	0	1	1	30	20	50	3 Hrs
6	2	BES	ME/ME	22CV206	Lab: Engineering Graphics	P	0	0	4	4	2		60	40	
7	2	BES	CT/CT	22CV207	Elements of AIML	T	3	0	0	3	3	30	20	50	3 Hrs
8	2	BES	ME/ME	22CV208	FAB Shop	P	0	0	2	2	1		60	40	
9	2	BES	CV/CV	22CV209	Strength of Materials	T	3	0	0	3	3	30	20	50	3 Hrs
10	2	BES	CV/CV	22CV210	Lab: Strength of Materials	P	0	0	2	2	1		60	40	
						TOTAL	**16**	**1**	**10**	**27**	**22**				
List of Mandatory Learning Course (MLC)															
1	2	HS	GE/T&P	MLC2122	YCAP2 -Functional English	**A**	2	0	0	2	0				
2	2	BES	GE/CHE	GE2132	Environmental Science	**A**	2	0	0	2	0				

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TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	June 2022	1.00
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Yeshwantrao Chavan College of Engineering

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SoE No. 22CV-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Civil Engineering)

B. Tech in Civil Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
THIRD SEMESTER															
1	3	BS	GE	22CV301	Integral Transforms and Partial Differential Equations	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	3	HS	GE/HUM	22CV302	Fundamentals of Management and Economics	**T**	3	0	0	3	3	30	20	50	3 Hrs
3	3	PC	CV	22CV303	Geotechnical Engineering	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	3	PC	CV	22CV304	**Lab:-** Geotechnical Engineering	**P**	0	0	2	2	1		60	40	
5	3	PC	CV	22CV305	Fluid Mechanics	**T**	3	1	0	3	3	30	20	50	3 Hrs
6	3	PC	CV	22CV306	**Lab:-** Fluid Mechanics	**P**	0	0	2	2	1		60	40	
7	3	PC	CV	22CV307	Water Supply Engineering	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	3	PC	CV	22CV308	**Lab:-** Water Supply Engineering	**P**	0	0	2	2	1		60	40	
9	3	PC	CV	22CV309	Building Construction and Building Materials	**T**	3	0	0	3	3	30	20	50	3 Hrs
10	3	PC	CV	22CV310	**Lab:-** Computer Aided Drawing	**P**	0	0	2	2	1		60	40	
11	3	PC	CV	22CV311	Environmental Sustainability, Pollution and Management	**T**	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL THIRD SEM		**18**	**1**	**8**	**26**	**25**				
List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC123	**YCAP3 :**	**A**	3	0	0	3	0				
2	3	BES	CV	MLC101	Application of Python Programming in Civil Engineering	**A**	2	0	0	2	0				
FOURTH SEMSTER															
1	4	PC	CV	22CV401	Wastewater Engineering	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	4	PC	CV	22CV402	Reinforced Concrete Structures	**T**	3	1	0	3	3	30	20	50	3 Hrs
3	4	PC	CV	22CV403	Concrete Technology	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	4	PC	CV	22CV404	**Lab:-** Concrete Technology	**P**	0	0	2	2	1		60	40	
5	4	PC	CV	22CV405	Surveying	**T**	3	0	0	3	3	30	20	50	3 Hrs
6	4	PC	CV	22CV406	**Lab:-** Surveying	**P**	0	0	2	2	1		60	40	
7	4	PC	CV	22CV407	Structural Analysis	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	4	PC	CV	22CV408	**Lab:-** Structural Analysis	**P**	0	0	2	2	1		60	40	
9	4	PC	CV	22CV409	Transportation Engineering	**T**	3	0	0	3	3	30	20	50	3 Hrs
10	4	PC	CV	22CV410	**Lab:-** Transportation Engineering	**P**	0	0	2	2	1		60	40	
					TOTAL FOURTH SEM		**18**	**1**	**8**	**26**	**22**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC2124	**YCAP4 :**	**A**	3	0	0	3	0				
2	4	BES	CV	MLC102	Quantity ,Estimation and Management	**A**	2	0	0	2	0				

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Yeshwantrao Chavan College of Engineering

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SoE No. 22CV-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Civil Engineering)

B. Tech in Civil Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIFTH SEMESTER															
1	5	PC	CV	22CV501	Engineering Hydrology	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	5	PC	CV	22CV502	Advanced Structural Analysis	**T**	3	0	0	3	3	30	20	50	3 Hrs
3	5	PC	CV	22CV503	**Lab:-** Analysis and Design Studio	**P**	0	0	2	2	1		60	40	
4	5	PC	CV	22CV504	Steel Structures	**T**	3	0	0	3	3	30	20	50	3 Hrs
5	5	PC	CV	22CV505	**Lab:-** Building Design Drawing	**P**	0	0	2	2	1		60	40	
6	5	PE	CV		**Professional Elective-I**	**T**	3	0	0	3	3	30	20	50	3 Hrs
7	5	OE-I	CV		**Open Elective-I**	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	5	OE-II	CV		**Open Elective-II**	**T**	3	0	0	3	3	30	20	50	3 Hrs
9	5	STR	CV	22CV506	**Industrial training, Seminar & Report**	**P**	0	0	1	1	1		100		
					TOTAL FIFTH SEM		**18**	**0**	**5**	**23**	**21**				
Audit Courses															
1	5	HS	T&P	MLC2125	**YCAP5 :**	**A**	3	0	0	3	0				
2	5	HS	R&D	MLC125	Design thinking	**A**	2	0	0	2	0				

Professional Elective - I					
1	5	PE-I	CV	22CV511	PE-I : Advanced Surveying
2	5	PE-I	CV	22CV512	PE-I : Computer Applications in Civil Engineering
3	5	PE-I	CV	22CV513	PE-I : Advanced Concrete Technology
4	5	PE-I	CV	22CV514	PE-I : Water Treatment
5	5	PE-I	CV	22CV515	PE-I : Environmental Management
6	5	PE-I	CV	22CV516	PE-I : Soil Characterization and Identification
7	5	PE-I	CV	22CV517	PE-I : Geographical Information Systems

Open Electives -I					
1	5	OE-I	CV	22CV531	OE-I : Building Services Engineering
2	5	OE-I	CV	22CV532	OE-I : Construction Techniques
3	5	OE-I	CV	22CV533	OE-I : Introduction to Environmental Management
4	5	OE-I	CV	22CV534	OE-I : Basics of Transportation Engineering
5	5	OE-I	CV	22CV535	OE-I : Basics of Water Resource Engineering
6	5	OE-I	CV	22CV536	OE-I : Elements of Water Power Engineering

Open Electives -II					
1	5	OE-II	CV	22CV551	OE II : Elements of Earthquake Engineering
2	5	OE-II	CV	22CV552	OE II : Introduction to Finite Element Method
3	5	OE-II	CV	22CV553	OE II : Air Pollution and Solid Waste Management
4	5	OE-II	CV	22CV554	OE-II : Environmental and Social Impact Assessment
5	5	OE-II	CV	22CV555	OE II : Disaster Management

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(Department of Civil Engineering)

B. Tech in Civil Engineering

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							L	T	P	Hrs		MSEs*	TA**	ESE	
SIXTH SEMESTER															
1	6	PC	CV	22CV601	Foundation Engineering	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	6	PC	CV	22CV602	**Lab:-** Building Information Modeling	**P**	0	0	2	2	1		60	40	
3	6	PC	CV	22CV603	Hydraulic Engineering	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	6	PC	CV	22CV604	**Lab:-** Hydraulic Engineering	**P**	0	0	2	2	1		60	40	
5	6	PE	CV		**Professional Elective-II**	**T**	3	0	0	3	3	30	20	50	3 Hrs
6	6	PE	CV		**Professional Elective-III**	**T**	3	0	0	3	3	30	20	50	3 Hrs
7	6	OE	CV		**Open Elective-III**	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	6	OE	CV		**Open Elective-IV**	**T**	3	0	0	3	3	30	20	50	3 Hrs
9	6	PR	CV	22CV605	Project Phase-I	**P**	0	0	4	4	2		60	40	
					TOTAL SIXTH SEM		**18**	**0**	**8**	**26**	**22**				
Audit Courses															
1	6	HS		MLC126	**YCAP6 :**	**A**	3	0	0	3	0				

Professional Elective - II

1	6	PE-II	CV	22CV611	PE-II : Earthquake Engineering
2	6	PE-II	CV	22CV612	PE-II : Water Transmission and Distribution Systems
3	6	PE-II	CV	22CV613	PE-II : Matrix Analysis of Structures
4	6	PE-II	CV	22CV614	PE-II : Environmental Geotechniques
5	6	PE-II	CV	22CV615	PE-II : Traffic Engineering
6	6	PE-II	CV	22CV616	PE-II : Construction Management And Machinery
7	6	PE-II	CV	22CV617	PE-II : Wastewater Treatment

Professional Elective - III

1	6	PE-III	CV	22CV631	PE-III : Prestressed Concrete
2	6	PE-III	CV	22CV632	PE-III : Advanced RCC
3	6	PE-III	CV	22CV633	PE-III : Numerical Methods and Computational Techniques
4	6	PE-III	CV	22CV634	PE-III : Environmental Impact Assessment
5	6	PE-III	CV	22CV635	PE-III : Energy Conversion and Management
6	6	PE-III	CV	22CV636	PE-III : Geotechnical Investigation and Geotextiles
7	6	PE-III	CV	22CV637	PE-III : Earth Pressure & Earth Retaining Structures
8	6	PE-III	CV	22CV638	PE-III : Urban Transportation Planning

Open Electives - III

1	6	OE-III	CV	22CV651	OE-III : Building Services Engineering
2	6	OE-III	CV	22CV652	OE-III : Construction Techniques
3	6	OE-III	CV	22CV653	OE-III : Introduction to Environmental Management
4	6	OE-III	CV	22CV654	OE-III : Basics of Transportation Engineering
5	6	OE-III	CV	22CV655	OE-III : Basics of Water Resource Engineering
6	6	OE-III	CV	22CV656	OE-III : Elements of Water Power Engineering

Open Electives - IV

1	6	OE-IV	CV	22CV671	OE-IV : Elements of Earthquake Engineering
2	6	OE-IV	CV	22CV672	OE-IV : Introduction to Finite Element Method
3	6	OE-IV	CV	22CV673	OE-IV : Air Pollution and Solid Waste Management
4	6	OE-IV	CV	22CV674	OE-IV : Environmental and Social Impact Assessment
5	6	OE-IV	CV	22CV675	OE-IV : Disaster Management

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SoE No. 22CV-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Civil Engineering)

B. Tech in Civil Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
SEVENTH SEMESTER															
1	7	PC	CV	22CV701	Estimating & Costing	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	7	PC	CV	22CV702	Lab:- Estimating andCosting	**P**	0	0	2	2	1		60	40	
3	7	PC	CV	22CV703	Project Planning and Quality Assurance	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	7	PC	CV	22CV704	Irrigation Engineering	**T**	3	0	0	3	3	30	20	50	3 Hrs
5	7	PE	CV		**Professional Elective-IV**	**T**	3	0	0	3	3	30	20	50	3 Hrs
6	7	PE	CV		**Professional Elective-V**	**T**	3	0	0	3	3	30	20	50	3 Hrs
7	7	PE	CV		**Professional Elective-VI**	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	7	PR	CV	22CV705	Project Phase-II	**P**	0	0	10	10	5		60	40	
9	7	STR	CV	22CV706	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL SEVENTH SEM		**18**	**0**	**12**	**30**	**26**				

Professional Elective - IV

1	7	PE-IV	CV	22CV711	PE-IV : Natural Resources Management
2	7	PE-IV	CV	22CV712	PE-IV : Finite Element Method
3	7	PE-IV	CV	22CV713	PE-IV : Introduction to Structural Dynamics
4	7	PE-IV	CV	22CV714	PE-IV : Optimization Techniques
5	7	PE-IV	CV	22CV715	PE-IV : Environmental Legislation and Management System
6	7	PE-IV	CV	22CV716	PE-IV : Advanced Foundation Engineering
7	7	PE-IV	CV	22CV717	PE-IV :Advanced Transportation Engineering

Professional Elective - V

1	7	PE-V	CV	22CV731	PE-V : Maintenance and Rehabilitation Engineering
2	7	PE-V	CV	22CV732	PE-V : Modern Surveying Technique
3	7	PE-V	CV	22CV733	PE-V : Advanced Steel Design
4	7	PE-V	CV	22CV734	PE-V : Design of Bridge Structures
5	7	PE-V	CV	22CV735	PE-V : Industrial Waste Water Treatment and Reuse
6	7	PE-V	CV	22CV736	PE-V : Finite Element methods in Geotechnical Engineering
7	7	PE-V	CV	22CV737	PE-V : Structural Engineering Practices
8	7	PE-V	CV	22CV738	PE-V : Advanced Fluid Mechanics and Hydraulic Machines

Professional Elective - VI

1	7	PE-VI	CV	22CV751	PE-VI : Modern and Innovative Construction Materials
2	7	PE-VI	CV	22CV752	PE-VI : Building Services
3	7	PE-VI	CV	22CV753	PE-VI : Introduction to Remote Sensing
4	7	PE-VI	CV	22CV754	PE-VI : Advanced Hydraulics
5	7	PE-VI	CV	22CV755	PE-VI : Watershed Management
6	7	PE-VI	CV	22CV756	PE-VI : Pavement Design
7	7	PE-VI	CV	22CV757	PE-VI: Water Power Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	L	T	P	Hrs	Credits	MSEs*	TA**	ESE	ESE Duration Hours
EIGHTH SEMESTER															
1	8	STR	CV	22CV801	Internship - training / Seminar & Report	**P**	0	0	0	0	3		60	40	
2	8	ER	CV	22CV802	Extracurricular Activity Evaluation	**P**	0	0	0	0	2		100		
					TOTAL EIGHTH SEM		**0**	**0**	**0**	**0**	**5**				

					GRAND TOTAL		**124**	**4**	**57**	**183**	**165**			

		June 2022	**1.00**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. 22ME-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER															
1	1	BS	GE/MTH	22ME101	Differential Equation, matrices and Statistics	T	3	1	0	4	4	30	20	50	3 Hrs
2	1	BS	GE/PHY	22ME102	Engineering Physics	T	3	0	0	3	3	30	20	50	3 Hrs
3	1	BS	GE/PHY	22ME103	Lab: Engineering Physics	P	0	0	2	2	1		60	40	
4	1	HS	GE/HUM	22ME104	Social Science	T	3	0	0	3	3	30	20	50	3 Hrs
5	1	BES	ME/ME	22ME105	Engineering Graphics	T	1	0	0	1	1	30	20	50	3 Hrs
6	1	BES	ME/ME	22ME106	Lab: Engineering Graphics	P	0	0	4	4	2		60	40	
7	1	BES	CT/CT	22ME107	Elements of AIML	T	3	0	0	3	3	30	20	50	3 Hrs
8	1	BES	ME/ME	22ME108	FAB Shop	P	0	0	2	2	1		60	40	
9	1	BES	ME/ME	22ME109	Machining Process	T	3	0	0	3	3	30	20	50	3 Hrs
10	1	BES	ME/ME	22ME110	Lab: Machining Process	P	0	0	2	2	1		60	40	
						TOTAL	**16**	**1**	**10**	**27**	**22**				
List of Mandatory Learning Course (MLC)															
1	1	HS	GE/T&P	MLC2121	YCAP1-Get Set Go	**A**	2	0	0	2	0				
2	1	BES	GE/CHE	GE2132	Environmental Science	**A**	2	0	0	2	0				
SECOND SEMESTER															
1	2	BS	GE/MTH	22ME201	Calculus and Vector	T	3	1	0	4	4	30	20	50	3 Hrs
2	2	BS	GE/CHE	22ME202	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3 Hrs
3	2	BS	GE/CHE	22ME203	Lab: Engineering Chemistry	P	0	0	2	2	1		60	40	
4	2	HS	GE/HUM	22ME204	Professional Communication	T	3	0	0	3	3	30	20	50	3 Hrs
5	2	BES	CV/CV	22ME205	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3 Hrs
6	2	BES	CV/CV	22ME206	Lab: Engineering Mechanics	P	0	0	2	2	1		60	40	
7	2	BES	EE/EE	22ME207	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3 Hrs
8	2	BES	IT/IT	22ME208	Programming for Problem Solving	T	3	0	0	3	3	30	20	50	3 Hrs
9	2	BES	IT/IT	22ME209	**Lab:** Programming for Problem Solving	P	0	0	2	2	1		60	40	
						TOTAL	**18**	**1**	**6**	**25**	**22**				
List of Mandatory Learning Course (MLC)															
1	2	HS	GE/HUM	GE2131	Universal Human Value	**A**	2	0	0	2	0				
2	2	HS	GE/T&P	MLC2122	YCAP2 -Functional English	**A**	2	0	0	2	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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SoE No. 22ME-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
THIRD SEMESTER															
1	3	BS	GE/MTH	22ME301	Integral Transforms and Partial Differential Equations	T	3	0	0	3	3	30	20	50	3 Hrs
2	3	HS	GE/HUM	22ME302	Fundamentals of Management and Economics	T	3	0	0	3	3	30	20	50	3 Hrs
3	3	PC	ME/ME	22ME303	Material Science & Metallurgy	T	3	0	0	3	3	30	20	50	3 Hrs
4	3	PC	ME/ME	22ME304	**Lab:-** Material Science & Metallurgy	P	0	0	2	2	1		60	40	
5	3	PC	ME/ME	22ME305	Manufacturing Process	T	3	0	0	3	3	30	20	50	3 Hrs
6	3	PC	ME/ME	22ME306	**Lab:-** Manufacturing Process	P	0	0	2	2	1		60	40	
7	3	PC	ME/ME	22ME307	Kinematics of Machines	T	3	0	0	3	3	30	20	50	3 Hrs
8	3	PC	ME/ME	22ME308	Mechanics of Materials	T	3	1	0	3	3	30	20	50	3 Hrs
9	3	PC	ME/ME	22ME309	**Lab:-** Mechanics of Materials	P	0	0	2	2	1		60	40	
10	3	PC	CV/EL	22ME310	Environmental Sustainability, Pollution and Management	T	3	0	0	3	3	30	20	50	3 Hrs
						TOTAL	**21**	**1**	**6**	**27**	**24**				
List of Mandatory Learning Course (MLC)															
1	3	HS	GE/T&P	MLC2123	YCAP3 -	A	3	0	0	3	0				
2	3	HS	ME	MLC103	Computer Aided Design	A	2	0	0	2	0				
FOURTH SEMESTER															
1	4	BS	ME/ME	22ME401	Production Management	T	3	0	0	3	3	30	20	50	3 Hrs
2	4	PC	ME/ME	22ME402	Design of Machine Elements	T	3	0	0	3	3	30	20	50	3 Hrs
3	4	PC	ME/ME	22ME403	Engineering Thermodynamics	T	3	0	0	3	3	30	20	50	3 Hrs
4	4	PC	ME/ME	22ME404	Fluid Mechanics	T	3	1	0	3	4	30	20	50	3 Hrs
5	4	PC	ME/ME	22ME405	**Lab:-** Fluid Mechanics	P	0	0	2	2	1		60	40	
6	4	PC	ME/ME	22ME406	Dynamics of Machines	T	3	0	0	3	3	30	20	50	3 Hrs
7	4	PC	ME/ME	22ME407	**Lab:-** Dynamics of Machines	P	0	0	2	2	1		60	40	
8	4	PC	ME/ME	22ME408	Metrology & Quality control	T	3	0	0	3	3	30	20	50	3 Hrs
9	4	PC	ME/ME	22ME409	**Lab:-** Metrology & Quality control	P	0	0	2	2	1		60	40	
						TOTAL	**18**	**1**	**6**	**24**	**22**				
List of Mandatory Learning Course (MLC)															
1	4	HS	GE/T&P	MLC2124	YCAP4 -	A	3	0	0	3	0				
2	4	HS	ME	MLC104	MATLAB for Mechanical Engineering	A	2	0	0	2	0				

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TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

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Yeshwantrao Chavan College of Engineering

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SoE No. 22ME-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIFTH SEMESTER															
1	5	PC		22ME501	Heat Transfer	**T**	3	0	0	3	3	30	30	40	3
2	5	PC		22ME502	**Lab:-** Heat Transfer	**P**	0	0	2	2	1		60	40	
3	5	PC		22ME503	Fluid Machines	**T**	3	0	0	3	3	30	30	40	3
4	5	PC		22ME504	**Lab:-** Fluid Machines	**P**	0	0	2	2	1	0	60	40	
5	5	PC		22ME505	Operations Research Techniques	**T**	3	0	0	3	3	30	30	40	3
6	5	OE-I			**Open Elective - I ***	**T**	3	0	0	3	3	30	30	40	3
7	5	OE-II			**Open Elective - II ***	**T**	3	0	0	3	3	30	30	40	3
8	5	PC		22ME506	**Lab:-** Machine Drawing	**P**	0	0	2	2	1		60	40	
9	5	PC		22ME507	Mechanical measurement & Instrumentation	**T**	3	0	0	3	3	30	10	60	3
10	5	PC		22ME508	**Lab:-** Mechanical measurement & Instrumentation	**P**	0	0	2	2	1		60	40	
11	5	STR		22ME509	**Industrial training, Seminar & Report**	**P**	0	0	0	0	1		100		
					TOTAL FOURTH SEM		**18**	**0**	**8**	**26**	**23**				

Open Elective-I*

1	5	OE-I	ME	22ME531	OE I : Operations Research Techniques
2	5	OE-I	ME	22ME532	OE I : Automobile Engineering
3	5	OE-I	ME	22ME533	OE I : Control System Engineering
4	5	OE-I	ME	22ME534	OE I: Robotics and Subtractive Manufacturing

Open Elective-II*

1	5	OE-II	ME	22ME551	OE II : Total Quality Management
2	5	OE-II	ME	22ME552	OE II : Reliability Engineering
3	5	OE-II	ME	22ME553	OE II : Power Generation Engineering
4	5	OE-II	ME	22ME554	OE II : Project Evaluation & Management

List of Mandatory Learning Course (MLC)

1	5	HS		MLC2125	**YCAP5 :**	A	3	0	0	3	0	
2	5	HS		MLC125	Design thinking	A	2	0	0	2	0	

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TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities
TA = for Practical : MSPA will be 15 marks each**

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Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

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SoE No. 22ME-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
SIXTH SEMESTER															
1	6	PC	ME/ME	22ME601	CAD/CAM	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	6	PC	ME/ME	22ME602	CAD/CAM LAB	**P**	0	0	2	2	1		60	40	
5	6	PC	ME/ME	22ME603	Design of Mechanical Drives	**T**	3	0	0	3	3	30	20	50	3 Hrs
3	6	PE	ME/ME		**Professional Elective -I**	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	6	PE	ME/ME		**Professional Elective -I LAB**	**P**	0	0	2	2	1		60	40	
6	6	PE	ME/ME		**Professional Elective II**	**T**	3	0	0	3	3	30	20	50	3 Hrs
7	6	PE	ME/ME		**Professional Elective III**	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	6	OE-III	ME/ME		**Open Elective - III ****	**T**	3	0	0	3	3	30	20	50	3 Hrs
9	6	OE-IV	ME/ME		**Open Elective - IV ****	**T**	3	0	0	3	3	30	20	50	3 Hrs
10	6	PR	ME/ME	22ME604	PROJECT PHASE-1	**P**	0	0	2	2	1		60	40	
					TOTAL SIXTH SEM		**21**	**0**	**6**	**27**	**24**				

List of Professional Electives- I, II & III

Professional Electives-I

1	6	PE-I	ME	22ME611	PE I : Finite Element Methods
2	6	PE-I	ME	22ME612	PE I : **Lab:-** Finite Element Methods
3	6	PE-I	ME	22ME613	PE I :Industrial Fluid Power
4	6	PE-I	ME	22ME614	PE I : **Lab:-** Industrial Fluid Power
5	6	PE-I	ME	22ME615	PE I : I.C. Engines
6	6	PE-I	ME	22ME616	PE I : **Lab:-** I.C. Engines
7	6	PE-I	ME	22ME617	PE I : Advance Welding Techniques
8	6	PE-I	ME	22ME618	PE I : **Lab:** Advance Welding Techniques
9	6	PE-I	ME	22ME619	PE I : Computer Integrated Manufacturing
10	6	PE-I	ME	22ME620	PE I : **Lab:-** Computer Integrated Manufacturing
11	6	PE-I	ME	22ME621	PE I : Mechatronics
12	6	PE-I	ME	22ME622	PE I : **Lab:-** Mechatronics
13	6	PE-I	ME	22ME623	PE I :Computer Graphics and Solid Modelling
14	6	PE-I	ME	22ME624	PE I : **Lab:-** Computer Graphics and Solid Modelling
15	6	PE-I	ME	22ME625	PE I :Two Wheeler technology
16	6	PE-I	ME	22ME626	PE I : **Lab:-** Two Wheeler technology

Professional Electives-II

1	6	PE-II	ME	22ME631	PE II : Tool Design
2	6	PE-II	ME	22ME632	PE II : Additive Manufacturing
3	6	PE-II	ME	22ME633	PE II : Fuel Cell Technology
4	6	PE-II	ME	22ME634	PE II : Material Handling Systems
5	6	PE-II	ME	22ME635	PE II : Reliability Engineering
6	6	PE-II	ME	22ME636	PE II : Bio- Mechanics
7	6	PE-II	ME	22ME637	PE II :Composites
8	6	PE-II	ME	22ME638	PE II : Data Analytics In Mechanical Engineering
9	6	PE-II	ME	22ME639	PE II : Advanced Manufacturing Techniques

Professional Electives-III

1	6	PE-III	ME	22ME651	PE III : Artificial Intelligence
2	6	PE-III	ME	22ME652	PE III : Design for Manufacturing & Assembly
3	6	PE-III	ME	22ME653	PE III : Renewable Energy System
4	6	PE-III	ME	22ME654	PE III : Plastics and Composite
5	6	PE-III	ME	22ME655	PE III : Tribology in Manufacturing
6	6	PE-III	ME	22ME656	PE III : Finance & Cost Management
7	6	PE-III	ME	22ME657	PE III : Maintenance Management

Open Electives-III**

1	6	OE-III	ME	22ME671	OE III : Operations Research Techniques
2	6	OE-III	ME	22ME672	OE III : Automobile Engineering
3	6	OE-III	ME	22ME673	OE III : Robotics and Subtractive Manufacturing
4	6	OE-III	ME	22ME674	OE III : Control System Engineering

Open Electives-IV**

1	6	OE-IV	ME	22ME691	OE IV : Total Quality Management
2	6	OE-IV	ME	22ME692	OE IV : Reliability Engineering
3	6	OE-IV	ME	22ME693	OE IV : Power Generation Engineering
4	6	OE-IV	ME	22ME694	OE IV : Project Evaluation & Management

List of Mandatory Learning Course (MLC)

1	6	HS		MLC126	**YCAP6 :**		**A**	3	0	0	3	0	

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TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.00**
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SoE No. 22ME-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
SEVENTH SEMESTER															
1	7	PC	ME/ME	22ME701	Automation In Production	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	7	PC	ME/ME	22ME702	**Lab:-** Automation In Production	**P**	0	0	2	2	1		60	40	
5	7	PE	ME/ME		**Professional Elective IV**	**T**	3	0	0	3	3	30	20	50	3 Hrs
3	7	PE	ME/ME		**Professional Elective IV-LAB**	**P**	0	0	2	2	1				
4	7	PE	ME/ME		**Professional Elective V**	**T**	3	0	0	3	3	30	20	50	3 Hrs
6	7	PE	ME/ME		**Professional Elective VI**	**T**	3	0	0	3	3	30	20	50	3 Hrs
7	7	PE	ME/ME		**Professional Elective VII**	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	7	PR	ME/ME	22ME703	PROJECT PHASE-2	**P**	0	0	0	10	5		60	40	
9	7	STR	ME/ME	22ME704	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL SIXTH SEM		**15**	**0**	**4**	**29**	**24**				

List of Professional Electives- IV, V, VI & VII

Professional Electives-IV

1	7	PE-IV	ME	22ME711	PE IV : CFD
2	7	PE-IV	ME	22ME712	PE IV : **Lab**:- CFD
3	7	PE-IV	ME	22ME713	PE IV : Referigeration Air conditioning and Cryogenics
4	7	PE-IV	ME	22ME714	PE IV : **Lab**:- Referigeration Air conditioning and Cryogenics
5	7	PE-IV	ME	22ME715	PE IV : Vehicle Engineering
6	7	PE-IV	ME	22ME716	PE IV : **Lab**:- Vehicle Engineering
7	7	PE-IV	ME	22ME717	PE IV : Solar Energy and It'S Utilisation
8	7	PE-IV	ME	22ME718	PE IV : **Lab**:- Solar Energy and It'S Utilisation
9	7	PE-IV	ME	22ME719	PE IV : CNC & Robotics
10	7	PE-IV	ME	22ME720	PE IV : **Lab**:- CNC & Robotics
11	7	PE-IV	ME	22ME721	PE IV : Electric and Hybrid Vehicle
12	7	PE-IV	ME	22ME722	PE IV : **Lab**:- Electric and Hybrid Vehicle
13	7	PE-IV	ME	22ME723	PE IV : Earth Moving Equipments
14	7	PE-IV	ME	22ME724	PE IV : **Lab**:- Earth Moving Equipments

Professional Electives-V

1	7	PE-V	ME	22ME731	PE V : Machine Learning in Manufacturing
2	7	PE-V	ME	22ME732	PE V : Project Evaluation & Management
3	7	PE-V	ME	22ME733	PE V: Thermal Engineering Systems
4	7	PE-V	ME	22ME734	PE V : Surface Engineering
5	7	PE-V	ME	22ME735	PE V : Synthesis of Mechanism
6	7	PE-V	ME	22ME736	PE V : Turbines
7	7	PE-V	ME	22ME737	PE V : Control System Engineering
8	7	PE-V	ME	22ME738	PE V: Machine Tool Design

Professional Electives-VI

1	7	PE-VI	ME	22ME751	PE VI: Stress Analysis
2	7	PE-VI	ME	22ME752	PE VI : Product Design and Development
3	7	PE-VI	ME	22ME753	PE VI : Power Plant Engineering
4	7	PE-VI	ME	22ME754	PE VI : IOT in ME
5	7	PE-VI	ME	22ME755	PE VI : Design of Experiments and Taguchi Methods
6	7	PE-VI	ME	22ME756	PE VI : Non Destructive testing
7	7	PE-VI	ME	22ME757	PE VI:Computetional Methods in ME

Professional Electives-VII

1	7	PE-VII	ME	22ME771	PE VII: Engineering failure Analysis
2	7	PE-VII	ME	22ME772	PE VII: Vibration
3	7	PE-VII	ME	22ME773	PE VII; Gas Dynamics and Jet Propulsion
4	7	PE-VII	ME	22ME774	PE VII: Industry 4.0
5	7	PE-VII	ME	22ME775	PE VII: MEMS
6	7	PE-VII	ME	22ME776	PE VII: AI in Manufacturing
7	7	PE-VII	ME	22ME777	PE VII : Lean Manufacturing and Six Sigma

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SoE No.
22ME-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Mechanical Engineering)

B. Tech in Mechanical Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Eighth Semester															
1	8	STR	ME	22ME801	Industrial Internship	P	0	0	12	12	3		60	40	
2	8	STR	ME	22ME802	Extra Curricular Activity Evaluation	P	0	0	0	0	2		100		
TOTAL EIGHTH SEM							**0**	**0**	**12**	**12**	**5**				
GRAND TOTAL							**127**	**4**	**58**	**197**	**166**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities
TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.00**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 22EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER															
1	1	BS	GE/MTH	22EL101	Differential Equation, Complex Variables and Matrices	T	3	1	0	4	4	30	20	50	3 Hrs
2	1	BS	GE/PHY	22EL102	Engineering Physics	T	3	0	0	3	3	30	20	50	3 Hrs
3	1	BS	GE/PHY	22EL103	Lab: Engineering Physics	P	0	0	2	2	1		60	40	
4	1	HS	GE/HUM	22EL104	Social Science	T	3	0	0	3	3	30	20	50	3 Hrs
5	1	BES	ME/ME	22EL105	Engineering Graphics	T	1	0	0	1	1	30	20	50	3 Hrs
6	1	BES	ME/ME	22EL106	Lab: Engineering Graphics	P	0	0	4	4	2		60	40	
7	1	BES	CT/CT	22EL107	Elements of AIML	T	3	0	0	3	3	30	20	50	3 Hrs
8	1	BES	EL/EL	22EL108	Electrical workshop	P	0	0	2	2	1		60	40	
9	1	BES	EL/EL	22EL109	Fundamentals of Electrical Engineering	T	3	0	0	3	3	30	20	50	3 Hrs
10	1	BES	EL/EL	22EL110	Lab: Fundamentals of Electrical Engineering	P	0	0	2	2	1		60	40	
						TOTAL	**16**	**1**	**10**	**27**	**22**				
List of Mandatory Learning Course (MLC)															
1	1	HS	GE/T&P	MLC2121	YCAP1-Get Set Go	**A**	2	0	0	2	0				
2	1	BES	GE/CHE	GE2132	Environmental Science	**A**	2	0	0	2	0				

SECOND SEMESTER															
1	2	BS	GE/MTH	22EL201	Differential and Integral Calculus	T	3	1	0	4	4	30	20	50	3 Hrs
2	2	BS	GE/CHE	22EL202	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3 Hrs
3	2	BS	GE/CHE	22EL203	Lab: Engineering Chemistry	P	0	0	2	2	1		60	40	
4	2	HS	GE/HUM	22EL204	Professional Communication	T	3	0	0	3	3	30	20	50	3 Hrs
5	2	BES	CV/CV	22EL205	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3 Hrs
6	2	BES	CV/CV	22EL206	Lab: Engineering Mechanics	P	0	0	2	2	1		60	40	
7	2	BES	EE/EE	22EL207	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3 Hrs
8	2	BES	IT/IT	22EL208	Programming for Problem Solving	T	3	0	0	3	3	30	20	50	3 Hrs
9	2	BES	IT/IT	22EL209	**Lab:** Programming for Problem Solving	P	0	0	2	2	1		60	40	
						TOTAL	**18**	**1**	**6**	**25**	**22**				
List of Mandatory Learning Course (MLC)															
1	2	HS	GE/HUM	GE2131	Universal Human Value	**A**	2	0	0	2	0				
2	2	HS	GE/T&P	MLC2122	YCAP2 -Functional English	**A**	2	0	0	2	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activities decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.00
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 22EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
THIRD SEMESTER															
1	3	BS	GE/HUM	22EL301	Integral Transforms and Partial differential Equations	T	3	0	0	3	3	30	20	50	3 Hrs
2	3	HS	EL/EL	22EL302	Electrical Energy Generation System	T	3	0	0	3	3	30	20	50	3 Hrs
3	3	PC	EL/EL	22EL303	**Lab**: Electrical Engineering Workshop	P	0	0	2	2	1		60	40	
4	3	PC	EL/EL	22EL304	Network Analysis	T	3	0	0	3	3	30	20	50	3 Hrs
5	3	PC	EL/EL	22EL305	**Lab**:Computer Programming	P	0	0	2	2	1		60	40	
6	3	PC	EL/EL	22EL306	Electrical Machines	T	3	1	0	3	3	30	20	50	3 Hrs
7	3	PC	EL/EL	22EL307	**Lab:**Electrical Machines	P	0	0	2	2	1		60	40	
8	3	PC	EL/EL	22EL308	Electrical Measurement & Instrumentation	T	3	0	0	3	3	30	20	50	3 Hrs
9	3	PC	EL/EL	22EL309	**Lab:** Electrical Measurement and Instrumentation	P	0	0	2	2	1		60	40	
10	3	PC	CV/EL	22EL310	Environmental Sustainability, Pollution and Management	**T**	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL THIRD SEM		**18**	**1**	**8**	**26**	**22**				
Audit Courses															
1	3	HS	T&P	MLC2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
2	3	BES	EL	MLC105	Introduction to C language	**A**	2	0	0	2	0				
FOURTH SEMESTER															
1	4	BS	EL/EL	22EL401	Signals and System	T	3	0	0	3	3	30	20	50	3 Hrs
2	4	PC	GE/GE	22EL402	Fundamentals of Management and Economics	T	3	0	0	3	3	30	20	50	3 Hrs
3	4	PC	EL/EL	22EL403	Electrical Machines in Power System	T	3	0	0	3	3	30	20	50	3 Hrs
4	4	PC	EL/EL	22EL404	**Lab:**Electrical Machines in Power System	P	0	0	2	2	1		60	40	
5	4	PC	EL/EL	22EL405	Fundamentals of Power System	T	3	0	0	3	3	30	20	50	3 Hrs
6	4	PC	EL/EL	22EL406	Embedded systems	T	3	0	0	3	3	30	20	50	3 Hrs
7	4	PC	EL/EL	22EL407	**Lab:** Embedded systems	P	0	0	2	2	1		60	40	
8	4	PC	EL/EL	22EL408	Fundamentals of Electrical Drives	T	3	1	0	3	3	30	20	50	3 Hrs
9	4	PC	EL/EL	22EL409	**Lab:** Fundamentals of Electrical Drives	P	0	0	2	2	1		60	40	
10	4	PC	EL/EL	22EL410	**Lab:** Renewable Energy Sources	P	0	0	2	2	1		60	40	
					TOTAL FOURTH SEM		**18**	**1**	**8**	**26**	**22**				
Audit Courses															
1	4	HS	T&P	MLC2124	YCCE Communication Aptitude Preparation (YCAP4)	**A**	3	0	0	3	0				
2	4	BES	EL	MLC106	Object Oriented Programming	**A**	2	0	0	2	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activities decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.00
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

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Yeshwantrao Chavan College of Engineering

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SoE No. 22EL-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIFTH SEMESTER															
1	5	PC	EL	22EL501	Electrical Distribution in Power System	T	3	0	0	3	3	30	20	50	3 Hrs
2	5	PC	EL	22EL502	Power Electronics	T	3	0	0	3	3	30	20	50	3 Hrs
3	5	PC	EL	22EL503	Lab:Power Electronics	P	0	0	1	2	1		60	40	
4	5	PE	EL		**Professional Elective -I ***	T	3	0	0	3	3	30	20	50	3 Hrs
5	5	PE	EL		**Professional Elective -II****	T	3	0	0	3	3	30	20	50	3 Hrs
6	5	STR	EL	22EL504	Industrial training, Seminar and Report	P	0	0	1	1	1		60	40	
7	5	OE	EL		**Open Elective - I**	T	3	0	0	3	3	30	20	50	3 Hrs
8	5	OE	EL		**Open Elective - II**	T	3	0	0	3	3		60	40	
					TOTAL FIFTH SEM		**18**	**0**	**2**	**21**	**20**				

List of Lab. Professional Electives-I *

1	5	PE-I	EL	22EL511	PEI: Electric and Magnetic Field
2	5	PE-I	EL	22EL512	PEI: Electrical Machine Design
3	5	PE-I	EL	22EL513	PEI: Design of Photovoltaic System
4	5	PE-I	EL	22EL514	PEI: Electric Power Utilization

List of Lab. Professional Electives-II **

1	5	PE-I	EL	22EL531	PEII:Illumination Engineering(MOOC)
2	5	PE-I	EL	22EL532	PEII:: Applied Numerical methods with MATLAB
3	5	PE-I	EL	22EL533	PEII:Geothermal and Ocean wave Energy conversion
4	5	PE-I	EL	22EL534	PEII:Distributed Generations in Power System

Open Elective-I

1	5	OE-I	EL	22EL551	OEI:Renewable Energy Generation System
2	5	OE-I	EL	22EL552	OEI:Electrical Machines and their Applications
3	5	OE-I	EL	22EL553	OEI:Solar Power Plant Design and Installation

Open Elective-II

1	5	OE-II	EL	22EL571	OEII:Electrical Energy Audit and Safety
2	5	OE-II	EL	22EL572	OEII:Utilization of Electrical Energy
3	5	OE-II	EL	22EL573	OEII:Power System Engineering

Audit Courses

1	5	HS	T&P	AU2127	YCCE Communication Aptitude Preparation (YCAP5)	A	3	0	0	3	0	
2	5	HS	R&D		Design thinking	A	2	0	0	2	0	

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TA ** = for Theory : 12 marks on lecture quizzes & TA2 activities decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

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SoE No. 22EL-101

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(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
SIXTH SEMESTER															
1	6	PC	EL	22EL601	Control System	T	3	0	0	3	3	30	20	50	3 Hrs
2	6	PC	EL	22EL602	Lab:Control System	P	0	0	2	2	1		60	40	
3	6	PC	EL	22EL603	Power System Analysis	T	3	0	0	3	3	30	20	50	3 Hrs
4	6	PC	EL	22EL604	Electric Vehicles	T	3	0	0	3	3	30	20	50	3 Hrs
5	6	PC	EL	22EL605	Lab:Electric Vehicles	P	0	0	2	2	1		60	40	
6	6	PE	EL		**Professional Elective -III**	T	3	0	0	3	3	30	20	50	3 Hrs
8	6	PE	EL		**Lab. Professional Elective -III**	P	0	0	2	2	1		60	40	
9	6	PC	EL	22EL606	Lab:Computer Aided Electrical Drawing	P	0	0	2	2	1		60	40	
10	6	PC	EL	22EL607	Lab:Simulation of Power Electronics & Power System	P	0	0	2	2	1		60	40	
11	6	PC	EL	22EL608	Lab.:Substation Design	P	0	0	2	2	1		60	40	
12	6	PC	EL	22EL609	Project Phase I	P	0	0	4	4	2		60	40	
13	6	OE	EL		**Open Elective - III**	T	3	0	0	3	3	30	20	50	3 Hrs
14	6	OE	EL		**Open Elective - IV**	T	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL SIXTH SEM		**18**	**0**	**16**	**34**	**26**				

List of Professional Electives- III

Professional Electives-III

1	6	PE-III	EL	22EL631	PEIII:Electrical Installation Design
		PE-III		22EL632	PEIII:Lab:Electrical Installation Design
2	6	PE-III	EL	22EL633	PEIII:Electrical Energy Audit and Safety Analysis
		PE-III		22EL634	PEIII:Lab:Electrical Energy Audit and Safety Analysis
3	6	PE-III	EL	22EL635	PEIII:Computer Methods in Power System
		PE-III		22EL636	PEIII:Lab:Computer Methods in Power System
4	6	PE-III	EL	22EL637	PEIII:Project Planning and Management
		PE-III		22EL638	PEIII:Lab: Project Planning and Management
5	6	PE-III	EL	22EL639	PEIII:Switched Mode Power Conversion
		PE-III		22EL640	PEIII:Lab: Switched Mode Power Conversion

Open Elective-III

1	6	OE-III	EL	22EL651	OEIII:Renewable Energy Generation System
2	6	OE-III	EL	22EL652	OEIII:Electrical Machines and their Applications
3	6	OE-III	EL	22EL653	OEIII:Solar Power Plant Design and Installation

Open Elective-IV

1	6	OE-IV	EL	22EL671	OEIV:Electrical Energy Audit and Safety
2	6	OE-IV	EL	22EL672	OEIV:Utilization of Electrical Energy
3	6	OE-IV	EL	22EL673	OEIV:Power System Engineering

Audit Courses

1	6	HS		AU2128	YCCE Communication Aptitude Preparation (YCAP6)	**A**	3	0	0	3	0

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

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TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.00**
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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electrical Engineering)

B. Tech in Electrical Engineering

SoE No. 22EL-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
SEVENTH SEMESTER															
1	7	PC	EL	22EL701	High Voltage Engineering	T	3	0	0	3	3	30	20	50	3 Hrs
2	7	PC	EL	22EL702	Lab.:High Voltage Engineering	P	0	0	2	2	1		60	40	
3	7	PE	EL		**Professional Elective -IV**	T	3	0	0	3	3	30	20	50	3 Hrs
4	7	PE	EL		**Professional Elective -V**	T	3	0	0	3	3	30	20	50	3 Hrs
5	7	PE	EL		**Professional Elective -VI**	T	3	0	0	3	3	30	20	50	3 Hrs
6	7	PE	EL		**Lab. Professional Elective -VI**	P	0	0	2	2	1		60	40	
7	7	PC	EL	22EL703	Switchgear & Protection	T	3	0	0	3	3	30	20	50	3 Hrs
8	7	PC	EL	22EL704	**Lab**: Switchgear & Protection	P	0	0	2	2	1		60	40	
9	7	PR	EL	22EL705	Project Phase-II	**P**	0	0	10	10	5		60	40	
10	7	STR	EL	22EL706	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL SEVENTH SEM		**15**	**0**	**16**	**31**	**25**				

List of Professional Electives-IV,V,VI

Professional Electives -IV

1	7	PE-IV	PE	22EL711	PEIV:Advanced Power Electronics
2	7	PE-IV	PE	22EL712	PEIV:Advanced Electrical Drives
3	7	PE-IV	PE	22EL713	PEIV:Grid integration in Renewable Energy Systems
4	7	PE-IV	PE	22EL714	PEIV:Power System Operation and Management
5	7	PE-IV	PE	22EL715	PEIV:Microgrid

Professional Electives -V

1	7	PE-V	PE	22EL731	PEV: Fundamentals of Power Quality
2	7	PE-V	PE	22EL732	PEV:FACTS Devices
3	7	PE-V	PE	22EL733	PEV: Artificial Intelligence Based System
4	7	PE-V	PE	22EL734	PEV:Hybrid Electric Vehicles
5	7	PE-V	PE	22EL735	PEV:Power Electronics Converters for Renewable Energy
6	7	PE-V	PE	22EL736	PEV: Fundamentals of Smart Grid

Professional Electives -VI

1	7	PE-VI	PE	22EL751	PEVI:Testing and Maintenance of Electrical Machines
				22EL752	PEVI: **Lab:**Testing and Maintenance of Electrical Machines
2	7	PE-VI	PE	22EL753	PEVI: Industrial Safety
				22EL754	PEVI: **Lab:** Industrial Safety
3	7	PE-VI	PE	22EL755	PEVI: Introduction to Smart Cities
				22EL756	PEVI: **Lab:**Introduction to Smart Cities

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
EIGHTH SEMESTER															
1	**8**	**STR**	EL	22EL801	Internship - training / Seminar & Report	P	0	0	10	10	3		50	50	
2	**8**	**STR**	EL	22EL802	Extra Curricular Activity Evaluation	P	0	0	0	0	2		100		
					TOTAL EIGHTH SEM		**0**	**0**	**10**	**10**	**5**				
					GRAND TOTAL		**121**	**4**	**76**	**200**	**164**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activities decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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SoE No. 22EE-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

B. Tech in Electronics Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER															
1	1	BS	GE/MTH	22EE101	Differential Equation, Complex Variables & Matrices	T	3	1	0	4	4	30	20	50	3 Hrs
2	1	BS	GE/PHY	22EE102	Engineering Physics	T	3	0	0	3	3	30	20	50	3 Hrs
3	1	BS	GE/PHY	22EE103	Lab: Engineering Physics	P	0	0	2	2	1		60	40	
4	1	HS	GE/HUM	22EE104	Social Science	T	3	0	0	3	3	30	20	50	3 Hrs
5	1	BES	ME/ME	22EE105	Engineering Graphics	T	1	0	0	1	1	30	20	50	3 Hrs
6	1	BES	ME/ME	22EE106	Lab: Engineering Graphics	P	0	0	4	4	2		60	40	
7	1	BES	CT/CT	22EE107	Elements of AIML	T	3	0	0	3	3	30	20	50	3 Hrs
8	1	BES	EL/EL	22EE108	Electrical workshop	P	0	0	2	2	1		60	40	
9	1	BES	EE/EE	22EE109	Digital Logic Design	T	3	0	0	3	3	30	20	50	3 Hrs
10	1	BES	EE/EE	22EE110	Lab: Digital Logic Design	P	0	0	2	2	1		60	40	
						TOTAL	**16**	**1**	**10**	**27**	**22**				
List of Mandatory Learning Course (MLC)															
1	1	HS	GE/T&P	MLC2121	YCAP1-Get Set Go	**A**	2	0	0	2	0				
2	1	BES	GE/CHE	GE2132	Environmental Science	**A**	2	0	0	2	0				

SECOND SEMESTER															
1	2	BS	GE/MTH	22EE201	Differential & Integral Calculus	T	3	1	0	4	4	30	20	50	3 Hrs
2	2	BS	GE/CHE	22EE202	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3 Hrs
3	2	BS	GE/CHE	22EE203	Lab: Engineering Chemistry	P	0	0	2	2	1		60	40	
4	2	HS	GE/HUM	22EE204	Professional Communication	T	3	0	0	3	3	30	20	50	3 Hrs
5	2	BES	CV/CV	22EE205	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3 Hrs
6	2	BES	CV/CV	22EE206	Lab: Engineering Mechanics	P	0	0	2	2	1		60	40	
7	2	BES	EE/EE	22EE207	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3 Hrs
8	2	BES	IT/IT	22EE208	Programming for Problem Solving	T	3	0	0	3	3	30	20	50	3 Hrs
9	2	BES	IT/IT	22EE209	**Lab:** Programming for Problem Solving	P	0	0	2	2	1		60	40	
						TOTAL	**18**	**1**	**6**	**25**	**22**				
List of Mandatory Learning Course (MLC)															
1	2	HS	GE/HUM	GE2131	Universal Human Value	**A**	2	0	0	2	0				
2	2	HS	GE/T&P	MLC2122	YCAP2 -Functional English	**A**	2	0	0	2	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.00
Chairperson	Dean (Acad. Matters)	Date of Release	Version

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. 22EE-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

B. Tech in Electronics Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS	EE/EE	22EE301	Signal and Systems	T	3	0	0	3	3	30	20	50	3 Hrs
2	3	HS	GE/HUM	22EE302	Fundamentals of Management and Economics	T	3	0	0	3	3	30	20	50	3 Hrs
3	3	PC	EE/EE	22EE303	Electronic Devices and Circuits	T	3	1	0	3	3	30	20	50	3 Hrs
4	3	PC	EE/EE	22EE304	**Lab:**Electronic Devices and Circuits	P	0	0	2	2	1		60	40	
5	3	PC	EE/EE	22EE305	Microprocessor and Interfacing	T	3	0	0	3	3	30	20	50	3 Hrs
6	3	PC	EE/EE	22EE306	**Lab:** Microprocessor and Interfacing	P	0	0	2	2	1		60	40	
7	3	PC	EE/EE	22EE307	Network Analysis	T	3	0	0	2	3	30	20	50	3 Hrs
8	3	PC	EE/EE	22EE308	**Lab:** Network Analysis	P	0	0	2	2	1		60	40	
9	3	PC	EE/EE	22EE309	Switching Theory and Finite Automata	T	3	0	0	2	3	30	20	50	3 Hrs
10	3	PC	EE/EE	22EE310	**Lab:** Programming Language	P	0	0	2	2	1		60	40	
					TOTAL THIRD SEM		**18**	**1**	**8**	**24**	**22**				
List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
2	3	BES	EE	MLC107	Basics of MATLAB	A	2	0	0	2	0				
Fourth Semester															
1	4	BS	GE/HUM	22EE401	Probability and Statistical Theory	T	3	0	0	3	3	30	20	50	3 Hrs
2	4	PC	EE/EE	22EE402	Digital System Modelling	T	3	0	0	3	3	30	20	50	3 Hrs
3	4	PC	EE/EE	22EE403	Microcontroller and its Applications	T	3	0	0	3	3	30	20	50	3 Hrs
4	4	PC	EE/EE	22EE404	**Lab:** Microcontroller and its Applications	P	0	0	2	2	1		60	40	
5	4	PC	EE/EE	22EE405	Algorithm and Data Structure	T	3	0	0	3	3	30	20	50	3 Hrs
6	4	PC	EE/EE	22EE406	**Lab**: Algorithm and Data Structure	P	0	0	2	2	1		60	40	
7	4	PC	EE/EE	22EE407	Digital CMOS Circuits	T	3	0	0	3	3	30	20	50	3 Hrs
8	4	PC	EE/EE	22EE408	**Lab**:Digital CMOS Circuits	P	0	0	2	2	1		60	40	
9	4	PC	EE/EE	22EE409	Electromagnetic Fields	T	3	1	0	3	3	30	20	50	3 Hrs
10	4	PC	EE/EE	22EE410	**Lab**: Electronics Workshop	P	0	0	2	2	1		60	40	
11	4	PC	CV/EE	22EE411	Environmental Sustainability, Pollution and Management	T	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL FOURTH SEM		**21**	**1**	**8**	**29**	**25**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC2124	YCCE Communication Aptitude Preparation (YCAP4)	A	3	0	0	3	0				
2	4	BES	EE	MLC108	Basics of Arduino Programmimg	A	2	0	0	2	0				

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TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.00
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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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SoE No. 22EE-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

B. Tech in Electronics Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester															
1	5	PC	EE	22EE501	Analog Communication	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	5	PC	EE	22EE502	**Lab:** Analog Communication	**P**	0	0	2	2	1		60	40	
3	5	PC	EE	22EE503	Embedded System	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	5	PC	EE	22EE504	**Lab:**Embedded System	**P**	0	0	2	2	1		60	40	
5	5	PC	EE	22EE505	Analog Integrated Circuits & Design	**T**	3	0	0	3	3	30	20	50	3 Hrs
6	5	PC	EE	22EE506	**Lab:** Analog Integrated Circuits & Design	**T**	0	0	2	2	1	30	20	50	3 Hrs
7	5	PE	EE		**Professional Elective-I**	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	5	PE	EE		**Lab.**: Professional Elective-I	**P**	0	0	2	2	1		60	40	
9	5	STR	EE	22EE507	Industrial training, Seminar & Report	**P**	0	0	2	2	1		60	40	
10	5	OE-I	EE		**Open Elective - I**	**T**	3	0	0	3	3	30	20	50	3 Hrs
11	5	OE-II	EE		**Open Elective - II**	**T**	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL FOURTH SEM		**18**	**0**	**10**	**28**	**23**				

List of Professional Electives-I *

1	5	PE-I	EE	22EE511	PE-I:Operating System
2	5	PE-I	EE	22EE512	PE-I: **Lab:** Operating System
3	5	PE-I	EE	22EE513	Object Oriented Programming
4	5	PE-I	EE	22EE514	PE-I: **Lab:** Object Oriented Programming
5	5	PE-I	EE	22EE515	PE-I: Computer Communication Networks
6	5	PE-I	EE	22EE516	PE-I: **Lab:** Computer Communication Networks
7	5	PE-I	EE	22EE517	PE-I: Analog VLSI Design
8	5	PE-I	EE	22EE518	PE-I: **Lab:** Analog VLSI Design

Open Elective-I

1	5	OE-I	EE	22EE531	OE I : Fuzzy Logic & Neural Networks
2	5	OE-I	EE	22EE532	OE I : Basics of Analog and Digital Communication
3	5	OE-I	EE	22EE533	OE I : Biomedical Instrumentation
4	5	OE-I	EE	22EE534	OE I : Digital Logic Design

Open Elective-II

1	5	OE-II	EE	22EE551	OE II : Sensors and Actuators
2	5	OE-II	EE	22EE552	OE II : Computer Architecture
3	5	OE-II	EE	22EE553	OE II : Consumer Electronics
4	5	OE-II	EE	22EE554	OE II : Industrial Automation

List of Mandatory Learning Course (MLC)

1	5	HS		MLC125	YCCE Communication Aptitude Preparation (YCAP5)	A	3	0	0	3	0	
2	5	HS			Design thinking	A	2	0	0	2	0	

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TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2022

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(Department of Electronics Engineering)

B. Tech in Electronics Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester															
1	6	PC	EE	22EE601	Control System Engineering	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	6	PC	EE	22EE602	Digital Signal Processing	**T**	3	0	0	3	3	30	20	50	3 Hrs
3	6	PC	EE	22EE603	**Lab:**Digital Signal Processing	P	0	0	2	2	1		60	40	
4	6	PC	EE	22EE604	**Lab:**Electronics Design Automation	P	0	0	2	2	1		60	40	
5	6	PE	EE		**Professional Elective-II**	**T**	0	0	2	2	3	30	20	50	3 Hrs
6	6	PE	EE		**Lab.: Professional Elective-II**	P	3	0	0	3	1		60	40	
7	6	PE	EE		**Professional Elective-III**	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	6	OE-III	EE		**Open Elective - III**	**T**	3	0	0	3	3	30	20	50	3 Hrs
9	6	OE-IV	EE		**Open Elective - IV**	**T**	3	0	0	3	3	30	20	50	3 Hrs
10	6	PR	EE	22EE605	Project Phase -I	P	0	0	4	4	2		60	40	
					TOTAL SIXTH SEM		**18**	**0**	**10**	**28**	**23**				

List of Professional Electives- II & III

Professional Electives-II

1	6	PE-II	EE	22EE611	PE II:Digital Image Processing
2	6	PE-II	EE	22EE612	**Lab:** PE II: Digital Image Processing
3	6	PE-II	EE	22EE613	PE II:Machine Learning
4	6	PE-II	EE	22EE614	**Lab:** PE II: Machine Learning
5	6	PE-II	EE	22EE615	CMOS Subsystem Design
6	6	PE-II	EE	22EE616	**Lab:**CMOS Subsystem Design
7	6	PE-II	EE	22EE617	PE II:PE-I:Soft Computing & OptimizationTechniques
8	6	PE-II	EE	22EE618	**Lab**:PE II:PE-I:Soft Computing & OptimizationTechniques
9	6	PE-II	EE	22EE619	PE II: RF and Microwave
10	6	PE-II	EE	22EE620	**Lab:** PE II: RF and Microwave

Professional Electives-III

1	6	PE-III	EE	22EE631	PE III: Industrial Automation
2	6	PE-III	EE	22EE632	PE III :Power Electronics
3	6	PE-III	EE	22EE633	PE III: Optical Communication
4	6	PE-III	EE	22EE634	PE III: Computer Orgnization
5	6	PE-III	EE	22EE635	PE III:Transmission line and wave Guide

Open Electives-III

1	6	OE-III	EE	22EE651	OE III : Fuzzy Logic & Neural Networks
2	6	OE-III	EE	22EE652	OE III : Basics of Analog and Digital Communication
3	6	OE-III	EE	22EE653	OE III : Biomedical Instrumentation
4	6	OE-III	EE	22EE654	OE III : Digital Logic Design

Open Electives-IV

1	6	OE-IV	EE	22EE671	OE IV : Sensors and Actuators
2	6	OE-IV	EE	22EE672	OE IV : Computer Architecture
3	6	OE-IV	EE	22EE673	OE IV : Consumer Electronics
4	6	OE-IV	EE	22EE674	OE IV : Industrial Automation

List of Mandatory Learning Course (MLC)

1	6	HS		MLC126	YCCE Communication Aptitude Preparation (YCAP6)		**A**	3	0	0	3	0

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TA = for Practical : MSPA will be 15 marks each**

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Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

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SoE No. 22EE-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

B. Tech in Electronics Engineering

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester															
1	7	PC	EE	22EE701	Digital Communication	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	7	PC	EE	22EE702	**Lab:**Digital Communication	**P**	0	0	2	2	1		60	40	
3	7	PC	EE	22EE703	Internet of Things	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	7	PC	EE	22EE704	**Lab:** Internet of Things	**P**	0	0	2	2	1		60	40	
5	7	PE	EE		Professional Elective-IV	**T**	3	0	0	3	3	30	20	50	3 Hrs
6	7	PE	EE		Professional Elective-V	**T**	3	0	0	3	3	30	20	50	3 Hrs
7	7	PE	EE		Professional Elective-VI	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	7	STR	EE	22EE705	Project Phase-II	**P**	0	0	10	10	5		60	40	
9	7	STR	EE	22EE706	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL SEVENTH SEM		**15**	**0**	**14**	**29**	**24**				

List of Professional Electives-IV,V & VI

Professional Electives -IV

1	7	PE-IV	EE	22EE721	PE IV: Introduction to remote sensing and Image Analysis
2	7	PE-IV	EE	22EE722	PE IV: Wireless Sensor Networks
3	7	PE-IV	EE	22EE723	PE IV: System on Chip Design
3	7	PE-IV	EE	22EE724	PE IV: Deep learning

Professional Electives -V

1	7	PE-V	EE	22EE741	PE V: Biomedical Engineering
2	7	PE-V	EE	22EE742	PE V: Wireless Communication
3	7	PE-V	EE	22EE743	PE V: Cryptography and Network Security
4	7	PE-V	EE	22EE744	PE V: Nano Electronics
5	7	PE-V	EE	22EE745	PE V:VLSI Signal Processing

Professional Electives -VI

1	7	PE-VI	EE	22EE761	PE-VI: Design Verification and Test of Digital VLSI Circuits
2	7	PE-V	EE	22EE762	PE-VI: Micro Electro Mechanical Systems (MEMS)
3	7	PE-V	EE	22EE763	PE-VI: Mechatronics
4	7	PE-V	EE	22EE764	PE-VI: Computer Vision

Eighth Semester															
1	**8**	**STR**	EE	22EE801	Industrial Internship	**P**	0	0	12	12	3		60	40	
2	**8**	**STR**	EE	22EE802	Extra Curricular Activity Evaluation	**P**	0	0	0	0	2		100		
					TOTAL EIGHTH SEM		**0**	**0**	**12**	**12**	**5**				
					GRAND TOTAL		**124**	**4**	**78**	**202**	**166**				

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TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics & Telecommunication Engineering)

B. Tech in Electronics & Telecommunication Engineering

SoE No. 22ET-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER															
1	1	BS	GE/MTH	22ET101	Differential and Integral Calculus	T	3	1	0	4	4	30	20	50	3 Hrs
2	1	BS	GE/CHE	22ET102	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3 Hrs
3	1	BS	GE/CHE	22ET103	Lab: Engineering Chemistry	P	0	0	2	2	1		60	40	
4	1	HS	GE/HUM	22ET104	Professional Communication	T	3	0	0	3	3	30	20	50	3 Hrs
5	1	BES	CV/CV	22ET105	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3 Hrs
6	1	BES	CV/CV	22ET106	Lab: Engineering Mechanics	P	0	0	2	2	1		60	40	
7	1	BES	EE/EE	22ET107	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3 Hrs
8	1	BES	IT/IT	22ET108	Programming for Problem Solving	T	3	0	0	3	3	30	20	50	3 Hrs
9	1	BES	IT/IT	22ET109	Lab: Programming for Problem Solving	P	0	0	2	2	1		60	40	
					TOTAL		**18**	**1**	**6**	**25**	**22**				
List of Mandatory Learning Course (MLC)															
1	1	HS	GE/HUM	GE2131	Universal Human Value	**A**	2	0	0	2	0				
2	1	HS	GE/T&P	MLC2121	YCAP1-Get Set Go	**A**	2	0	0	2	0				
SECOND SEMESTER															
1	2	BS	GE/MTH	22ET201	Differential Equation, Complex Variables & Matrices	T	3	1	0	4	4	30	20	50	3 Hrs
2	2	BS	GE/PHY	22ET202	Engineering Physics	T	3	0	0	3	3	30	20	50	3 Hrs
3	2	BS	GE/PHY	22ET203	Lab: Engineering Physics	P	0	0	2	2	1		60	40	
4	2	HS	GE/HUM	22ET204	Social Science	T	3	0	0	3	3	30	20	50	3 Hrs
5	2	BES	ME/ME	22ET205	Engineering Graphics	T	1	0	0	1	1	30	20	50	3 Hrs
6	2	BES	ME/ME	22ET206	Lab: Engineering Graphics	P	0	0	4	4	2		60	40	
7	2	BES	CT/CT	22ET207	Elements of AIML	T	3	0	0	3	3	30	20	50	3 Hrs
8	2	BES	EL/EL	22ET208	Electrical workshop	P	0	0	2	2	1		60	40	
9	2	BES	ET/ET	22ET209	Digital Logic Design	T	3	0	0	3	3	30	20	50	3 Hrs
10	2	BES	ET/ET	22ET210	Lab: Digital Logic Design	P	0	0	2	2	1		60	40	
					TOTAL		**16**	**1**	**10**	**27**	**22**				
List of Mandatory Learning Course (MLC)															
1	2	HS	GE/T&P	MLC2122	YCAP2 -Functional English	**A**	2	0	0	2	0				
2	2	BES	GE/CHE	GE2132	Environmental Science	**A**	2	0	0	2	0				

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TA = for Practical : MSPA will be 15 marks each**

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(Department of Electronics & Telecommunication Engineering)

B. Tech in Electronics & Telecommunication Engineering

SoE No. 22ET-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS	ET/ET	22ET301	Signals & Systems	T	3	0	0	3	3	30	20	50	3 Hours
2	3	BS	ET/ET	22ET302	Lab: Signals & Systems	P	0	0	2	2	1		60	40	
3	3	HS	GE/HUM	22ET303	Fundamentals of Management and Economics	T	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	ET/ET	22ET304	Electronic Devices and Circuits	T	3	1	0	4	4	30	20	50	3 Hours
5	3	PC	ET/ET	22ET305	Lab: Electronic Devices and Circuits	P	0	0	2	2	1		60	40	
6	3	PC	ET/ET	22ET306	Digital System Design	T	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	ET/ET	22ET307	Lab: Digital System Design	P	0	0	2	2	1		60	40	
8	3	PC	ET/ET	22ET308	Computer Organization	T	3	0	0	3	3	30	20	50	3 Hours
9	3	PC	ET/ET	22ET309	Network Theory	T	3	0	0	3	3	30	20	50	3 Hours
10	3	PC	CV/ET	22ET310	Environmental Sustainability, Pollution and Management	T	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL THIRD SEM		**21**	**1**	**6**	**28**	**25**				
List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
2	3		ET/ET	MLC109	Exploring MATLAB	A	2	0	0	2	0				
Fourth Semster															
1	4	BS	GE/MTH	22ET401	Probability and Statistical Theory	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	ET/ET	22ET402	Electromagnetic Fields	T	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	ET/ET	22ET403	Microcontroller and Interfacing	T	3	0	0	3	3	30	20	50	3 Hours
4	4	PC	ET/ET	22ET404	Lab: Microcontroller and Interfacing	P	0	0	2	2	1		60	40	
5	4	PC	ET/ET	22ET405	Analog Communication	T	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	ET/ET	22ET406	Lab.: Analog Communication	P	0	0	2	2	1		60	40	
7	4	PC	ET/ET	22ET407	Control Systems	T	3	1	0	4	3	30	20	50	3 Hours
8	4	PC	ET/ET	22ET408	Lab.: Control Systems	P	0	0	2	2	1		60	40	
9	4	PC	ET/ET	22ET409	Object Oriented Programming	T	3	0	0	3	3	30	20	50	3 Hours
10	4	PC	ET/ET	22ET410	Lab.: Object Oriented Programming	P	0	0	2	2	1		60	40	
					TOTAL FOURTH SEM		**18**	**1**	**8**	**27**	**22**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC2124	YCCE Communication Aptitude Prepartion (YCAP 4)	A	3	0	0	3	0				
2	4		ET/ET	MLC110	Embedded System & IoT	A	2	0	0	2	0				

MSEs* = Two MSEs of 15 Marks each will be conducted and marks 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory :12 marks on lecture quizzes, 12 marks on 2 Activities, 2 marks on class performance,4 marks on Common TA

TA = for Practical : MSPA will be 15 marks each**

		June 2023	1.00
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics & Telecommunication Engineering)

B. Tech in Electronics & Telecommunication Engineering

SoE No. 22ET-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester															
1	5	PC	ET/ET	22ET501	Digital Communication	T	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	ET/ET	22ET502	Lab:Digital Communication	P	0	0	2	1	1		60	40	
3	5	PC	ET/ET	22ET503	Analog Circuits	T	3	1	0	4	3	30	20	50	3 Hours
4	5	PC	ET/ET	22ET504	Lab:Analog Circuits	P	0	0	2	2	1		60	40	
5	5	PC	ET/ET	22ET505	Fields & Radiating System	T	3	0	0	3	3	30	20	50	3 Hours
6	5	PE	ET/ET		Professional Elective I	T	3	0	0	3	3	30	20	50	3 Hours
7	5	PE	ET/ET		Lab:Professional Elective I	P	0	0	2	2	1		60	40	
8	5	OE-I	ET/ET		Open Elective - I *	T	3	0	0	3	3	30	20	50	3 Hours
9	5	OE -II	ET/ET		Open Elective - II *	T	3	0	0	3	3	30	20	50	3 Hours
10	5	PC	ET/ET	22ET506	Lab.: Electronics Design Workshop	P	0	0	2	2	1		60	40	
11	5	STR	ET/ET	22ET507	Industrial training, Seminar & Report	P	0	0	2	2	1		60	40	
					TOTAL FIFTH SEM		**18**	**1**	**10**	**28**	**23**				

List of Mandatory Learning Course (MLC)												
1	5	HS		MLC125	YCCE Communication Aptitude Preparation (YCAP5)	A	3	0	0	3	0	
2	5				Design thinking	A	2	0	0	2	0	

Professional Elective-I

1	5	PE	PC	22ET511	PE I : CMOS VLSI Design
2	5	PE	PC	22ET512	PE I :Lab:CMOS VLSI Design
3	5	PE	PC	22ET513	PE I : Sensors & Wearable Device
4	5	PE	PC	22ET514	PE I :Lab: Sensors & Wearable Device
5	5	PE	PC	22ET515	PE I : Discrete Structures and Algorithms
6	5	PE	PC	22ET516	PE I :Lab: Discrete Structures and Algorithms
7	5	PE	PC	22ET517	PE I : Optical Communication
8	5	PE	PC	22ET518	PE I :Lab: Optical Communication
9	5	PE	PC	22ET519	PE I : Digital Image Processing
10	5	PE	PC	22ET520	PE I :Lab: Digital Image Processing
11	5	PE	PC	22ET521	PEI: Internet of Things
12	5	PE	PC	22ET522	PEI: Lab: Internet of Things

Open Electives -I

1	5	OE I	PC	22ET531	OE I : Principles of Communication
2	5	OE I	PC	22ET532	OE I : Industrial Automation
3	5	OE I	PC	22ET533	OE I :Medical Electronics
4	5	OE I	PC	22ET534	OE I : Fundamentals of Image Processing

Open Electives -II

1	5	OE II	PC	22ET551	OE II :Fundamentals of Computer Networks
2	5	OE II	PC	22ET552	OE II :Soft Computing
3	5	OE II	PC	22ET553	OE II : Microcontrollers & Embedded systems
4	5	OE II	PC	22ET554	OE II : Fundamentals of Internet of Things

MSEs* = Two MSEs of 15 Marks each will be conducted and marks 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory :12 marks on lecture quizzes, 12 marks on 2 Activities, 2 marks on class performance,4 marks on Common TA

TA = for Practical : MSPA will be 15 marks each**

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Yeshwantrao Chavan College of Engineering

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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics & Telecommunication Engineering)

B. Tech in Electronics & Telecommunication Engineering

SoE No. 22ET-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester															
1	6	PC	ET/ET	22ET601	Digital Signal Processing	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	ET/ET	22ET602	Lab:Digital Signal Processing	**P**	0	0	2	2	1		60	40	
3	6	PC	ET/ET	22ET603	Antennas & Wave Propagation	**T**	3	0	0	3	3	30	20	50	3 Hours
4	6	PC	ET/ET	22ET604	Lab:Antennas & Wave Propagation	**P**	3	0	0	3	1	30	20	50	3 Hours
5	6	PE	ET/ET		**Professional Elective II**	**T**	3	0	0	3	3	30	20	50	3 Hours
6	6	PE	ET/ET		**Lab: Professional Elective II**	**P**	0	0	2	2	1		60	40	
7	6	PE	ET/ET		**Professional Elective III**	**T**	3	0	0	3	3	30	20	50	3 Hours
8	6	OE-III	ET/ET		**Open Elective - III ****	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	OE-IV	ET/ET		**Open Elective - IV ****	**T**	3	0	0	3	3	30	20	50	3 Hours
10	6	PR	ET/ET	22ET605	Project Phase I	**P**	0	0	4	4	2		60	40	
					TOTAL SIXTH SEM		**21**	**0**	**8**	**29**	**23**				

List of Mandatory Learning Course (MLC)												
1	6	HS		MLC126	YCCE Communication Aptitude Preparation (YCAP6)		A	3	0	**0**	3	0

Professional Electives -II

1	6	PE II	PC	22ET611	PE II : Analog VLSI Design
2	6	PE II	PC	22ET612	PE II : Lab: Analog VLSI Design
3	6	PE II	PC	22ET613	PE II : Machine Learning
4	6	PE II	PC	22ET614	PE II : Lab : Machine Learning
5	6	PE II	PC	22ET615	PE II : Embedded System Design
6	6	PE II	PC	22ET616	PE II :Lab Embedded System Design
7	6	PE II	PC	22ET617	PE II : Multimedia Communication
8	6	PE II	PC	22ET618	PE II : Lab Multimedia Communication
9	6	PE II	PC	22ET619	PE II : Digital Image Analysis for Remote Sensing Application
10	6	PE II	PC	22ET620	PE II : Lab Digital Image Analysis for Remote Sensing Application
11	6	PE II	PC	22ET621	PEII: Radio Frequency Circuit Design
12	6	PE II	PC	22ET622	PEII:Lab Radio Frequency Circuit Design

Professional Electives -III

1	6	PE III	PC	22ET641	PE III : Introduction to Photonics
2	6	PE III	PC	22ET642	PE III : Wireless Mobile Communication
3	6	PE III	PC	22ET643	PE III : Soft Computing & Application
4	6	PE III	PC	22ET644	PE III : Power Electronics
5	6	PE III	PC	22ET645	PE III : Information Theory and coding
6	6	PE III	PC	22ET646	PE III : VLSI Testing and Verification

Open Electives -III

1	6	OE III	PC	22ET661	OE III : Principles of Communication
2	6	OE III	PC	22ET662	OE III : Industrial Automation
3	6	OE III	PC	22ET663	OE III :Medical Electronics
4	6	OE III	PC	22ET664	OE III : Fundamentals of Image Processing

Open Electives -IV

1	6	OE IV	PC	22ET681	OE IV :Fundamentals of Computer Networks
2	6	OE IV	PC	22ET682	OE IV :Soft Computing
3	6	OE IV	PC	22ET683	OE IV : Microcontrollers & Embedded systems
4	6	OE IV	PC	22ET684	OE IV : Fundamentals of Internet of Things

MSEs* = Three MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

TA ** = for Theory :12 marks on lecture quizzes, 12 marks on 2 Activities, 2 marks on class performance,4 marks on Common TA

TA = for Practical : MSPA will be 15 marks each**

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Yeshwantrao Chavan College of Engineering
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B.TECH SCHEME OF EXAMINATION 2022
(Scheme of Examination w.e.f. 2022-23 onward)
(Department of Electronics & Telecommunication Engineering)
B. Tech in Electronics & Telecommunication Engineering

SoE No. 22ET-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester															
1	7	PC	ET/ET	22ET701	Microwave Theory and Techniques	T	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	ET/ET	22ET702	Lab:Microwave Theory and Techniques	P	0	0	2	2	1		60	40	
3	7	PC	ET/ET	22ET703	Computer Network	T	3	0	0	3	3	30	20	50	3 Hours
4	7	PC	ET/ET	22ET704	Lab: Computer Network	P	0	0	2	2	1		60	40	
5	7	PE	ET/ET		**Professional Elective IV**	T	3	0	0	3	3	30	20	50	3 Hours
6	7	PE	ET/ET		**Professional Elective V**	P	0	0	2	2	3		60	40	
7	7	PE	ET/ET		**Professional Elective VI**	T	3	0	0	3	3	30	20	50	3 Hours
8	7	PR	ET/ET	22ET705	Project Phase-II	P	0	0	10	10	5		60	40	
9	7	STR	ET/ET	22ET706	Campus Recruitment Training (CRT)	P	0	0	0	0	2		100		
					TOTAL SEVENTH SEM		**12**	**0**	**16**	**28**	**24**				

Professional Electives -IV

1	7	PE IV	PC	22ET711	PE IV :Satellite Communication
2	7	PE IV	PC	22ET712	PE IV : Error Control Coding
3	7	PE IV	PC	22ET713	PE IV : Switching Theory
4	7	PE IV	PC	22ET714	PE IV : Pattern Recognition
5	7	PE IV	PC	22ET715	PE IV : VLSI CAD Mixed Signal Design
6	7	PE IV	PC	22ET716	PE IV: Advanced Embedded System Design

Professional Electives -V

1	7	PE V	PC	22ET731	PE V : Wireless Sensor Networks
2	7	PE V	PC	22ET732	PE V : Virtual & Augmented Reality
3	7	PE V	PC	22ET733	PE V : Low Power VLSI
4	7	PE V	PC	22ET734	PE V : Biomedical Electronics
5	7	PE V	PC	22ET735	PE V :Data Compression and Encryption
6	7	PE V	PC	22ET736	PE V: RADAR Engineering

Professional Electives -VI

1	7	PE VI	PC	22ET751	PE VI : 5G Communications
2	7	PE VI	PC	22ET752	PE VI : Speech Processing
3	7	PE VI	PC	22ET753	PE VI : Deep Learning
4	7	PE VI	PC	22ET754	PE VI : Industrial Automation
5	7	PE VI	PC	22ET755	PE VI : Nano Electronics
6	7	PE VI	PC	22ET756	PE VI : Adhoc Networks

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(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics & Telecommunication Engineering)

B. Tech in Electronics & Telecommunication Engineering

SoE No. 22ET-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester															
1	8	STR		22ET801	Internship - training / Seminar & Report	**P**	0	0	12	12	3		60	40	
2	8	ER		22ET802	Extracurricular Activity Evaluation	**P**	0	0	0	0	2		100		
TOTAL EIGHTH SEM							**0**	**0**	**12**	**12**	**5**				
GRAND TOTAL							**124**	**5**	**76**	**204**	**166**				

		June 2022	**1.00**	**Applicable for AY 2022-23 Onwards**
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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

B. Tech in Computer Technology

SoE No. 22CT-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER															
1	1	BS	GE/MTH	22CT101	Calculus Sequences and Series	T	3	1	0	4	4	30	20	50	3 Hrs
2	1	BS	GE/CHE	22CT102	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3 Hrs
3	1	BS	GE/CHE	22CT103	Lab: Engineering Chemistry	P	0	0	2	2	1		60	40	
4	1	HS	GE/HUM	22CT104	Professional Communication	T	3	0	0	3	3	30	20	50	3 Hrs
5	1	BES	CV/CV	22CT105	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3 Hrs
6	1	BES	CV/CV	22CT106	Lab: Engineering Mechanics	P	0	0	2	2	1		60	40	
7	1	BES	EE/EE	22CT107	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3 Hrs
8	1	BES	IT/IT	22CT108	Programming for Problem Solving	T	3	0	0	3	3	30	20	50	3 Hrs
9	1	BES	IT/IT	22CT109	Lab: Programming for Problem Solving	P	0	0	2	2	1		60	40	
					TOTAL		**18**	**1**	**6**	**25**	**22**				
List of Mandatory Learning Course (MLC)															
1	1	HS	GE/HUM	GE2131	Universal Human Value	**A**	2	0	0	2	0				
2	1	HS	GE/T&P	MLC2121	YCAP1-Get Set Go	**A**	2	0	0	2	0				

SECOND SEMESTER															
1	2	BS	GE/MTH	22CT201	Differential Equation and Complex Analysis	T	3	1	0	4	4	30	20	50	3 Hrs
2	2	BS	GE/PHY	22CT202	Engineering Physics	T	3	0	0	3	3	30	20	50	3 Hrs
3	2	BS	GE/PHY	22CT203	Lab: Engineering Physics	P	0	0	2	2	1		60	40	
4	2	HS	GE/HUM	22CT204	Social Science	T	3	0	0	3	3	30	20	50	3 Hrs
5	2	BES	ME/ME	22CT205	Engineering Graphics	T	1	0	0	1	1	30	20	50	3 Hrs
6	2	BES	ME/ME	22CT206	Lab: Engineering Graphics	P	0	0	4	4	2		60	40	
7	2	BES	CT/CT	22CT207	Elements of AIML	T	3	0	0	3	3	30	20	50	3 Hrs
8	2	BES	CT/CT	22CT208	Computer Workshop	P	0	0	2	2	1		60	40	
9	2	BES	CT/CT	22CT209	Data Structures	T	3	0	0	3	3	30	20	50	3 Hrs
10	2	BES	CT/CT	22CT210	Lab: Data Structures	P	0	0	2	2	1		60	40	
					TOTAL		**16**	**1**	**10**	**27**	**22**				
List of Mandatory Learning Course (MLC)															
1	2	HS	GE/T&P	MLC2122	YCAP2 -Functional English	**A**	2	0	0	2	0				
2	2	BES	GE/CHE	GE2132	Environmental Science	**A**	2	0	0	2	0				

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TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

B. Tech in Computer Technology

SoE No. 22CT-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	PC	CT	22CT301	Discrete Maths and Probability Theory	T	3	1	0	4	4	30	20	50	3 Hrs
2	3	PC	CT	22CT302	Computer Architecture and Organisation	T	3	0	0	3	3	30	20	50	3 Hrs
3	3	PC	CT	22CT303	Database Management Systems	T	3	0	0	3	3	30	20	50	3 Hrs
4	3	PC	CT	22CT304	**Lab:** Database Management Systems	P	0	0	2	2	1		60	40	
5	3	PC	CT	22CT305	Object Oriented Programming	T	3	1	0	4	4	30	20	50	3 Hrs
6	3	PC	CT	22CT306	**Lab:** Object Oriented Programming	P	0	0	2	2	1		60	40	
7	3	PC	CT	22CT307	**Lab:** Python Programming	P	0	0	4	4	2		60	40	
8	3	PC	CT	22CT308	Ethics in Engineering Practice/Professional Ethics	T	1	0	0	1	1	30	20	50	3 Hrs
9	3	PC	CT	22CT309	**Lab:** Technical Writing	P	0	0	2	2	1		60	40	
					TOTAL THIRD SEM		**13**	**2**	**10**	**25**	**20**				
List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
2	3	BES	CT	MLC111	Document Presentation and Computation	**A**	2	0	0	2	0				
Fourth Semester															
1	4	BS	GE	22CT401	Linear Algebra	T	3	0	0	3	3	30	20	50	3 Hrs
2	4	GE	GE/HUM	22CT402	Fundamentals of Management and Economics	T	3	0	0	3	3	30	20	50	3 Hrs
3	4	PC	CT	22CT403	Operating Systems	T	3	0	0	3	3	30	20	50	3 Hrs
4	4	PC	CT	22CT404	**Lab:** Operating Systems	P	0	0	2	2	1		60	40	
5	4	PC	CT	22CT405	Theoritical Foundations of Computer Science	T	3	1	0	3	3	30	20	50	3 Hrs
6	4	PC	CT	22CT406	Mathematical Foundations for Data Analysis	T	3	0	0	3	3	30	20	50	3 Hrs
7	4	PC	CT	22CT407	**Lab:** Mathematical Foundations for Data Analysis	P	0	0	2	2	1		60	40	
8	4	PC	CT	22CT408	Computer Networks	T	3	0	0	3	3	30	20	50	3 Hrs
9	4	PC	CT	22CT409	**Lab:** Computer Networks	P	0	0	2	2	1		60	40	
10	4	PC	CT	22CT410	**Lab:** Web Technology	P	0	0	4	4	2		60	40	
11	4	PC	CV/CT	22CT411	Environmental Sustainability, Pollution and Management	**T**	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL FOURTH SEM		**21**	**1**	**10**	**31**	**26**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC124	YCCE Communication Aptitude Prepartion (YCAP 4)	**A**	3	0	0	3	0				
2	4	BES	CT	MLC112	Data Visualization	**A**	2	0	0	2	0				

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TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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SoE No. 22CT-101

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(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

B. Tech in Computer Technology

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester															
1	5	PC	CT	22CT501	Design & Analysis of Algorithms	T	3	0	0	3	3	30	20	50	3 Hrs
2	5	PC	CT	22CT502	**Lab:** Design & Analysis of Algorithms	P	0	0	2	2	1		60	40	
3	5	PC	CT	22CT503	Language Processor	T	3	0	0	3	3	30	20	50	3 Hrs
4	5	PC	CT	22CT504	**Lab:** Language Processor	P	0	0	2	2	1		60	40	
5	5	PC	CT	22CT505	Software Engineering	T	3	0	0	3	3	30	20	50	3 Hrs
6	5	PC	CT	22CT506	**Lab:** Software Engineering	P	0	0	2	2	1		60	40	
7	5	PC	CT	22CT507	Network Security	T	3	0	3	3	3	30	20	50	3 Hrs
8	5	PE	CT		**Lab: Professional Elective-I**	P	0	0	2	2	1		60	40	
9	5	STR	CT	22CT508	Internship 1	P	0	0	1	1	1		60	40	
10	5	OE	CT		**Open Elective - I**	T	3	0	0	3	3	30	20	50	3 Hrs
11	5	OE	CT		**Open Elective - II**	T	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL FOURTH SEM		**18**	**0**	**12**	**27**	**23**				

List of Lab. Professional Electives-I *

1	5	PE-I	PC	22CT511	PE I: Lab: Mobile Operating System
2	5	PE-I	PC	22CT512	PE I: Lab: Introduction to Geographical Information System
3	5	PE-I	PC	22CT513	PE I: Lab: Advanced Web Technologies
4	5	PE-I	PC	22CT514	PE I: Lab: Computing Laboratory
5	5	PE-I	PC	22CT515	PE I: Lab: Parallel Programming
6	5	PE-I	PC	22CT516	PEI: Lab : UI/UX Design

Open Elective-I

1	5	OE-I	PC	22CT531	OE-I : Introduction to DBMS
2	5	OE-I	PC	22CT532	OE-I : Essentials of IT
3	5	OE-I	PC	22CT533	OE-I : Operating System Concepts
4	5	OE-I	PC	22CT534	OE-I : Introduction to Salesforce

Open Elective-II

1	5	OE-II	PC	22CT551	OE-II : Software Testing
2	5	OE-II	PC	22CT552	OE-II : Internet Technology
3	5	OE-II	PC	22CT553	OE-II : Multimedia and Animation
4	5	OE-II	PC	22CT554	OE-II : Current Trends and Technologies

List of Mandatory Learning Course (MLC)

1	5	HS		MLC125	**YCAP5 :**	A	3	0	0	3	0	
2	5	HS			Design thinking	A	2	0	0	2	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes & TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.00
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. 22CT-101

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

B. Tech in Computer Technology

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester															
1	6	PC	CT	22CT601	Artificial Intelligence	T	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	CT	22CT602	**Lab:** Artificial Intelligence	P	0	0	2	2	1		60	40	
3	6	PC	CT	22CT603	Digital Image Processing	T	3	0	0	3	3	30	20	50	3 Hours
4	6	PC	CT	22CT604	**Lab:** Digital Image Processing	P	0	0	2	2	1		60	40	
5	6	PC	CT	22CT605	Distributed Systems and Cloud Computing	T	3	0	0	3	3	30	20	50	3 Hours
6	6	PC	CT	22CT606	**Lab:** Distributed Systems and Cloud Computing	P	0	0	2	2	1		60	40	
7	6	PE	CT		**Professional Elective-II**	T	3	0	0	3	3	30	20	50	3 Hours
8	6	PE	CT		**Lab: Professional Elective-II**	P	0	0	2	2	1		60	40	
9	6	PR	CT	22CT607	Project Phase I	P	0	0	4	4	2		60	40	
10	6	OE	CT		**Open Elective - III**	T	3	0	0	3	3	30	20	50	3 Hours
11	6	OE	CT		**Open Elective - IV**	T	3	0	0	3	3	30	20	50	3 Hours
					TOTAL SIXTH SEM		**18**	**0**	**12**	**30**	**24**				

List of Professional Electives- II

Professional Electives-II

1	6	PE-II	CT	22CT611	PE II: Software Testing
	6	PE-II	CT	22CT612	PE II: **Lab**: Software Testing
2	6	PE-II	CT	22CT613	PE II: Internet of Things
	6	PE-II	CT	22CT614	PE II: **Lab**: Internet of Things
3	6	PE-II	CT	22CT615	PE II: Business Intelligence
	6	PE-II	CT	22CT616	PE II: **Lab**: Business Intelligence

Open Elective-III

1	6	OE-III	CT	22CT631	OE-III : Introduction to DBMS
2	6	OE-III	CT	22CT632	OE-III : Essentials of IT
3	6	OE-III	CT	22CT633	OE-III : Operating System Concepts
4	6	OE-III	CT	22CT634	OE-III : Introduction to Salesforce

Open Elective-IV

1	6	OE-IV	CT	22CT651	OE-II : Software Testing
2	6	OE-IV	CT	22CT652	OE-II : Internet Technology
3	6	OE-IV	CT	22CT653	OE-II : Multimedia and Animation
4	6	OE-IV	CT	22CT654	OE-II : Current Trends and Technologies

List of Mandatory Learning Course (MLC)

1	6	HS		MLC126	**YCAP6:**	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

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TA = for Practical : MSPA will be 15 marks each**

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(Department of Computer Technology)

B. Tech in Computer Technology

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester															
1	7	PC	CT	22CT701	Operation Research and Optimization	T	3	1	0	4	4	30	20	50	3 Hours
2	7	PE	CT		**Professional Elective-III**	T	3	0	0	3	3		60	40	
3	7	PE	CT		**Professional Elective-IV**	T	3	0	0	3	3	30	20	50	3 Hours
4	7	PE	CT		**Lab: Professional Elective-IV**	P	0	0	2	2	1	30	20	50	3 Hours
5	7	PE	CT		**Professional Elective-V**	T	3	0	0	3	3	30	20	50	3 Hours
6	7	PR	CT	22CT702	Project Phase-II	**P**	0	0	10	10	5		60	40	
7	7	STR	CT	22CT703	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL SEVENTH SEM		**12**	**1**	**12**	**25**	**21**				

List of Professional Electives-III,IV & V

Professional Electives -III

1	7	PE-III	CT	22CT721	PE III: Neural Network & Fuzzy Logic
2	7	PE-III	CT	22CT722	PE III: Adhoc Wireless Network
3	7	PE-III	CT	22CT723	PE III: Information Retrival System
4	7	PE-III	CT	22CT724	PE III: Data Mining
5	7	PE-III	CT	22CT725	PE III: Graph Theory and Mining

Professional Electives -IV

1	7	PE-IV	CT	22CT741	PE IV: Cyber Forensic
2	7	PE-IV	CT	22CT742	PE IV: Lab: Cyber Forensic
3	7	PE-IV	CT	22CT743	PE IV: Machine Learning
4	7	PE-IV	CT	22CT744	PE IV: Lab: Machine Learning
5	7	PE-IV	CT	22CT745	PE IV: Design Patterns
6	7	PE-IV	CT	22CT746	PE IV: Lab: Design Patterns
7	7	PE-IV	CT	22CT747	PE IV: Customer Relationship Management
8	7	PE-IV	CT	22CT748	PE IV: Lab: Customer Relationship Management

Professional Electives -V

1	7	PE-V	CT	22CT761	PE V: Introduction to Natural Language Processing
2	7	PE-V	CT	22CT762	PE V: Embedded Systems
3	7	PE-V	CT	22CT763	PE V: Computer Vision
4	7	PE-V	CT	22CT764	PE V: Bioinformatics
5	7	PE-V	CT	22CT765	PE V: Cyber Physical Systems

Eighth Semester															
1	**8**	**STR**		22CT801	Internship - training / Seminar & Report	P	0	0	12	12	3		50	50	
2	**8**	**STR**		22CT802	Extra Curricular Activity Evaluation	P	0	0	0	0	2		100		
					TOTAL EIGHTH SEM		**0**	**0**	**12**	**12**	**5**				
					GRAND TOTAL		**116**	**6**	**84**	**202**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2022

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(Department of Information Technology)

B. Tech in Information Technology

SoE No. 22IT-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER															
1	1	BS	GE/MTH	22IT101	Calculus Sequences and Series	T	3	1	0	4	4	30	20	50	3 Hrs
2	1	BS	GE/CHE	22IT102	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3 Hrs
3	1	BS	GE/CHE	22IT103	Lab: Engineering Chemistry	P	0	0	2	2	1		60	40	
4	1	HS	GE/HUM	22IT104	Professional Communication	T	3	0	0	3	3	30	20	50	3 Hrs
5	1	BES	CV/CV	22IT105	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3 Hrs
6	1	BES	CV/CV	22IT106	Lab: Engineering Mechanics	P	0	0	2	2	1		60	40	
7	1	BES	EE/EE	22IT107	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3 Hrs
8	1	BES	IT/IT	22IT108	Programming for Problem Solving	T	3	0	0	3	3	30	20	50	3 Hrs
9	1	BES	IT/IT	22IT109	Lab: Programming for Problem Solving	P	0	0	2	2	1		60	40	
						TOTAL	**18**	**1**	**6**	**25**	**22**				
List of Mandatory Learning Course (MLC)															
1	1	HS	GE/HUM	GE2131	Universal Human Value	**A**	2	0	0	2	0				
2	1	HS	GE/T&P	MLC2121	YCAP1-Get Set Go	**A**	2	0	0	2	0				
SECOND SEMESTER															
1	2	BS	GE/MTH	22IT201	Differential Equation & Complex Analysis	T	3	1	0	4	4	30	20	50	3 Hrs
2	2	BS	GE/PHY	22IT202	Engineering Physics	T	3	0	0	3	3	30	20	50	3 Hrs
3	2	BS	GE/PHY	22IT203	Lab: Engineering Physics	P	0	0	2	2	1		60	40	
4	2	HS	GE/HUM	22IT204	Social Science	T	3	0	0	3	3	30	20	50	3 Hrs
5	2	BES	ME/ME	22IT205	Engineering Graphics	T	1	0	0	1	1	30	20	50	3 Hrs
6	2	BES	ME/ME	22IT206	Lab: Engineering Graphics	P	0	0	4	4	2		60	40	
7	2	BES	IT/IT	22IT207	Elements of AIML	T	3	0	0	3	3	30	20	50	3 Hrs
8	2	BES	IT/IT	22IT208	Computer Workshop	P	0	0	2	2	1		60	40	
9	2	BES	IT/IT	22IT209	Basics of Python Programming	T	3	0	0	3	3	30	20	50	3 Hrs
10	2	BES	IT/IT	22IT210	Lab: Basics of Python Programming	P	0	0	2	2	1		60	40	
						TOTAL	**16**	**1**	**10**	**27**	**22**				
List of Mandatory Learning Course (MLC)															
1	2	HS	GE/T&P	MLC2122	YCAP2 -Functional English	**A**	2	0	0	2	0				
2	2	BES	GE/CHE	GE2132	Environmental Science	**A**	2	0	0	2	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

B. Tech in Information Technology

SoE No. 22IT-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS	GE	22IT301	Linear Algebra	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	3	PC	IT	22IT302	Data Structure and Program Design-I	**T**	3	0	0	3	3	30	20	50	3 Hrs
3	3	PC	IT	22IT303	**Lab:** Data Structures and Program Design-I	P	0	0	2	2	1		60	40	
4	3	PC	IT	22IT304	Computer Architecture and Organization	**T**	3	0	0	3	3	30	20	50	3 Hrs
5	3	PC	IT	22IT305	Computer Networks	**T**	3	1	0	3	3	30	20	50	3 Hrs
6	3	PC	IT	22IT306	**Lab:** Computer Networks	p	0	0	2	2	1		60	40	
7	3	PC	IT	22IT307	Digital Circuits and Microprocessors	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	3	PC	IT	22IT308	**Lab:** Digital Circuits and Microprocessors	p	0	0	2	2	1		60	40	
9	3	PC	IT	22IT309	**Lab:** IT Workshop (Web. Programming*)	p	0	0	2	2	1		60	40	
					TOTAL THIRD SEM		**15**	**1**	**8**	**23**	**19**				
List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
2	3	BES	IT	MLC113	Technical Documentation	**A**	2	0	0	2	0				
Fourth Semester															
1	4	PC	IT	22IT401	Discrete Mathematics and Graph Theory	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	4	PC	GE/HUM	22IT402	Fundamentals of Management and Economics	**T**	3	0	0	3	3	30	20	50	3 Hrs
3	4	PC	IT	22IT403	Data Structure and Program Design-II	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	4	PC	IT	22IT404	**Lab:** Data Structures and Program Design-II	p	0	0	2	2	1		60	40	
5	4	PC	IT	22IT405	Formal Language and Automata Theory	**T**	3	0	0	3	3	30	20	50	3 Hrs
6	4	PC	IT	22IT406	Operating System	**T**	3	1	0	3	3	30	20	50	3 Hrs
7	4	PC	IT	22IT407	**Lab:** Operating System	p	0	0	2	2	1		60	40	
8	4	PC	IT	22IT408	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3 Hrs
9	4	PC	IT	22IT409	**Lab:** Object Oriented Programming	p	0	0	2	2	1		60	40	
10	4	PC	CV/IT	22IT410	Environmental Sustainability, Pollution and Management	**T**	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL FOURTH SEM		**21**	**1**	**6**	**27**	**24**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC124	YCCE Communication Aptitude Prepartion (YCAP 4)	**A**	3	0	0	3	0				
2	4	BES	IT	MLC114	Cyber Laws	**A**	2	0	0	2	0				

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TA = for Practical : MSPA will be 15 marks each**

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(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

B. Tech in Information Technology

SoE No. 22IT-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester															
1	5	PC	IT	22IT501	Database and Information System	**T**	3	0	0	3	4	30	20	50	3 Hrs
2	5	PC	IT	22IT502	**Lab.:** Database and Information System	p	0	0	2	2	1		60	40	
3	5	PC	IT	22IT503	Design & Analysis of Algorithm	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	5	PC	IT	22IT504	**Lab.:**Design & Analysis of Algorithm	p	0	0	2	2	1		60	40	
5	5	PC	IT	22IT505	Software Engineering	**T**	3	0	0	3	3	30	20	50	3 Hrs
6	5	PE-I	IT		**Professional Elective -1**	**T**	3	0	0	3	3	30	20	50	3 Hrs
7	5	PE-I	IT		**Lab: Professional Elective -1**	P	0	0	2	2	1		60	40	
8	5	STR	IT	22IT506	Industrial training, Seminar & Report	P	0	0	1	1	1		60	40	
9	5	OE-I	IT		**Open Elective - I**	**T**	3	0	0	3	3	30	20	50	3 Hrs
10	5	OE-II	IT		**Open Elective - II**	**T**	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL FOURTH SEM		**18**	**0**	**7**	**25**	**23**				

List of Lab. Professional Electives-I *

1	5	PE-I	PC	22IT511	Network Security & Cryptography
2	5	PE-I	PC	22IT512	**Lab.:** Network Security & Cryptography
3	5	PE-I	PC	22IT513	Data Science
4	5	PE-I	PC	22IT514	**Lab.:** Data Science
5	5	PE-I	PC	22IT515	Digital Image Processing
6	5	PE-I	PC	22IT516	**Lab.:** Digital Image Processing
7	5	PE-I	PC	22IT517	Customer Relationshiop Management
8	5	PE-I	PC	22IT518	**Lab.:** Customer Relationshiop Management

Open Elective-I

1	5	OE-I	PC	22IT531	Industry 5.0
2	5	OE-I	PC	22IT532	Core Java
3	5	OE-I	PC	22IT533	Introduction to Data Science

Open Elective-II

1	5	OE-II	PC	22IT551	Introduction to Machine Learning
2	5	OE-II	PC	22IT552	Network security and cryptography
3	5	OE-II	PC	22IT553	Concepts in Web Programming

List of Mandatory Learning Course (MLC)												
1	5	HS		MLC125	**YCAP5 :**	A	3	0	0	3	0	
2	5	HS			Design thinking	A	2	0	0	2	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes & TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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							L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester															
1	6	PC	IT	22IT601	Machine Learning	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	6	PC	IT	22IT602	**Lab.:** Machine Learning	p	0	0	2	2	1		60	40	
3	6	PC	IT	22IT603	Principles of Compiler Design	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	6	PC	IT	22IT604	**Lab.:** Principles of Compiler Design	p	0	0	2	2	1		60	40	
5	6	PE-II	IT		**Professional Electives -II**	**T**	3	0	0	3	3	30	20	50	3 Hrs
6	6	PE-III	IT		**Professional Electives -III**	**T**	3	0	0	3	3	30	20	50	3 Hrs
7	6	PE-III	IT		**Lab.:Professional Electives -III**	p	0	0	2	2	1		60	40	
8	6	PR	IT	22IT605	Project Phase I	P	0	0	4	4	2		60	40	
9	6	OE-I	IT		**Open Elective - III**	**T**	3	0	0	3	3	30	20	50	3 Hrs
10	6	OE-II	IT		**Open Elective - IV**	**T**	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL SIXTH SEM		**18**	**0**	**10**	**28**	**23**				

List of Professional Electives- II & III

Professional Electives-II

1	6	PE-II	IT	22IT611	Cloud Computing
2	6	PE-II	IT	22IT612	Real Time Systems
3	6	PE-II	IT	22IT613	Mobile Communication
4	6	PE-II	IT	22IT614	UX and UI Design

Professional Electives-III

1	6	PE-III	IT	22IT631	Blockchain Technology
2	6	PE-III	IT	22IT632	**Lab.:** Blockchain Technology
3	6	PE-III	IT	22IT633	Business Intellegience
4	6	PE-III	IT	22IT634	**Lab.:** Business Intellegience
5	6	PE-III	IT	22IT635	Internet of Things
6	6	PE-III	IT	22IT636	**Lab.:** Internet of Things
7	6	PE-III	IT	22IT637	Mobile Operating Systems
8	6	PE-III	IT	22IT638	**Lab.:** Mobile Operating Systems

Open Elective-III

1	6	OE-III	IT	22IT651	Industry 5.0
2	6	OE-III	IT	22IT652	Core Java
3	6	OE-III	IT	22IT653	Introduction to Data Science

Open Elective-IV

1	6	OE-IV	IT	22IT671	Introduction to Machine Learning
2	6	OE-IV	IT	22IT672	Network security and cryptography
3	6	OE-IV	IT	22IT673	Concepts in Web Programming

List of Mandatory Learning Course (MLC)

1	6	HS		MLC126	**YCAP6:** YCCE Communication Aptitude Preparation	**A**	3	0	0	3	0

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TA* = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activities decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA** = for Practical : MSPA will be 15 marks each

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B. Tech in Information Technology

SoE No. 22IT-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester															
1	7	PC	IT	22IT701	Data Mining	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	7	PC	IT	22IT702	**Lab:** Data Mining	P	0	0	2	2	1		60	40	
3	7	PC	IT	22IT703	Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	7	PC	IT	22IT704	**Lab:** Artificial Intelligence	P	0	0	2	2	1		60	40	
5	7	PE-IV	IT		**Professional Electives -IV**	**T**	3	0	0	3	3	30	20	50	3 Hrs
6	7	PE-V	IT		**Lab: Professional Electives -IV**	P	0	0	2	2	1		60	40	
7	7	PE-V	IT		**Professional Electives -V**	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	7	PE- VI	IT		**Professional Electives -VI**	**T**	3	0	0	3	3	30	20	50	3 Hrs
9	7	PR	IT	22IT705	Project Phase-II	**P**	0	0	10	10	5		60	40	
10	7	STR	IT	22IT706	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL SEVENTH SEM		**15**	**0**	**16**	**31**	**25**				

List of Professional Electives-IV,V & VI

Professional Electives -IV

1	7	PE-IV	IT	22IT721	Parallel Computing
2	7	PE-IV	IT	22IT722	**Lab.:** Parallel Computing
3	7	PE-IV	IT	22IT723	Neural Network and Fuzzy Logic
4	7	PE-IV	IT	22IT724	**Lab.:** Neural Network and Fuzzy Logic
5	7	PE-IV	IT	22IT725	Big Data Analytics
6	7	PE-IV	IT	22IT726	**Lab.:** Big Data Analytics
7	7	PE-IV	IT	22IT727	Deep Learning
8	7	PE-IV	IT	22IT728	**Lab.:** Deep Learning

Professional Electives -V

1	7	PE-V	IT	22IT741	Information Retrival
2	7	PE-V	IT	22IT742	Basics of Bioinformatics
3	7	PE-V	IT	22IT743	Ethical Hacking and Cyber Forensic
4	7	PE-V	IT	22IT744	E-Commerce
5	7	PE-V	IT	22IT745	Advanced Computer Architecture

Professional Electives -VI

1	7	PE-VI	IT	22IT761	Wireless Sensor Network
2	7	PE-VI	IT	22IT762	Natural Language Processing
3	7	PE-VI	IT	22IT763	Computer Vision
4	7	PE-VI	IT	22IT764	Distributed Systems

Eighth Semester															
1	**8**	**STR**		22CT801	Internship - training / Seminar & Report	P	0	0	12	12	3		50	50	
2	**8**	**STR**		22CT802	Extra Curricular Activity Evaluation	P	0	0	0	0	2		100		
					TOTAL EIGHTH SEM		**0**	**0**	**12**	**12**	**5**				
					GRAND TOTAL		**121**	**4**	**75**	**198**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.00**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Science & Engineering)

B. Tech in Computer Science & Engineering)

SoE No. 22CSE-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER															
1	1	BS	GE/MTH	22CSE101	Differential Equation and Complex Analysis	T	3	1	0	4	4	30	20	50	3 Hrs
2	1	BS	GE/PHY	22CSE102	Engineering Physics	T	3	0	0	3	3	30	20	50	3 Hrs
3	1	BS	GE/PHY	22CSE103	Lab: Engineering Physics	P	0	0	2	2	1		60	40	
4	1	HS	GE/HUM	22CSE104	Social Science	T	3	0	0	3	3	30	20	50	3 Hrs
5	1	BES	ME/ME	22CSE105	Engineering Graphics	T	1	0	0	1	1	30	20	50	3 Hrs
6	1	BES	ME/ME	22CSE106	Lab: Engineering Graphics	P	0	0	4	4	2		60	40	
7	1	BES	CT/CT	22CSE107	Elements of AIML	T	3	0	0	3	3	30	20	50	3 Hrs
8	1	BES	CT/CT	22CSE108	Computer Workshop	P	0	0	2	2	1		60	40	
9	1	BES	CSE/CSE	22CSE109	Introduction to Computing with Python	T	3	0	0	3	3	30	20	50	3 Hrs
10	1	BES	CSE/CSE	22CSE110	Lab: Introduction to Computing with Python	P	0	0	2	2	1		60	40	
						TOTAL	**16**	**1**	**10**	**27**	**22**				
List of Mandatory Learning Course (MLC)															
1	1	HS	GE/T&P	MLC2121	YCAP1-Get Set Go	**A**	2	0	0	2	0				
2	1	BES	GE/CHE	GE2132	Environmental Science	**A**	2	0	0	2	0				
SECOND SEMESTER															
1	2	BS	GE/MTH	22CSE201	Calculus Sequences and Series	T	3	1	0	4	4	30	20	50	3 Hrs
2	2	BS	GE/CHE	22CSE202	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3 Hrs
3	2	BS	GE/CHE	22CSE203	Lab: Engineering Chemistry	P	0	0	2	2	1		60	40	
4	2	HS	GE/HUM	22CSE204	Professional Communication	T	3	0	0	3	3	30	20	50	3 Hrs
5	2	BES	CV/CV	22CSE205	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3 Hrs
6	2	BES	CV/CV	22CSE206	Lab: Engineering Mechanics	P	0	0	2	2	1		60	40	
7	2	BES	EE/EE	22CSE207	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3 Hrs
8	2	BES	IT/IT	22CSE208	Programming for Problem Solving	T	3	0	0	3	3	30	20	50	3 Hrs
9	2	BES	IT/IT	22CSE209	Lab: Programming for Problem Solving	P	0	0	2	2	1		60	40	
						TOTAL	**18**	**1**	**6**	**25**	**22**				
List of Mandatory Learning Course (MLC)															
1	2	HS	GE/HUM	GE2131	Universal Human Value	**A**	2	0	0	2	0				
2	2	HS	GE/T&P	MLC2122	YCAP2 -Functional English	**A**	2	0	0	2	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

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TA = for Practical : MSPA will be 15 marks each**

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(Department of Computer Science & Engineering)

B. Tech in Computer Science & Engineering)

SoE No. 22CSE-101

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							L	T	P	Hrs		MSEs*	TA**	ESE	
THIRD SEMESTER															
1	3	PC	CSE/CSE	22CSE301	Discrete Mathematics & Graph Theory	**T**	3	1	0	4	4	30	20	50	3 Hrs
2	3	PC	CSE/CSE	22CSE302	Computer Architecture and Organisation	**T**	3	0	0	3	3	30	20	50	3 Hrs
3	3	PC	CSE/CSE	22CSE303	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	3	PC	CSE/CSE	22CSE304	Lab: Object Oriented Programming	**P**	0	0	2	2	1		60	40	
5	3	PC	CSE/CSE	22CSE305	Data Structures I	**T**	3	0	0	3	3	30	20	50	3 Hrs
6	3	PC	CSE/CSE	22CSE306	Lab: Data Structures I	**P**	0	0	2	2	1		60	40	
7	3	PC	CSE/CSE	22CSE307	Web Technology	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	3	PC	CSE/CSE	22CSE308	Lab: Web Technology	**P**	0	0	2	2	1		60	40	
						TOTAL	**15**	**1**	**6**	**22**	**19**				
List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
2	3	BSE	CSE	MLC115	Latex	**A**	2	0	0	2	0				
FOURTH SEMESTER															
1	4	BS	GE/GE	22CSE401	Linear Algebra	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	4	HS	GE/HUM	22CSE402	Fundamentals of Management and Economics	T	3	0	0	3	3	30	20	50	3 Hrs
3	4	PC	CSE/CSE	22CSE403	Theory of Computation	T	3	1	0	4	4	30	20	50	3 Hrs
4	4	PC	CSE/CSE	22CSE404	Operating Systems	**T**	3	0	0	3	3	30	20	50	3 Hrs
5	4	PC	CSE/CSE	22CSE405	Lab:Operating Systems	**P**	0	0	2	2	1		60	40	
6	4	PC	CSE/CSE	22CSE406	Data Structures II	**T**	3	0	0	3	3	30	20	50	3 Hrs
7	4	PC	CSE/CSE	22CSE407	Lab: Data Structures II	**P**	0	0	2	2	1		60	40	
8	4	PC	CSE/CSE	22CSE408	Introduction to Data Analysis	**T**	3	0	0	3	3	30	20	50	3 Hrs
9	4	PC	CSE/CSE	22CSE409	Lab: Introduction to Data Analysis	**P**	0	0	2	2	1		60	40	
10	4	PC	CV/CSE	22CSE410	Environmental Sustainability, Pollution and Management	**T**	3	0	0	3	3	30	20	50	3 Hrs
						TOTAL	**21**	**1**	**6**	**28**	**25**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC2124	YCCE Communication Aptitude Prepartion (YCAP 4)	**A**	3	0	0	3	0				
2	4	BSE	CSE	MLC116	Ethics in IT	**A**	2	0	0	2	0				

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(Department of Computer Science & Engineering)

B. Tech in Computer Science & Engineering)

SoE No. 22CSE-101

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							L	T	P	Hrs		MSEs*	TA**	ESE	
FIFTH SEMESTER															
1	5	PC	CSE/CSE	22CSE501	Computer Networks	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	5	PC	CSE/CSE	22CSE502	Lab: Computer Networks	**P**	0	0	2	2	1		60	40	
3	5	PC	CSE/CSE	22CSE503	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	5	PC	CSE/CSE	22CSE504	Lab: Database Management Systems	**P**	0	0	2	2	1		60	40	
5	5	PC	CSE/CSE	22CSE505	Design & Analysis of Algorithms	**T**	3	1	0	4	4	30	20	50	3 Hrs
6	5	PC	CSE/CSE	22CSE506	Lab: Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
7	5	PE	CSE/CSE		**Professional Elective-I**	**T**	3	0	0	3	3	30	20	50	3 Hrs
8	5	PE	CSE/CSE		**Lab: Professional Elective-I**	**P**	0	0	2	2	1		60	40	
9	5	OE	CSE/CSE		**Open Elective - I**	**T**	3	0	0	3	3	30	20	50	3 Hrs
10	5	OE	CSE/CSE		**Open Elective - II**	**T**	3	0	0	3	3	30	20	50	3 Hrs
11	5	**STR**	CSE/CSE	22CSE507	**Industrial visit,Seminar & report**	**P**	**0**	**0**	**1**	**1**	**1**		60	40	
						TOTAL	**18**	**1**	**9**	**28**	**24**				

List of Professional Electives-I

1	5	PE-I	CSE/CSE	22CSE511	PE-I: Digital Image Processing
2	5	PE-I	CSE/CSE	22CSE512	PE-I: **Lab:** Digital Image Processing
3	5	PE-I	CSE/CSE	22CSE513	PE-I: Advanced Web Technologies
4	5	PE-I	CSE/CSE	22CSE514	PE-I: **Lab:** Advanced Web Technologies
5	5	PE-I	CSE/CSE	22CSE515	PE-I: Machine Learning
6	5	PE-I	CSE/CSE	22CSE516	PE-I: **Lab:** Machine learning
7	5	PE-I	CSE/CSE	22CSE517	PE-I: Mobile operating system
8	5	PE-I	CSE/CSE	22CSE518	PE-I: **Lab:** Mobile operating system

Open Elective-I

1	5	OE-I	CSE/CSE	22CSE531	OE I: Database System Essentials
2	5	OE-I	CSE/CSE	22CSE532	OE I: Operating System Essentials
3	5	OE-I	CSE/CSE	22CSE533	OE I: Programming with Python

Open Elective-II

1	5	OE-II	CSE/CSE	22CSE551	OE II: Software Testing for Beginners
2	5	OE-II	CSE/CSE	22CSE552	OE II: Introduction to Web Technology
3	5	OE-II	CSE/CSE	22CSE553	OE II: Introduction to Cloud Computing

List of Mandatory Learning Course (MLC)												
1	5	HS	T&P	MLC2125	YCAP5 :	**A**	3	0	0	3	0	
2	5	BSE			DESIGN THINKING	**A**	2	0	0	2	0	

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SoE No. 22CSE-101

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							L	T	P	Hrs		MSEs*	TA**	ESE	
SIXTH SEMESTER															
1	6	PC	CSE/CSE	22CSE601	Language Processor	**T**	3	0	0	4	4	30	20	50	3 Hrs
2	6	PC	CSE/CSE	22CSE602	Lab: Language Processor	**P**	0	0	2	2	1		60	40	
3	6	PC	CSE/CSE	22CSE603	Cloud Computing	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	6	PC	CSE/CSE	22CSE604	Software Engineering	**T**	3	0	0	3	3	30	20	50	3 Hrs
5	6	PC	CSE/CSE	22CSE605	Lab: Software Engineering	**P**	0	0	2	2	1		60	40	
6	6	PE	CSE/CSE		**Professional Elective-II**	**T**	3	0	0	3	3	30	20	50	3 Hrs
7	6	PE	CSE/CSE		**Lab: Professional Elective-II**	**P**	0	0	2	2	1		60	40	
8	6	OE	CSE/CSE		**Open Elective - III**	**T**	3	0	0	3	3	30	20	50	3 Hrs
9	6	OE	CSE/CSE		**Open Elective - IV**	**T**	3	0	0	3	3	30	20	50	3 Hrs
10	6	PR	CSE/CSE	22CSE606	PROJECT PHASE 1	**P**	0	0	4	4	2		60	40	
						TOTAL	**18**	**0**	**10**	**29**	**24**				

List of Professional Electives-II

1	6	PE-II	CSE/CSE	22CSE611	PE-II: Business Intelligence
2	6	PE-II	CSE/CSE	22CSE612	PE-II: **Lab:** Business Intelligence
3	6	PE-II	CSE/CSE	22CSE613	PE-II: Internet of Things
4	6	PE-II	CSE/CSE	22CSE614	PE-II: **Lab:** Internet of Things
5	6	PE-II	CSE/CSE	22CSE615	PE-II: Neural Network and applications
6	6	PE-II	CSE/CSE	22CSE616	PE-II: **Lab :** Neural Network and applications
7	6	PE-II	CSE/CSE	22CSE617	PE-II: Augmented and Virtual Reality
8	6	PE-II	CSE/CSE	22CSE618	PE-II: **Lab:** Augmented and Virtual Reality

Open Elective-III

1	6	OE-III	CSE/CSE	22CSE631	OE III: Database System Essentials
2	6	OE-III	CSE/CSE	22CSE632	OE III: Operating System Essentials
3	6	OE-III	CSE/CSE	22CSE633	OE III: Programming with Python

Open Elective-IV

1	6	OE-IV	CSE/CSE	22CSE651	OE IV: Software Testing for Beginners
2	6	OE-IV	CSE/CSE	22CSE652	OE IV: Introduction to Web Technology
3	6	OE-IV	CSE/CSE	22CSE653	OE IV: Introduction to Cloud Computing

List of Mandatory Learning Course (MLC)												
1	6	HS	T&P	MLC2126	YCAP6 :	**A**	3	0	0	3	0	

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							L	T	P	Hrs		MSEs*	TA**	ESE	
SEVENTH SEMESTER															
1	7	PC	CSE/CSE	22CSE701	Cryptography and Network Security	**T**	3	0	0	3	3	30	20	50	3 Hrs
2	7	PC	CSE/CSE	22CSE702	Lab: Cryptography and Network Security	**P**	0	0	2	2	1		60	40	
3	7	PC	CSE/CSE	22CSE703	Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3 Hrs
4	7	PC	CSE/CSE	22CSE704	Lab: Artificial Intelligence	**T**	0	0	2	2	1	30	20	50	3 Hrs
5	7	PE	CSE/CSE		**Professional Elective-III**	**T**	3	0	0	3	3	30	20	50	3 Hrs
6	7	PE	CSE/CSE		**Professional Elective-IV**	**T**	3	0	0	3	3	30	20	50	3 Hrs
7	7	PE	CSE/CSE		**Lab:Professional Elective-IV**	**P**	0	0	2	2	1		60	40	
8	7	PE	CSE/CSE		**Professional Elective-V**	**T**	3	0	0	3	3	30	20	50	3 Hrs
9	7	STR	CSE/CSE	22CSE705	Project Phase-II	**P**	0	0	10	10	5		60	40	
10	7	STR	CSE/CSE	22CSE706	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
						TOTAL	**15**	**0**	**16**	**31**	**25**				

List of Professional Electives-III

1	7	PE-III	CSE/CSE	22CSE711	PE-III : Advanced computer architecture
2	7	PE-III	CSE/CSE	22CSE712	PE-III : Adhoc Wireless Network
3	7	PE-III	CSE/CSE	22CSE713	PE-III : Big data Analytics
4	7	PE-III	CSE/CSE	22CSE714	PE-III : Deep learning

List of Professional Electives-IV

1	7	PE-IV	CSE/CSE	22CSE731	PE IV: Cyber Forensic (industry aligned)
2	7	PE-IV	CSE/CSE	22CSE732	**PE IV: Lab:** Cyber Forensic
3	7	PE-IV	CSE/CSE	22CSE733	PE IV: Natural Language Processing
4	7	PE-IV	CSE/CSE	22CSE734	PE IV: **Lab:** Natural Language Processing
5	7	PE-IV	CSE/CSE	22CSE735	PE IV: Parallel Programming
6	7	PE-IV	CSE/CSE	22CSE736	PE IV: **Lab:** Parallel Programming
7	7	PE-IV	CSE/CSE	22CSE737	PE IV: Data mining
8	7	PE-IV	CSE	22CSE738	PE IV: **Lab:** Data mining

List of Professional Electives-V

1	7	PE-V	CSE/CSE	22CSE751	PE V: Information Retrival System
2	7	PE-V	CSE/CSE	22CSE752	PE V: Distributed System
3	7	PE-V	CSE/CSE	22CSE753	PE V: Human Computer Interaction
4	7	PE-V	CSE/CSE	22CSE754	PE V: Real Time System

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TA = for Practical : MSPA will be 15 marks each**

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SoE No. 22CSE-101

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							L	T	P	Hrs		MSEs*	TA**	ESE	
Eighth Semester															
1	8	STR	CSE/CSE	22CSE801	Internship- Training Seminar & Report	P	0	0	12	12	3		60	40	
2	8	STR	CSE/CSE	22CSE802	Extra Curricular Activity Evaluation	P	0	0	0	0	2		100		
TOTAL EIGHTH SEM							**0**	**0**	**12**	**12**	**5**				
GRAND TOTAL							**121**	**5**	**75**	**202**	**166**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.00	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

B. Tech in CSE (IOT)

SoE No. 22CSIoT-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER															
1	1	BS	GE/MTH	22IOT101	Calculus	T	3	1	0	3	4	30	20	50	3 Hours
2	1	BS	GE/PHY	22IOT102	Semiconductor Physics	T	3	0	0	3	3	30	20	50	3 Hours
3	1	BS	GE/PHY	22IOT103	**Lab.:** Semiconductor Physics	P	0	0	2	2	1		60	40	
4	1	HS	GE/HUM	22IOT104	Social Science	T	3	0	0	3	3	30	20	50	3 Hours
5	1	BES	EE/EE	22IOT105	Basic Electronics Engineering	T	3	0	0	3	3	30	20	50	3 Hours
6	1	BES	EL/EL	22IOT106	Basic Electrical Engineering	T	3	0	0	3	3	30	20	50	3 Hours
7	1	BES	EL/EL	22IOT107	**Lab.:** Basic Electrical Engineering	P	0	0	2	2	1		60	40	
8	1	PC	EE/EE	22IOT108	Programming for problem solving	T	3	0	0	3	3	30	20	50	3 Hours
9	1	PC	EE/EE	22IOT109	**Lab.:** Programming for problem solving	P	0	0	2	2	1		60	40	
					TOTAL FIRST SEM		**18**	**1**	**6**	**24**	**22**				
List of Mandatory Learning Course (MLC)															
1	1	BES	GE/CHE	GE2132	Environmental Science	**A**	2	0	0	2	0				
2	1	HS	GE/T&P	MLC2121	YCAP1-Get Set Go	**A**	2	0	0	2	0				

SECOND SEMESTER															
1	2	BS	GE/MTH	22IOT201	Linear Algebra	T	3	1	0	3	4	30	20	50	3 Hours
2	2	BS	GE/CHE	22IOT202	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3 Hours
3	2	BS	GE/CHE	22IOT203	**Lab.:** Engineering Chemistry	P	0	0	2	2	1		60	40	
4	2	HS	GE/HUM	22IOT204	Professional Communication	T	3	0	0	3	3	30	20	50	3 Hours
5	2	BES	ME/ME	22IOT205	Engineering Graphics	T	1	0	0	1	1	30	20	50	3 Hours
6	2	BES	ME/ME	22IOT206	**Lab.:** Engineering Graphics	P	0	0	4	4	2		60	40	
7	2	PC	ME/ME	22IOT207	Fundamentals of Manufacturing Process	T	3	0	0	3	3	30	20	50	3 Hours
8	2	PC	ME/ME	22IOT208	**Lab.:** Fundamentals of Manufacturing Process	P	0	0	2	2	1		60	40	
9	2	PC	EE/EE	22IOT209	**Lab.:** Python Programming	P	0	0	2	2	1		60	40	
					TOTAL SECOND SEM		**13**	**1**	**10**	**23**	**19**				
List of Mandatory Learning Course (MLC)															
1	2	HS	GE/T&P	MLC2122	YCAP2 -Functional English	**A**	2	0	0	2	0				
2	2	HS	GE/HUM	GE2131	Universal Human Value	**A**	2	0	0	2	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.00
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

B. Tech in CSE (IOT)

SoE No. 22CSIoT-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS	GE/GE	22IoT301	Probability Theory and Sampling Theory	T	3	0	0	3	3	30	20	50	3 Hours
2	3	HS	GE/HUM	22IoT302	Fundamentals of Management and Economics	T	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	EE/EE	22IoT303	Digital Logic Design	T	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	EE/EE	22IoT304	**Lab. :** Digital Logic Design	P	0	0	2	2	1		60	40	
5	3	PC	EE/EE	22IoT305	Analog Circuits	T	3	0	0	3	3	30	20	50	3 Hours
6	3	PC	EE/EE	22IoT306	**Lab.:** Analog Circuits	P	0	0	2	2	1		60	40	
7	3	PC	EE/EE	22IoT307	Data Structures	T	3	0	0	3	3	30	20	50	3 Hours
8	3	PC	EE/EE	22IoT308	**Lab.:** Data Structures	P	0	0	2	2	1		60	40	
9	3	PC	EE/EE	22IoT309	Sensor and actuators	T	3	1	0	3	3	30	20	50	3 Hours
					TOTAL THIRD SEM		**18**	**1**	**6**	**24**	**21**				
List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
2	3	BES	IoT	MLC117	Arduino Programming	**A**	2	0	0	2	0				

Fourth Semester															
1	4	PC	EE/CT	22IoT401	Database Management System	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	EE/CT	22IoT402	**Lab.:** Database Management System	P	0	0	2	2	1		60	40	
3	4	PC	EE/CT	22IoT403	Object Oriented Programming using JAVA	**T**	3	0	0	3	3	30	20	50	3 Hours
4	4	PC	EE/CT	22IoT404	**Lab.:** Object Oriented Programming using JAVA	**P**	0	0	2	2	1		60	40	
5	4	PC	EE/ME	22IoT405	Mechatronics	T	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	EE/ME	22IoT406	**Lab.:** Mechatronics	P	0	0	2	2	1		60	40	
7	4	PC	EE/EE	22IoT407	Microcontroller & its Applications	T	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	EE/EE	22IoT408	**Lab.:** Microcontroller & its Applications	P	0	0	2	2	1		60	40	
9	4	PC	EE/EE	22IoT409	Computer Architecture Organization	T	3	0	0	3	3	30	20	50	3 Hours
10	4	PC	EE/EE	22IoT410	**Lab.:** Electronics Workshop	P	0	0	2	2	1		60	40	
11	4	PC	CV/EE	22IoT411	Environmental Sustainability, Pollution and Management	**T**	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL FOURTH SEM		**18**	**0**	**10**	**28**	**23**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC2124	YCCE Communication Aptitude Preparation (YCAP4)	**A**	3	0	0	3	0				
2	4	BES	IoT	MLC118	Matlab Programming	**A**	2	0	0	2	0				

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TA = for Practical : MSPA will be 15 marks each**

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B. Tech in CSE (IOT)

SoE No. 22CSIoT-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester															
1	5	PC	EE	22IoT501	Introduction to IoT	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	EE	22IoT502	**Lab.:** Introduction to IoT	**P**	0	0	2	2	1	30	20	50	3 Hours
3	5	PC	CT	22IoT503	Computer Communication network	**T**	3	0	0	3	3	30	20	50	3 Hours
4	5	PC	CT	22IoT504	**Lab. :** Computer Communication network	**P**	0	0	2	2	1		60	40	
5	5	PC	CT	22IoT505	Mathematical Foundations for Data Analysis	**T**	3	0	0	3	3	30	20	50	3 Hours
6	5	PC	CT	22IoT506	**Lab.:**Mathematical Foundations for Data Analysis	**P**	0	0	2	2	1		60	40	
7	5	PC	ME	22IoT507	CNC & Robotics	T	3	0	0	3	3		60	40	
8	5	PC	CT	22IoT508	Design & Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5	PC	CT	22IoT509	**Lab.:** Design & Analysis of Algorithms	**T**	0	0	2	2	1	30	20	50	3 Hours
					Professional Elective-I *	**P**	3	0	0	3	3	30	20	50	3 Hours
10	5	STR	EE	22IoT510	Industrial Training & Seminar	**P**	0	0	0	0	1		60	40	
					TOTAL FOURTH SEM		**18**	**0**	**8**	**26**	**23**				

List of Professional Electives-I *

1	5	PE-I	EE/EE	22IoT511	Pattern Recognization
2	5	PE-I	EE/CT	22IoT512	Artificial Intelligence
3	5	PE-I	EE/EL	22IoT513	Power Electronics
4	5	PE-I	EE/ME	22IoT514	Supply chain management

List of Mandatory Learning Course (MLC)

1	5	HS		MLC2125	YCAP5	A	3	0	0	3	0		
2	5	HS			Design thinking	A	2	0	0	2	0		

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(Department of Electronics Engineering)

B. Tech in CSE (IOT)

SoE No. 22CSIoT-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester															
1	6	PC	EE	22IoT601	Data Analytics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	EE	22IoT602	**Lab.:** Data Analytics	**P**	0	0	2	2	1		60	40	
3	6	PC	EE	22IoT603	Embedded System Design	**T**	3	0	0	3	3	30	20	50	3 Hours
4	6	PC	EE	22IoT604	**Lab.:** Embedded System Design	**P**	0	0	2	2	1		60	40	
5	6	PC	EE	22IoT605	Data Acquisition & Signal Conditioning	**T**	3	0	0	3	3	30	20	50	3 Hours
6	6	PC	CT	22IoT606	AI and Machine Learning	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PC	CT	22IoT607	**Lab**:AI and Machine Learning	**P**	0	0	2	2	1		60	40	
8	6	PC	EE	22IoT608	**Project Phase-I**	**P**	0	0	2	4	2		60	40	
9	6	PC	EE	22IoT609	Soft Computing	**T**	3	0	0	3	3	30	20	50	3 Hours
10	6	PE			**Professional Elective-II**	**T**	3	0	0	3	3	30	20	50	3 Hours
11	6	PE			**Lab: Professional Elective-II**	**P**	0	0	2	2	1		60	40	
					TOTAL SIXTH SEM		**18**	**0**	**10**	**30**	**24**				

List of Professional Electives- II

Professional Electives-II

1	6	PE-II	EE/EE	22IoT651	PE-II Digital Image processing
	6	PE-II	EE/EE	22IoT652	PE-II: **Lab.:** Digital Image processing
2	6	PE-II	EE/ME	22IoT653	PE-II Flexible Manufacturing System
	6	PE-II	EE/ME	22IoT654	PE-II: **Lab: :** Flexible Manufacturing System
3	6	PE-II	EE/EL	22IoT655	PE-II Electrical Drives
	6	PE-II	EE/EL	22IoT656	PE-II **: Lab:** Electrical Drives
4	6	PE-II	CT	22IoT657	Introduction to GIS
	6	PE-II	CT	22IoT658	**Lab.:** Introduction to GIS

List of Mandatory Learning Course (MLC)

1	6	HS	T&P	MLC2126	YCAP6 :	**A**	3	0	0	3	0

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TA = for Practical : MSPA will be 15 marks each**

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(Department of Electronics Engineering)

B. Tech in CSE (IOT)

SoE No. 22CSIoT-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester															
1	7	PC	EE	22IoT701	Real Time Operting System	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	EE	22IoT702	**Lab.:** Real Time Operting System	**P**	0	0	2	2	1		60	40	
3	7	PC	EL	22IoT703	Industrial Automation	**T**	3	0	0	3	3	30	20	50	3 Hours
3	7	PC	EL	22IoT704	**Lab.:** Industrial Automation	**P**	0	0	2	2	1	30	20	50	3 Hours
3	7	PC	CT	22IoT705	Cloud computing	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PC	CT	22IoT706	**Lab.:** Cloud computing	**P**	0	0	2	2	1		60	40	
5	7	PE			**Professional Elective-III**	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	PE			**Professional Elective-IV**	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	PE			**Professional Elective-V**	**T**	3	0	0	3	3	30	20	50	3 Hours
9	7	STR	EE	22IoT707	Project Phase-II	**P**	0	0	10	10	5		60	40	
10	7	STR	EE	22IoT708	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL SEVENTH SEM		**18**	**0**	**16**	**34**	**28**				

List of Professional Electives-III,IV & V

Professional Electives -III

1	7	PE-III	EL	22IoT721	PE-III : Industrial Safety
2	7	PE-III	EE	22IoT722	PE-III : Wireless Sensor Network
3	7	PE-III	CT		PE-III: Business Intelligence and Applications
4	7	PE-III	ME	22IoT723	PE-III : Additive Manufacturing

Professional Electives -IV

1	7	PE-IV	EL	22IoT741	PE IV: Smart Grid
2	7	PE-IV	CT		Deep learnng
3	7	PE-IV	ME	22IoT742	PE IV: Design for Manufacturing and Assembly
4	7	PE-IV	EE	22IoT743	PE IV:Cryptography

Professional Electives -V

1	7	PE-V	CT	22IoT761	PE-V: Cyber Security
2	7	PE-V	EE		Wireless Communication
3	7	PE-V	ME	22IoT762	PE-V: Shop floor control
4	7	PE-V	EL	22IoT763	PE-V: Electric Vehicle

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Eighth Semester															
1	**8**	**STR**		22IoT801	**Industrial Internship**	**P**	0	0	12	12	3		60	40	
2	**8**	**STR**		22IoT802	**Extra Curricular Activity Evaluation**	**P**	0	0	0	0	2		100		
					TOTAL EIGHTH SEM		**0**	**0**	**12**	**12**	**5**				
					GRAND TOTAL		**121**	**3**	**78**	**201**	**165**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activitie
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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

Computer Science and Design

SoE No. 22CSD-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER															
1	1	BS	GE/MTH	22CSD101	Probability and Statistics	T	3	1	0	3	4	30	20	50	3 Hours
2	1	BS	GE/PHY	22CSD102	Engineering Physics	T	3	0	0	3	3	30	20	50	3 Hours
3	1	BS	GE/PHY	22CSD103	Lab.: Engineering Physics	P	0	0	2	2	1		60	40	
4	1	HS	GE/HUM	22CSD104	Social Science	T	3	0	0	3	3	30	20	50	3 Hours
5	1	BES	CV/CV	22CSD105	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3 Hours
6	1	BES	CV/CV	22CSD106	Lab.:Engineering Mechanics	P	0	0	2	2	1		60	40	
7	1	BES	IT/IT	22CSD107	Introduction to Computer Programming	T	3	0	0	3	3	30	20	50	3 Hours
8	1	BES	IT/IT	22CSD108	Lab.: Introduction to Computer Programming	P	0	0	2	2	1		60	40	
					TOTAL FIRST SEM		**15**	**1**	**6**	**21**	**19**				
List of Mandatory Learning Course (MLC)															
1	1	BES	GE/CHE	GE2132	Environmental Science	**A**	2	0	0	2	0				
2	1	HS	GE/T&P	MLC2121	YCAP1-Get Set Go	**A**	2	0	0	2	0				
SECOND SEMESTER															
1	2	BS	GE/MTH	22CSD201	Calculus, Sequences and Series	T	3	1	0	3	4	30	20	50	3 Hours
2	2	BS	GE/CHE	22CSD202	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3 Hours
3	2	BS	GE/CHE	22CSD203	Lab: Engineering Chemistry	p	0	0	2	2	1		60	40	
4	2	HS	GE/HUM	22CSD204	Technical Communication	T	3	0	0	3	3	30	20	50	3 Hours
5	2	HS	GE/HUM	22CSD205	Lab:Technical Communication	P	0	0	2	2	1		60	40	
6	2	BES	EE/EE	22CSD206	Digital Circuit Design	T	3	0	0	3	3	30	20	50	3 Hours
7	2	BES	EE/EE	22CSD207	Lab.:Digital Circuit Design	P	0	0	2	2	1		60	40	
8	2	BES	EL/EL	22CSD208	Basic Electrical Machines	T	3	0	0	3	3	30	20	50	3 Hours
9	2	BES	EL/EL	22CSD209	Lab:Basic Electrical Machines	P	0	0	2	2	1		60	40	
10	2	BES	ME/ME	22CSD210	Lab.: Engineering Design	P	0	0	4	4	2		60	40	
					TOTAL SECOND SEM		**15**	**1**	**12**	**27**	**22**				
List of Mandatory Learning Course (MLC)															
1	2	HS	GE/T&P	MLC2122	YCAP2 -Functional English	**A**	2	0	0	2	0				
2	2	HS	GE/HUM	GE2131	Universal Human Value	**A**	2	0	0	2	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

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(Department of Information Technology)

Computer Science and Design

SoE No. 22CSD-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
THIRD SEMESTER															
1	3	BS	GE/GE	22CSD301	Linear Algebra	T	3	1	0	4	4	30	30	40	3
2	3	PC	CSD	22CSD302	Microprocessors and Microcontrollers	T	3	0	0	3	3	30	30	40	3
3	3	PC	CSD	22CSD303	Lab:Microprocessors and Microcontrollers	P	0	0	2	2	1		60	40	
4	3	PC	CSD	22CSD304	Data Structures	T	4	0	0	4	4	30	30	40	3
5	3	PC	CSD	22CSD305	Lab: Data Structures	P	0	0	2	2	1		60	40	
6	3	PC	CSD	22CSD306	Computer System Organization	T	3	0	0	3	3	30	30	40	3
7	3	PC	CSD	22CSD307	Theoretical Foundation of Computer Sciences	T	3	0	0	3	3	30	30	40	3
8	3	PC	CSD	22CSD308	Software Lab-I	P	0	0	4	4	2		60	40	
9	3	PC	CV/CSD	22CSD309	Environmental Sustainability, Pollution and Management	**T**	3	0	0	3	3	30	20	50	3 Hrs
						TOTAL	**19**	**1**	**8**	**28**	**24**				
List of Mandatory Learning Course (MLC)															
1	3	HS	GE/T&P	MLC2123	YCAP3 -	**A**	2	0	0	2	0				
2	3	BES	CSD	MLC119	Technical Documentation	**A**	2	0	0	2	0				

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FOURTH SEMESTER															
1	4	BS	GE	22CSD401	Discrete Mathematics and Graph Theory	T	3	1	0	4	4	30	30	40	3
2	4	PC	CSD	22CSD402	Operating Systems	T	3	0	0	3	3	30	30	40	3
3	4	PC	CSD	22CSD403	Lab : Operating Systems	P	0	0	2	2	1		60	40	
4	4	PC	CSD	22CSD404	Computer Networks	T	3	0	0	3	3	30	30	40	3
5	4	PC	CSD	22CSD405	Object Oriented Programming	T	3	0	0	3	3	30	30	40	3
6	4	PC	CSD	22CSD406	Lab:Object Oriented Programming	P	0	0	2	2	1		60	40	
7	4	PC	CSD	22CSD407	Design and Analysis of Algorithms	T	3	0	0	3	3	30	10	60	3
8	5	PC	CSD	22CSD409	Lab.:Design and Analysis of Algorithms	P	0	0	2	2	1		60	40	
9	4	PC	CSD	22CSD410	Software Lab-II	P	0	0	4	4	2		60	40	
						TOTAL	**15**	**1**	**10**	**26**	**21**				
List of Mandatory Learning Course (MLC)															
1	4	HS	GE/T&P	MLC2124	YCAP4 -	**A**	2	0	0	2	0				
2	4	BES	CSD	MLC120	Open Source Tool for Graphics	**A**	2	0	0	2	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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Yeshwantrao Chavan College of Engineering

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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

Computer Science and Design

SoE No. 22CSD-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIFTH SEMESTER															
1	5	HS	CSD	22CSD501	Cyber Laws & Professional Ethics	T	3	0	0	3	3	30	30	40	3
2	5	PC	CSD	22CSD502	Database Management Systems	T	3	0	0	3	3	30	30	40	3
3	5	PC	CSD	22CSD503	Lab: Database Management Systems	P	0	0	2	2	1		60	40	
4	5	PC	CSD	22CSD504	Principles of Compiler Design	T	3	0	0	3	3	30	30	40	3
5	5	PC	CSD	22CSD505	Lab.:Principles of Compiler Design	P	0	0	2	2	1		60	40	
6	5	PE	CSD		**Professional Elective-I**	T	3	0	0	3	3	30	30	40	3
7	5	PE	CSD		**Lab. Professional Elective-I**	P	0	0	2	2	1		60	40	
8	5	OE	CSD		**Open Elective -I**	T	3	0	0	3	3	30	30	40	3
9	5	OE	CSD		**Open Elective -II**	T	3	0	0	3	3	30	30	40	3
10	5	STR	CSD	22CSD506	Seminar	P					1		100		
						TOTAL	**18**	**0**	**6**	**24**	**22**				

Professional Electives-I

1	5	PE-I	CSD	22CSD511	Digital Image Processing
2	5	PE-I	CSD	22CSD512	**Lab:** Digital Image Processing
3	5	PE-I	CSD	22CSD513	Machine Learning
4	5	PE-I	CSD	22CSD514	**Lab:** Machine Learning
5	5	PE-I	CSD	22CSD515	Data Visualization
6	5	PE-I	CSD	22CSD516	**Lab:** Data Visualization
7	5	PE-I	CSD	22CSD517	Computer Graphics
8	5	PE-I	CSD	22CSD518	**Lab:** Computer Graphics
9	5	PE-I	CSD	22CSD519	Internet of Things
10	5	PE-I	CSD	22CSD520	**Lab:**Internet of Things

Open Electives-I

1	5	OE-I	CSD	22CSD531	OE I : Computer Graphics
2	5	OE-I	CSD	22CSD532	OE I : Multimedia Design

Open Electives-II

1	5	OE-II	CSD	22CSD551	OE II : Advanced Web Designing
2	5	OE-II	CSD	22CSD552	OE II : Virtual Reality

List of Mandatory Learning Course (MLC)												
1	5	HS	GE/T&P	MLC2125	YCAP5 -	**A**	2	0	0	2	0	
2					Design thinking	**A**	2	0	0	2	0	

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TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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Computer Science and Design

SoE No. 22CSD-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
SIXTH SEMESTER															
1	6	HS	GE/HUM	22CSD601	Fundamentals of Management and Economics	T	3	0	0	3	3	30	30	40	3
2	6	PC	CSD	22CSD602	Software Architecture & Design	T	3	0	0	3	3	30	30	40	3
3	6	PC	CSD	22CSD603	Computer Game Design and Programming	T	3	0	0	3	3	30	30	40	3
4	6	PC	CSD	22CSD604	Lab: Computer Game Design and Programming	P	0	0	2	2	1		60	40	
5	6	PE2	CSD		**Professional Elective-II**	T	3	0	0	3	3	30	30	40	3
6	6	PE2	CSD		**Lab. Professional Elective-II**	P	0	0	2	2	1		60	40	
7	6	STR	CSD	22CSD605	Design Workshop	P	0	0	4	4	2		60	40	
8	6	OE3	CSD		**Open Elective -III**	T	3	0	0	3	3	30	30	40	3
9	6	OE4	CSD		**Open Elective -IV**	T	3	0	0	3	3	30	30	40	3
						TOTAL	**18**	**0**	**8**	**26**	**22**				

Professional Electives-II

1	6	PE-II	CSD	22CSD611	Multimedia Design & Processing
2	6	PE-II	CSD	22CSD612	**Lab:** Multimedia Design & Processing
3	6	PE-II	CSD	22CSD613	Advanced Web Designing
4	6	PE-II	CSD	22CSD614	**Lab:** Advanced Web Designing
5	6	PE-II	ME	22CSD615	Design Manufacturing and Assembly
6	6	PE-II	ME	22CSD616	**Lab:** Design Manufacturing and Assembly
7	6	PE-II	CSD	22CSD617	UX &UI Design
8	6	PE-II	CSD	22CSD618	**Lab:** UX &UI Design
9	6	PE-II	CSD	22CSD619	Introduction to Deep Learning
10	6	PE-II	CSD	22CSD620	**Lab:** Introduction to Deep Learning

Open Electives-III

1	6	OE-III	CSD	22CSD631	OE III : Computer Graphics
2	6	OE-III	CSD	22CSD632	OE III : Multimedia Design

Open Electives-IV

1	6	OE-IV	CSD	22CSD651	OE IV : Advanced Web Designing
2	6	OE-IV	CSD	22CSD652	OE IV : Virtual Reality

List of Mandatory Learning Course (MLC)

1	6	HS	T&P	MLC2126	YCAP6 :	**A**	2	0	0	2	0	

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TA = for Practical : MSPA will be 15 marks each**

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Computer Science and Design

SoE No. 22CSD-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
SEVENTH SEMESTER															
1	7	PC	CSD	22CSD701	Virtual and Augmented Reality	T	3	0	0	3	3	30	30	40	3
2	7	PC	CSD	22CSD702	Lab: Virtual & Augmented Reality	P	0	0	2	2	1		60	40	
3	7	PC	ME	22CSD703	Computer Aided Design	T	3	0	0	3	3	30	30	40	3
4	7	PC	ME	22CSD704	Lab: Computer Aided Design	P	0	0	2	2	1		60	40	
5	7	PE	CSD		**Professional Elective-III**	T	3	0	0	3	3	30	30	40	3
6	7	PE	CSD		**Lab.: Professional Elective-III**	P	0	0	2	2	1		60	40	
7	7	PE	CSD		**Professional Elective-IV**	T	3	0	0	3	3	30	30	40	3
8	7	PE	CSD		**Professional Elective-V**	T	3	0	0	3	3	30	30	40	3
9	7	STR	CSD	22CSD705	Project Phase-II	**P**	0	0	10	10	5		60	40	
10	7	STR	CSD	22CSD706	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
TOTAL SEVENTH SEM							**15**	**0**	**16**	**31**	**25**				

Professional Electives -III

1	7	PE III	CSD	22CSD711	GPU Computing
2	7	PE III	CSD	22CSD712	**Lab. :** GPU Computing
3	7	PE III	CSD	22CSD713	Digital Audio Design and Synthesis
4	7	PE III	CSD	22CSD714	**Lab. :** Digital Audio Design and Synthesis
5	7	PE III	CSD	22CSD715	Special Effects Techniques
6	7	PE III	CSD	22CSD716	**Lab. :** Special Effects Techniques
7	7	PE III	CSD	22CSD717	Animation Principles & Design
8	7	PE III	CSD	22CSD718	**Lab. :** Animation Principles & Design
9	7	PE III	CSD	22CSD719	Product Design and Development
10	7	PE III	CSD	22CSD720	**Lab. :** Product Design and Development

Professional Electives -IV

1	7	PE IV	CSD	22CSD731	Mobile Computing
2	7	PE IV	CSD	22CSD732	Information Retrival
3	7	PE IV	CSD	22CSD733	Image & Video Processing
4	7	PE IV	CSD	22CSD734	Computer Vision
5	7	PE IV	CSD	22CSD735	Sensors & Actuators

Professional Electives -V

1	7	PE V	CSD	22CSD751	Spatial Computing
2	7	PE V	CSD	22CSD752	Artificial Intelligence
3	7	PE V	CSD	22CSD753	Cloud Computing
4	7	PE V	CSD	22CSD754	Industry 4.o
5	7	PE V	ME	22CSD755	Additive Manufacturing

MSEs* = Three MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

TA ** = for Theory :12 marks on lecture quizzes, 12 marks on 2 Activities, 2 marks on class performance,4 marks on Common TA
TA = for Practical : MSPA will be 15 marks each**

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(Department of Information Technology)

Computer Science and Design

SoE No. 22CSD-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
EIGHT SEMESTER															
1	8	STR	CSD	22CSD801	Major Project/Internship	P	0	0	12	12	3		60	40	
2	8	ER	CSD	22CSD802	Extra curricular Activity Evaluation	P	0	0	0	0	2		100		
TOTAL EIGHTH SEM							**0**	**0**	**12**	**12**	**5**				
GRAND TOTAL							**115**	**4**	**78**	**195**	**160**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

Artificial Intelligence and Data Science

SoE No. 22ADS-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER															
1	1	BS	GE/MTH	22ADS101	Calculus, Sequances & Series	T	3	1	0	3	4	30	20	50	3 Hrs
2	1	BS	GE/CHE	22ADS102	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3 Hrs
3	1	BS	GE/CHE	22ADS103	**Lab.:** Engineering Chemistry	P	0	0	2	2	1		60	40	
4	1	HS	GE/HUM	22ADS104	Technical Communications	T	3	0	0	3	3	30	20	50	3 Hrs
5	1	HS	GE/HUM	22ADS105	**Lab.:** Technical Communications	P	0	0	2	2	1		60	40	
6	1	PC	CT/CT	22ADS106	Foundations of Data Science	T	3	0	0	3	3	30	20	50	3 Hrs
7	1	PC	CT/CT	22ADS107	**Lab.:** Foundations of Data Science	P	0	0	2	2	1		60	40	
8	1	BES	CT/CT	22ADS108	Computer Programing	T	3	0	0	3	3	30	20	50	3 Hrs
9	1	BES	CT/CT	22ADS109	**Lab.:** Computer Programing	P	0	0	2	2	1		60	40	
					TOTAL FIRST SEM		**15**	**1**	**8**	**23**	**20**				
List of Mandatory Learning Course (MLC)															
1	1	HS	GE/HUM	GE2131	Universal Human Value	A	2	0	0	2	0				
2	1	HS	GE/T&P	MLC2121	YCAP1-Get Set Go	A	2	0	0	2	0				
SECOND SEMESTER															
1	2	BS	GE/MTH	22ADS201	Probability and Statistics	T	3	1	0	3	4	30	20	50	3 Hrs
2	2	BS	GE/PHY	22ADS202	Engineering Physics	T	3	0	0	3	3	30	20	50	3 Hrs
3	2	BS	GE/PHY	22ADS203	**Lab.:** Engineering Physics	P	0	0	2	2	1		60	40	
4	2	HS	GE/HUM	22ADS204	Social Science	T	3	0	0	3	3	30	20	50	3 Hrs
5	2	BES	CT/CT	22ADS205	Computer Architecture and Organization	T	3	0	0	3	3	30	20	50	3 Hrs
6	2	PC	CT/CT	22ADS206	Object Oriented Programming	T	3	0	0	3	3	30	20	50	3 Hrs
7	2	PC	CT/CT	22ADS207	**Lab.:** Object Oriented Programming	P	0	0	2	2	1		60	40	
8	2	PC	CT/CT	22ADS208	Data Structures	T	3	0	0	3	3	30	20	50	3 Hrs
9	2	PC	CT/CT	22ADS209	**Lab.:** Data Structures	P	0	0	2	2	1		60	40	
10	2	PC	CT/CT	22ADS210	Software Lab	P	0	0	2	2	1		60	40	
					TOTAL SECOND SEM		**18**	**1**	**8**	**26**	**23**				
List of Mandatory Learning Course (MLC)															
1	2	HS	GE/T&P	MLC2122	YCAP2 -Functional English	A	2	0	0	2	0				
2	2	BES	GE/CHE	GE2132	Environmental Science	A	2	0	0	2	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2022

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(Department of Computer Technology)

Artificial Intelligence and Data Science

SoE No. 22ADS-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS	GE	22ADS301	Discrete Mathematics & Graph Theory	**T**	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CT	22ADS302	Statistics for Data Science	**T**	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	CT	22ADS303	**Lab** :Statistics for Data Science	P	0	0	2	2	1		60	40	
4	3	PC	CT	22ADS304	Computer Network	**T**	3	0	0	3	3	30	20	50	3 Hours
5	3	PC	CT	22ADS305	**Lab.:** Computer Network	P	0	0	2	2	1		60	40	
6	3	PC	CT	22ADS306	Software Engineering	**T**	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	CT	22ADS307	**Lab.:** Software Engineering	P	0	0	2	2	1		60	40	
8	3	PC	CT	22ADS308	Operating Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
9	3	PC	CT	22ADS309	**Lab.** Web Technology	P	0	0	4	4	2		60	40	
10	3	PC	CV/CT	22ADS310	Environmental Sustainability, Pollution and Management	**T**	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL THIRD SEM		**15**	**0**	**10**	**25**	**23**				
List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
2	3	BES	CT/AIDS	MLC121	Document Presentation and Computation	**A**	2	0	0	2	0				
Fourth Semester															
1	4	PC	GE	22ADS401	Linear Algebra	**T**	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CT	22ADS402	Theoretical foundation of Computer Science	**T**	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CT	22ADS403	Design & Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3 Hours
4	4	PC	CT	22ADS404	**Lab:** Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
5	4	PC	CT	22ADS405	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	CT	22ADS406	**Lab:** Database Management Systems	**P**	0	0	2	2	1		60	40	
7	4	PC	CT	22ADS407	Bayesian Data Analysis	**T**	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	CT	22ADS408	**Lab:** Advanced Python	**P**	0	0	2	2	1		60	40	
					TOTAL FOURTH SEM		**15**	**0**	**6**	**21**	**18**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC2124	YCCE Communication Aptitude Preparation (YCAP4)	**A**	3	0	0	3	0				
2	4	BES	CT/AIDS	MLC122	Data Visualization	**A**	2	0	0	2	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2022

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(Department of Computer Technology)

Artificial Intelligence and Data Science

SoE No. 22ADS-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester															
1	5	PC	CT	22ADS501	Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	CT	22ADS502	**Lab.:** Artificial Intelligence	**P**	0	0	2	2	1		60	40	
3	5	PC	CT	22ADS503	Data Mining	**T**	3	0	0	3	3	30	20	50	3 Hours
4	5	PC	CT	22ADS504	**Lab.:** Data Mining	**P**	0	0	2	2	1		60	40	
5	5	PC	CT	22ADS505	Cyber Laws and Ethics in IT	**T**	3	0	0	3	3		60	40	
6	5	PC	CT	22ADS506	**Lab :** Open Source Tools	**P**	0	0	2	2	1		60	40	
7	5	PC	CT		**Professional Elective-I**	**T**	3	0	0	3	3	30	20	50	3 Hours
8	5	PE	CT		**Professional Elective-I Lab**	**P**	0	0	2	2	1		60	40	
9	5	STR	CT		**Open Elective I**	**T**	3	0	0	3	3	30	20	50	3 Hours
10	5	OE	CT		**Open Elective II**	**T**	3	0	0	3	3	30	20	50	3 Hours
					TOTAL FOURTH SEM		**18**	**0**	**8**	**26**	**22**				

List of Professional Electives-I *

1	5	PE-I	PC	22ADS511	PE I: Digital Image Processing
2	5	PE-I	PC	22ADS512	PE I: **Lab.:** Digital Image Processing
3	5	PE-I	PC	22ADS513	PE I: Internet of Things
4	5	PE-I	PC	22ADS514	PE I: **Lab.:** Internet of Things
5	5	PE-I	PC	22ADS515	PE I : Numerical Methods
6	5	PE-I	PC	22ADS516	PE I : **Lab.:** Numerical Methods

Open Elective-I

1	5	OE-I	PC	22ADS531	OE I: Introduction to Data Science
2	5	OE-I	PC	22ADS532	OE I: Foundations of AI

Open Elective-II

1	5	OE-II	PC	22ADS551	OE II: Introduction to DBMS
2	5	OE-II	PC	22ADS552	OE II: Current Trends and Technologies

List of Mandatory Learning Course (MLC)

1	5	HS	T&P	MLC125	**YCAP5 :**	A	3	0	0	3	0	
2	5	HS			Design thinking	A	2	0	0	2	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes & TA2 activitied decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.00**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

Artificial Intelligence and Data Science

SoE No. 22ADS-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester															
1	6	GE	GE/HUM	22ADS601	Management Studies	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	CT	22ADS602	Business Analytics	**T**	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	CT	22ADS603	**Lab:** Business Analytics	P	0	0	2	2	1		60	40	
4	6	PC	CT	22ADS604	Machine Learning	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PC	CT	22ADS605	**Lab:** Machine Learning	P	0	0	2	2	1		60	40	
6	6	PC	CT	22ADS606	**Lab :** Advanced Web Technolgy	P	0	0	2	2	1		60	40	
7	6	PE	CT		**Professional Elective-II**	**T**	3	0	0	3	3	30	20	50	3 Hours
8	6	PE	CT		**Open Elective III**	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	PR	CT		**Open Elective IV**	**T**	3	0	0	3	3	30	20	50	3 Hours
10	6	OE	CT	22ADS607	Project Phase I	P	0	0	2	2	1		60	40	
					TOTAL SIXTH SEM		**18**	**0**	**8**	**26**	**22**				

List of Professional Electives- II

Professional Electives-II

1	6	PE-II	CT	22ADS611	Computer Vision
2	6	PE-II	CT	22ADS612	Natural Language Processing
3	6	PE-II	CT	22ADS613	Robotics
4	6	PE-II	CT	22ADS614	Data Analytics for Industry 4.0
5	6	PE-II	CT	22ADS615	Social Media Analytics
6	6	PE-II	CT	22ADS616	Optimization Techniques

Open Elective-III

1	6	OE-III	CT	22ADS631	OE III: Introduction to Data Science
2	6	OE-III	CT	22ADS632	OE III: Foundations of AI

Open Elective-IV

1	6	OE-IV	CT	22ADS651	OE IV: Introduction to DBMS
2	6	OE-IV	CT	22ADS652	OE IV: Current Trends and Technologies

List of Mandatory Learning Course (MLC)

1	6	HS		MLC126	**YCAP6:**	**A**	3	0	0	3	0

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA* = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activities decided by course teacher, 2 marks on class attendance and 4 marks on TA4 activities

TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

Artificial Intelligence and Data Science

SoE No. 22ADS-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester															
1	7	PC	CT	22ADS701	Deep Learning	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PE	CT	22ADS702	**Lab :** Deep Learning	P	0	0	2	2	1		60	40	
3	7	PE	CT	22ADS703	Big Data and Hadoop	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE	CT	22ADS704	**Lab:**Big Data and hadoop	P	0	0	2	2	1		60	40	
4	7	PE	CT	22ADS705	Computational Logic	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE	CT		**Professional Elective-III**	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE	CT		**Professional Elective-IV**	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE	CT		**Professional Elective-V**	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE	CT	22ADS706	**Lab:** High Performance Computing	P	0	0	2	2	1		60	40	
5	7	PE	CT	22ADS707	Project Phase-II	**P**	0	0	10	10	5		60	40	
7	7	STR	CT	22ADS708	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL SEVENTH SEM		**18**	**0**	**16**	**34**	**28**				

List of Professional Electives-III,IV & V

Professional Electives -III

1	7	PE-III	CT	22ADS721	PE III: Data Modeling and Simulation
2	7	PE-III	CT	22ADS722	PE III: Sensor Networks and Data Analysis
3	7	PE-III	CT	22ADS723	PE III: Data Warehousing

Professional Electives -IV

1	7	PE-IV	CT	22ADS741	PE IV: Data Visulization
2	7	PE-IV	CT	22ADS742	PE IV: **Lab:** Data Visulization
3	7	PE-IV	CT	22ADS743	PE IV: Cloud Computing
4	7	PE-IV	CT	22ADS744	PE IV: **Lab:** Cloud Computing
5	7	PE-IV	CT	22ADS745	AI for Medical Diagnosis

Professional Electives -V

1	7	PE-V	CT	22ADS761	PE V: Data Security
2	7	PE-V	CT	22ADS762	PE V: Time series analysis and Forecasting
3	7	PE-V	CT	22ADS763	PE V: Video Analytics

Eighth Semester															
1	**8**	**STR**		22ADS801	Internship - training / Seminar & Report	P	0	0	12	12	3		50	50	
2	**8**	**STR**		22ADS802	Extra Curricular Activity Evaluation	P	0	0	0	0	2		100		
					TOTAL EIGHTH SEM		**0**	**0**	**12**	**12**	**5**				
					GRAND TOTAL		**117**	**2**	**76**	**193**	**161**				

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TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Science & Engineering)

CSE (AIML)

SoE No. 22AML-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER															
1	1	BS	GE/MTH	22AML101	Calculus, Sequence and Series	**T**	3	1	0	3	4	30	20	50	3 Hrs
2	1	HS	GE/HUM	22AML102	Technical Communication	**T**	3	0	0	3	3	30	20	50	3 Hrs
3	1	HS	GE/HUM	22AML103	**Lab:** Technical Communication	**P**	0	0	2	2	1		60	40	
4	2	BES	CSE/CSE	22AML104	Computer Workshop	**P**	0	0	2	4	2		60	40	
5	1	BES	CSE/CSE	22AML105	Programming for Problem Solving	**T**	3	0	0	3	3	30	20	50	3 Hours
6	1	BES	CSE/CSE	22AML106	Lab: Programming for Problem Solving	**P**	0	0	2	2	1		60	40	
7	1	BS	GE/CHE	22AML107	Engineering Chemistry	**T**	3	0	0	3	3	30	20	50	3 Hours
8	1	BS	GE/CHE	22AML108	**Lab.:** Engineering Chemistry	**P**	0	0	2	2	1		60	40	
					TOTAL FIRST SEM		**12**	**1**	**8**	**22**	**18**				
List of Mandatory Learning Course (MLC)															
1	1	HS	GE/HUM	GE2131	Universal Human Value	**A**	2	0	0	2	0				
2	1	HS	GE/T&P	MLC2121	YCAP1-Get Set Go	**A**	2	0	0	2	0				
SECOND SEMESTER															
1	2	BS	GE/MTH	22AML201	Probability and Statistics	**T**	3	1	0	3	4	30	20	50	3 Hours
2	2	BS	GE/PHY	22AML202	Engineering Physics	**T**	3	0	0	3	3	30	20	50	3 Hours
3	2	BS	GE/PHY	22AML203	**Lab:** Engineering Physics	**P**	0	0	2	2	1		60	40	
4	2	BES	EE/EE	22AML204	Digital Electronics	**T**	3	0	0	3	3	30	20	50	3 Hours
5	2	BES	EE/EE	22AML205	**Lab:** Digital Electronics	**P**	0	0	2	2	1		60	40	
6	2	BES	CSE/CSE	22AML206	Object Oriented Programming	T	3	0	0	3	3	30	20	50	3 Hours
7	2	BES	CSE/CSE	22AML207	**Lab:** Object Oriented Programming	P	0	0	2	2	1		60	40	
8	2	BES	CSE/CSE	22AML208	Web Technology Lab	**P**	0	0	0	2	1		60	40	
9	2	HS	GE/HUM	22AML209	Social Science	**T**	3	0	0	3	3	30	20	50	3 Hours
					TOTAL SECOND SEM		**15**	**1**	**6**	**23**	**20**				

List of Mandatory Learning Course (MLC)															
3	2	HS	GE/T&P	MLC2122	YCAP2 -Functional English	**A**	2	0	0	2	0				
4	2	BES	GE/CHE	GE2132	Environmental Science	**A**	2	0	0	2	0				

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TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class

TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Science & Engineering)

CSE (AIML)

SoE No. 22AML-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
THIRD SEMESTER															
1	3	BS	GE	22AML301	Discrete Mathematics and Graph theory	**T**	3	1	0	3	4	30	20	50	3 Hours
2	3	PC	CSE	22AML302	Formal Language & Automata Theory	**T**	3	1	0	3	4	30	20	50	3 Hours
3	3	PC	CSE	22AML303	**Lab:** Formal Language & Automata Theory	**P**	0	0	2	2	1		60	40	
4	3	PC	CSE	22AML304	Data Structures	**T**	3	1	0	3	4	30	20	50	3 Hours
5	3	PC	CSE	22AML305	**Lab:** Data Structures	**P**	0	0	2	2	1		60	40	
6	3	PC	CSE	22AML306	Computer Architecture & Organisation	T	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	CSE	22AML307	Software Engineering	T	3	0	0	3	3	30	20	50	3 Hours
8	3	PC	CSE	22AML308	**Lab:** Software Engineering	**P**	0	0	2	2	1		60	40	
9	3	PC	CSE	22AML309	**Lab:** Software Lab.	**P**	0	0	2	2	1		60	40	
					TOTAL		**15**	**3**	**8**	**23**	**22**				
List of Mandatory Learning Course (MLC)															
1	3	HS	T&P	MLC2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
2	3	BSE	AIML	MLC123	Introduction to Haskell Programming	**A**	2	0	0	2	0				
FOURTH SEMESTER															
1	4	BS	GE	22AML401	Linear Algebra	**T**	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CSE	22AML402	Operating Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CSE	22AML403	**Lab:** Operating Systems	**P**	0	0	2	2	1		60	40	
2	4	PC	CSE	22AML404	Foundation of Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CSE	22AML405	**Lab:** Foundation of Artificial Intelligence	**P**	0	0	2	2	1		60	40	
6	4	PC	CSE	22AML406	Design & Analysis of Algorithms	**T**	3	1	0	3	4	30	20	50	3 Hours
7	4	PC	CSE	22AML407	**Lab:** Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
8	4	PC	CSE	22AML408	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
9	4	PC	CSE	22AML409	**Lab:** Database Management Systems	**P**	0	0	2	2	1		60	40	
10	4	PC	CV/CSE	22AML410	Environmental Sustainability, Pollution and Management	**T**	3	0	0	3	3	30	20	50	3 Hrs
					TOTAL		**18**	**1**	**8**	**26**	**23**				
List of Mandatory Learning Course (MLC)															
1	4	HS	T&P	MLC2124	YCCE Communication Aptitude Preparation (YCAP4)	**A**	3	0	0	3	0				
2	4	BSE	AIML	MLC124	Computational Sanskrit	**A**	2	0	0	2	0				

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TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Science & Engineering)

CSE (AIML)

SoE No. 22AML-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIFTH SEMESTER															
1	5	HS	CSE	22AML501	Fundamentals of Management and Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
4	5	PC	CSE	22AML504	Machine Learning Essentials	**T**	3	0	0	3	3	30	20	50	3 Hours
5	5	PC	CSE	22AML505	**Lab:** Machine Learning Essentials	**P**	0	0	2	2	1		60	40	
6	5	PE			**Professional Elective-I**	**T**	3	0	0	3	3	30	20	50	3 Hours
7	5	PE			**Lab: Professional Elective-I**	**P**	0	0	2	2	1		60	40	
8	5	OE			**Open Elective - I ***	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5	OE			**Open Elective - II ***	**T**	3	0	0	3	3	30	20	50	3 Hours
10	**5/6**	**STR**		22AML506	Seminar	**P**	**0**	**0**	**0**	**0**	**1**		60	40	
						TOTAL	**15**	**0**	**4**	**19**	**18**				

List of Professional Electives-I

1	5	PE-I	CSE	22AML511	PE-I: Design Patterns
2	5	PE-I	CSE	22AML512	PE-I: **Lab:** Design Patterns
3	5	PE-I	CSE	22AML513	PE-I: Embeded AI
4	5	PE-I	CSE	22AML514	PE-I: **Lab:** Embeded AI
5	5	PE-I	CSE	22AML515	PE-I: Business Intelligence
6	5	PE-I	CSE	22AML516	PE-I: **Lab:** Business Intelligence
7	5	PE-I	CSE	22AML517	PE-I: Advanced Web Technologies
8	5	PE-I	CSE	22AML518	PE-I: **Lab:** Advanced Web Technologies

Open Elective-I

1	5	OE-I	CSE	22AML531	OE I: Introduction to Artificial Intelligence
2	5	OE-I	CSE	22AML532	OE I: Software Testing

Open Elective-II

1	5	OE-II	CSE	22AML551	OE II: Introduction to Machine Learning
2	5	OE-II	CSE	22AML552	OE II: Problem solving Techniques and Statistical methods

List of Mandatory Learning Course (MLC)												
1	5	HS	T&P	MLC2125	YCAP5 :	**A**	3	0	0	3	0	
2	5	BSE			DESIGN THINKING	**A**	2	0	0	2	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

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TA = for Practical : MSPA will be 15 marks each**

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(Department of Computer Science & Engineering)

CSE (AIML)

SoE No. 22AML-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
SIXTH SEMESTER															
1	6	PC	CSE	22CSE601	Advanced Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	CSE	22CSE602	**Lab:** Advanced Artificial Intelligence	**P**	0	0	2	2	1		60	40	
3	6	PC	CSE	22CSE603	Computer Networks	**T**	3	0	0	3	3	30	20	50	3 Hours
4	6	PC	CSE	22CSE604	**Lab:** Computer Networks	**P**	0	0	2	2	1		60	40	
5	6	PC	CSE	22CSE605	Digital Image Processing	**T**	3	0	0	3	3	30	20	50	3 Hours
6	6	PC	CSE		**Lab:** Digital Image Processing	**P**	0	0	2	2	1		60	40	
7	6	PE	CSE		**Professional Elective-II**	**T**	3	0	0	3	3	30	20	50	3 Hours
8	6	PE	CSE		**Lab: Professional Elective-II**	**P**	0	0	2	2	1		60	40	
9	6	OE	CSE		**Open Elective - III**	**T**	3	0	0	3	3	30	20	50	3 Hours
10	6	OE	CSE	22CSE606	**Open Elective - IV**	**T**	3	0	0	3	3	30	20	50	3 Hours
					TOTAL		**18**	**0**	**8**	**26**	**22**				

List of Professional Electives-II

1	6	PE-II	CSE	22AML611	PE II: Blockchain Technology
2	6	PE-II	CSE	22AML612	PE II: **Lab:** Blockchain Technology
3	6	PE-II	CSE	22AML613	PE II: Internet of Things
4	6	PE-II	CSE	22AML614	PE II: **Lab:** Internet of Things
5	6	PE-II	CSE	22AML615	PE II: Cloud computing
6	6	PE-II	CSE	22AML616	PE II: **Lab:** Cloud Computing

Open Elective-III

1	6	OE-III	CSE	22AML631	OE III: Introduction to Artificial Intelligence
2	6	OE-III	CSE	22AML632	OE III: Software Testing

Open Elective-IV

1	6	OE-IV	CSE	22AML651	OE IV: Introduction to Machine Learning
2	6	OE-IV	CSE	22AML652	OE IV: Problem solving Techniques and Statistical methods

List of Mandatory Learning Course (MLC)												
1	6	HS	T&P	MLC2126	YCAP6 :	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class

TA = for Practical : MSPA will be 15 marks each**

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(Department of Computer Science & Engineering)

CSE (AIML)

SoE No. 22AML-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
SEVENTH SEMESTER															
1	7	7	PC	22CSE701	Computer Vision	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	7	PC	22CSE702	**Lab:** Computer Vision	**P**	0	0	2	2	1		60	40	
3	7	7	PC	22CSE703	Shallow & Deep Learning	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	7	PC	22CSE704	**Lab:** Shallow & Deep Learning	**P**	0	0	2	2	1		60	40	
5	7	7	HS		Cyber laws & Ethics in IT	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	7	PE		**Professional Elective-III**	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	7	PE		**Professional Elective-IV**	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	7	PE		**Lab:Professional Elective-IV**	**P**	0	0	2	2	1		60	40	
9	7	7	PE	22CSE705	**Professional Elective-V**	**T**	3	0	0	3	3	30	20	50	3 Hours
10	7	7	STR	22CSE706	Project Phase-II	**P**	0	0	10	10	5		60	40	
11	7	7	STR	22CSE706	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
						TOTAL	**18**	**0**	**16**	**34**	**28**				

List of Professional Electives-III

1	7	PE-III	CSE	22AML711	PE III: Big Data Analytics
2	7	PE-III	CSE	22AML712	PE III: Nature Inspired Computing
3	7	PE-III	CSE	22AML713	PE III: Information Retrival System
4	7	PE-III	CSE	22AML714	PE III: Data Mining

List of Professional Electives-IV

1	7	PE-IV	CSE	22AML731	PE IV: Cyber Forensic
2	7	PE-IV	CSE	22AML732	PE IV: **Lab:** Cyber Forensic
3	7	PE-IV	CSE	22AML733	PE IV: AI for Medical Domain
4	7	PE-IV	CSE	22AML734	PE IV: **Lab:** AI for Medical Domain
5	7	PE-IV	CSE	22AML735	PE IV: Cognitive System
6	7	PE-IV	CSE	22AML736	PE IV: **Lab:** Cognitive System
7	7	PE-IV	CSE	22AML737	PE IV: Natural Language Processing
8	7	PE-IV	CSE	22AML738	PE IV: **Lab:** Natural Language Processing

List of Professional Electives-V

1	7	PE-V	CSE	22AML751	PE V: Robotics and its Applications
2	7	PE-V	CSE	22AML752	PE V: Augumented / Virtual reality
3	7	PE-V	CSE	22AML753	PE V: Game theory
4	7	PE-V	CSE	22AML754	PE V: Human Computer Interaction

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activitied decided by course teacher, TA3 - 3 marks on class

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.00**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2022

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Science & Engineering)

CSE (AIML)

SoE No. 22AML-101

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Eighth Semester															
1	**8**	**STR**	AML	22CSE801	Major Project	**P**	0	0	12	12	3		60	40	
2	**8**	**STR**	AML	22CSE802	Extra Curricular Activity Evaluation	**P**	0	0	0	0	2		100		
					TOTAL EIGHTH SEM		**0**	**0**	**12**	**12**	**5**				
					GRAND TOTAL		**111**	**6**	**70**	**185**	**156**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 12 marks on lecture quizzes, 12 marks on two TA2 activitied decided by course teacher, 2 marks on class attendance and 4

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.00**	**Applicable for AY 2022-23 Onwards**
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Syllabus

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

3rd to 8th Semester

Civil Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CV-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						47				
				Third Semester										
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3
2	3	PC	CV2201	Strength of Materials	T	3	0	0	3	3	30	20	50	3
3	3	PC	CV2202	**Lab:-** Strength of Materials	P	0	0	2	2	1		60	40	
4	3	PC	CV2203	Geotechnical Engineering	T	3	0	0	3	3	30	20	50	3
5	3	PC	CV2204	**Lab:-** Geotechnical Engineering	P	0	0	2	2	1		60	40	
6	3	PC	CV2205	Fluid Mechanics	T	3	0	0	3	3	30	20	50	3
7	3	PC	CV2206	**Lab:-** Fluid Mechanics	P	0	0	2	2	1		60	40	
8	3	PC	CV2207	Water Supply Engineering	T	3	0	0	3	3	30	20	50	3
9	3	PC	CV2208	**Lab:-**Water Supply Engineering	P	0	0	2	2	1		60	40	
				TOTAL		**15**	**0**	**8**	**23**	**19**				
				Fourth Semster										
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	20	50	3
2	4	PC	CV2251	Concrete Technology	T	3	0	0	3	3	30	20	50	3
3	4	PC	CV2252	**Lab:-** Concrete Technology	P	0	0	2	2	1		60	40	
4	4	PC	CV2253	Surveying	T	3	0	0	3	3	30	20	50	3
5	4	PC	CV2254	**Lab:-** Surveying	P	0	0	2	2	1		60	40	
6	4	PC	CV2255	Structural Analysis	T	4	0	0	4	4	30	20	50	3
7	4	PC	CV2256	**Lab:-** Structural Analysis	P	0	0	2	2	1		60	40	
8	4	PC	CV2257	Transportation Engineering	T	3	0	0	3	3	30	20	50	3
9	4	PC	CV2258	**Lab:-** Transportation Engineering	P	0	0	2	2	1		60	40	
				TOTAL		**16**	**0**	**8**	**24**	**20**				
				Audit Courses										
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	A	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE	A	3	0	0	3	0				

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TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	20	50	3
2	5	PC	CV2301	Reinforced Concrete Structures	**T**	3	0	0	3	3	30	20	50	4
3	5	PC	CV2302	Advanced Structural Analysis	**T**	3	0	0	3	3	30	20	50	3
4	5	PC	CV2303	**Lab:-** Analysis and Design Studio	**P**	0	0	2	2	1		60	40	
5	5	PE-I		Professional Elective-I	**T**	3	0	0	3	3	30	20	50	3
6	5	PE-I		**Lab:-** Professional Elective -I	**P**	0	0	2	2	1		60	40	
7	5	OE-I		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3
8	5	OE-I		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3
					TOTAL	**18**	**0**	**4**	**22**	**20**				

Professional Elective - I

1	5	PE-I	CV2311	PE-I : Advanced Surveying
	5	PE-I	CV2312	**PE-I Lab :** Advanced Surveying
2	5	PE-I	CV2313	PE-I : Computer Applications in Civil Engineering
	5	PE-I	CV2314	**PE-I Lab :** Computer Applications in Civil Engineering
3	5	PE-I	CV2315	PE-I : Building Construction and Materials
	5	PE-I	CV2316	**PE-I Lab :** Building Construction and Materials
4	5	PE-I	CV2317	PE-I : Matrix Analysis of Structures
	5	PE-I	CV2318	**PE-I Lab :** Matrix Analysis of Structures
5	5	PE-I	CV2319	PE-I : Advanced Concrete Technology
	5	PE-I	CV2320	**PE-I Lab :** Advanced Concrete Technology
6	5	PE-I	CV2321	PE-I : Water Treatment
	5	PE-I	CV2322	**PE-I Lab :** Water Treatment
7	5	PE-I	CV2323	PE-I : Environmental Management
	5	PE-I	CV2324	**PE-I Lab :** Environmental Management
8	5	PE-I	CV2325	PE-I : Soil Characterization & Identification
	5	PE-I	CV2326	**PE-I Lab :** Soil Characterization & Identification
9	5	PE-I	CV2327	PE-I : Geographical Information Systems
	5	PE-I	CV2328	**PE-I Lab :** Geographical Information Systems

Open Electives -I

1	5	OE-I	CV2331	OE-I : Building Services Engineering
2	5	OE-I	CV2332	OE-I : Construction Techniques
3	5	OE-I	CV2333	OE-I : Introduction to Environmental Management
4	5	OE-I	CV2334	OE-I : Basics of Transportation Engineering
5	5	OE-I	CV2335	OE-I : Basics of Water Resource Engineering
6	5	OE-I	CV2336	OE-I : Elements of Water Power Engineering

Open Electives -II

1	5	OE-II	CV2341	OE II : Elements of Earthquake Engineering
2	5	OE-II	CV2342	OE II : Introduction to Finite Element Method
3	5	OE-II	CV2343	OE II : Air Pollution and Solid Waste Management
4	5	OE-II	CV2344	OE-II : Environmental & Social Impact Assessment
5	5	OE-II	CV2345	OE II : Disaster Management

Audit Courses											
1	5	HS	AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0	

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Yeshwantrao Chavan College of Engineering

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SoE No. CV-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	**3**
2	6	PC	CV2351	Steel Structures	**T**	3	0	0	3	3	30	20	50	4
3	6	PC	CV2352	**Lab:-** Building Design Drawing	**P**	0	0	2	2	1		60	40	
4	6	PC	CV2353	Hydraulic Engineering	**T**	3	0	0	3	3	30	20	50	3
5	6	PC	CV2354	**Lab:-** Hydraulic Engineering	**P**	0	0	2	2	1		60	40	
6	6	PC	CV2355	Foundation Engineering	**T**	3	0	0	3	3	30	20	50	3
7	6	PE-II		Professional Elective -II	**T**	3	0	0	3	3	30	20	50	3
8	6	OE-II		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3
9	6	OE-IV		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3
10	6	STR	CV2360	Industry Visit and its report	**P**	0	0	0	0	1		100		
					TOTAL	**21**	**0**	**4**	**25**	**24**				

Audit Courses														
1	6	HS	AU2128	YCCE Communication Aptitude Preparation (YCAP6.1) for CV,EL	**A**	3	0	0	3	0				

Professional Elective - II

1	6	PE-II	CV2361	PE-II : Building Services
2	6	PE-II	CV2362	PE-II : New Engineering Materials
3	6	PE-II	CV2363	PE-II : Construction Management And Machinery
4	6	PE-II	CV2364	PE-II : Earthquake Engineering
5	6	PE-II	CV2365	PE-II : Optimization Techniques
6	6	PE-II	CV2366	PE-II : Introduction to Remote Sensing
7	6	PE-II	CV2367	PE-II : Environmental Geotechniques
8	6	PE-II	CV2368	PE-II : Traffic Engineering
9	6	PE-II	CV2369	PE-II : Water Transmission and Distribution Systems
10	6	PE-II	CV2370	PE-II : Construction Management

Open Electives -III

1	VI	OE-III	CV2371	OE-III : Building Services Engineering
2	VI	OE-III	CV2372	OE-III : Construction Techniques
3	VI	OE-III	CV2373	OE-III : Introduction to Environmental Management
4	VI	OE-III	CV2374	OE-III : Basics of Transportation Engineering
5	VI	OE-III	CV2375	OE-III : Basics of Water Resource Engineering
6	VI	OE-III	CV2376	OE-III : Elements of Water Power Engineering

Open Electives -IV

1	VI	OE-IV	CV2381	OE-IV : Elements of Earthquake Engineering
2	VI	OE-IV	CV2382	OE-IV : Introduction to Finite Element Method
3	VI	OE-IV	CV2383	OE-IV : Air Pollution and Solid Waste Management
4	VI	OE-IV	CV2384	OE-IV : Environmental & Social Impact Assessment
5	VI	OE-IV	CV2385	OE-IV : Disaster Management

Coursera Electives

1	6	PE-II	CV2377	PE-II : Construction Management Technicques
2	5	PE-I	CV2329	PE-I : Mastering bitumen for better roads and innovative applications
	5	PE-I	CV2330	**PE-I : Lab** Mastering bitumen for better roads and innovative applications

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Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

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SoE No. CV-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	CV2401	Estimating & Costing	**T**	3	0	0	3	3	30	20	50	3
2	7	PC	CV2402	**Lab:-** Estimating &Costing	**P**	0	0	2	2	1		60	40	
3	7	PC	CV2403	Wastewater Engineering	**T**	3	0	0	3	3	30	20	50	3
4	7	PC	CV2404	Hydrology and Water Resources Engineering	**T**	3	0	0	3	3	30	20	50	3
5	7	PE-III		Professional Elective -III	**T**	3	0	0	3	3	30	20	50	3
6	7	PE-IV		Professional Elective -IV	**T**	3	0	0	3	3	30	20	50	3
7	7	PE-V		Professional Elective -V	**T**	3	0	0	3	3	30	20	50	3
8	7	STR	CV2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	CV2410	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**18**	**0**	**6**	**24**	**23**				

Professional Elective - III

1	7	PE-III	CV2411	PE-III : Prestressed Concrete
2	7	PE-III	CV2412	PE-III : Advanced RCC
3	7	PE-III	CV2413	PE-III : Numerical Methods and Computational Techniques
4	7	PE-III	CV2414	PE-III : Environmental Impact Assessment
5	7	PE-III	CV2415	PE-III : Energy Conversion and Management
6	7	PE-III	CV2416	PE-III : Geotechnical Investigation & Ground Improvement Techniques
7	7	PE-III	CV2417	PE-III : Earth and Earth Retaining Structures
8	7	PE-III	CV2418	PE-III : Urban Transportation Planning
9	7	PE-III	CV2419	PE-III : Advanced Hydraulics

Professional Elective - IV

1	7	PE-IV	CV2421	PE-IV : Natural Resources Management
2	7	PE-IV	CV2422	PE-IV : Finite Element Method
3	7	PE-IV	CV2423	PE-IV : Introduction to Structural Dynamics
4	7	PE-IV	CV2424	PE-IV : Wastewater Treatment
5	7	PE-IV	CV2425	PE-IV : Environmental Legislation and Management System
6	7	PE-IV	CV2426	PE-IV : Advanced Foundation Engineering
7	7	PE-IV	CV2427	PE-IV : Geosynthetics
8	7	PE-IV	CV2428	PE-IV : Advanced Transportation Engineering
9	7	PE-IV	CV2429	PE-IV : Watershed Management
10	7	PE-IV	CV2430	PE-IV : Advanced Fluid Mechanics and Hydraulic Machines

Professional Elective - V

1	7	PE-V	CV2431	PE-V : Maintenance and Rehabilitation Engineering
2	7	PE-V	CV2432	PE-V : Project Planning and Management
3	7	PE-V	CV2433	PE-V : Modern Surveying Technique
4	7	PE-V	CV2434	PE-V : Advanced Steel Design
5	7	PE-V	CV2435	PE-V : Design of Bridge Structures
6	7	PE-V	CV2436	PE-V : Industrial Waste Water Treatment and Reuse
7	7	PE-V	CV2437	PE-V : Finite Element methods in Geotechnical Engineering
8	7	PE-V	CV2438	PE-V : Pavement Design
9	7	PE-V	CV2439	PE-V : Water Power Engineering
10	7	PE-V	CV2440	PE-V : Structural Engineering Practices

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SoE No. CV-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

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Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	CV2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	CV2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
					TOTAL	**0**	**0**	**12**	**12**	**10**				
					GRAND TOTAL	**88**	**0**	**42**	**130**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

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Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

3rd Semester

Civil Engineering

28 June 2019

III Semester
GE2201 - Engineering Mathematics-III

Objectives	Outcomes
1. Finite Differences for Numerical Differentiation and Integration. 2. Different Transformation for solving difference and differential equation. 3. Partial differential equation with 1st and higher order.	1. Estimate the Calculus of Numerical Function and Solve difference equations. 2. Determine the transforms and inverse transforms of various functions and Apply it to solve Mathematical equations. 3. Discuss the periodicity of functions and express it in terms of Fourier series. 4. Solve partial differential equations.
Mapped Program Outcomes : 2, 3	

UNIT–1 :Finite Differences Difference table; Operators E and Δ, Central differences, Factorials notation, Numerical differentiation and integration, Difference equations with constant coefficients.	**[06 Hrs.]**
UNIT–2 : Laplace Transform Laplace transforms and their simple properties, Unit step function, inverse of Laplace transform, convolution theorem, Applications of Laplace transform to solve ordinary differential equations.	**[07 Hrs.]**
UNIT–3 : Z-transform Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant co-efficient.	**[06 Hrs.]**
UNIT–4 : Fourier Series Periodic Functions and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions	**[07 Hrs.]**
UNIT–5 : Partial Differential Equation **Partial Differential Equation:** Partial Differential Equations of first order first degree i.e. Lagrange"s form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve first and second order partial differential equations	**[07 Hrs.]**
UNIT–6 : Fourier Transform **Fourier Transform :** Definition: Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval"s Identity, convolution Theorem	**[06 Hrs.]**

Text Books:

1. Advance Engineering Mathematics, 9th Edition (September 2009), Kreyszig., Wiley
2. Higher Engineering Mathematics, 40th edition, (2010), B.S. Grewal, Khanna Publishers (2006)
3. Advanced Engineering Mathematics, 8th revised edition, 2007, H.K. Dass, Publisher: S.Chand and Company Limited

Reference Books:

1. Mathematics for Engineers, 19th edition, (2007), Chandrika Prasad., John Wiley & Sons.
2. Advanced Mathematics for Engineers, 4th edition, (2006), Chandrika Prasad, John Wiley & Sons.
3. Applied Mathematics for Engineers, 3rd edition, (1970), L.A. Pipes and Harville, McGraw Hill.
4. A text Book of Applied Mathematics, 3rd edition, (2000), P.N. and J.N. Wartikar, Pune Vidyarthi Griha, Prakashan

III Semester
CV2201 - Strength of Materials

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Various mechanical properties of materials. 2. Simple and compound stresses and strains 3. Bending of beams and torsion of shaft, deflection in beams 4. Shear force and bending moment and their graphical representation.	Students will be able to 1. Explain the basic concept and mechanical properties of materials. 2. Construct graphically the variation of shear force, bending moment and stresses. 3. Analyze the behavior of various structural components under different types of loading. 4. Calculate the slope, deflection and torsion of shaft.
Mapped Program Outcomes : 1, 2, 3, 4, 9, 10	

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UNIT–1 : **Mechanical properties and uniaxial problems:** Types of force distribution, concept of stress, strain and their relationship, stress strain behavior of ductile and brittle material in uniaxial state of stress, elastic constants, relation between elastic constants Uniaxial loading and deformation of simple cases of statically indeterminate problems under axial loading. Stress due to variation of temperature.	**[07 Hrs.]**
UNIT–2 : **Shear force and bending moment diagram:** Axial force, shear force and bending moment diagram. Determination of axial force, shear force and bending moment at a section. Axial force, shear force and bending moment diagram in beams, relation between bending moment, shear force and loading.	**[06 Hrs.]**
UNIT–3 : **Stresses in beam:** Theory of simple bending, Bending stresses in simple beam. Shear stresses in simple beams and shear stress distribution. Direct and bending stresses.	**[07 Hrs.]**
UNIT–4 : **Torsion of Shaft:** Torsion of circular sections, assumptions and derivation of relation between torsional moment, shear stress and angle of twist. Torsional stress in solid and hollow circular sections.	**[06 Hrs.]**
UNIT–5 : **Deflection of Beams**: Derivation of differential equation of elastic curve, Differential Equation relating deflection moment, shear and load. Deflection of simple beams by double integration method.	**[07 Hrs.]**
UNIT–6 : **Compound stresses:** State of stress in two dimensions, principal stresses, combined effect of Bending and Shear. Thin walled cylindrical and spherical pressure vessel subjected to internal pressure.	**[06 Hrs.]**

Text Books:

1. Bhavikatti S. S., Strength of Materials, 3rd Edition, Vikas Publication House Pvt. Ltd., Noida, UP, 2008.
2. Popov E.P., Engineering Mechanics of Solids, 4th Edition, Printice Hall, 2002.

Reference Books:

1. Chakraborti, M., Strength of Materials, S. K. Kataria& Sons.
2. Pytel A., Kivsalaas J. Mechenics of Material, CENGAGE LEARNING, (INDIAN EDITION),2010.
3. Shah V.L., Ogale R.A., Strength of Materials and Machine Element, 2nd Edition, Jain Book Agency, New Delhi.

III Semester
CV2202 - LAB : Strength of Materials

Objective	Course Outcome
1. Various mechanical properties of materials. 2. Simple and compound stresses and strains 3. Bending of beams and torsion of shaft, deflection in beams 4. Shear stress, stiffness, and impact test.	Students will be able to 1. Explain the basic concept and mechanical properties of materials. 2. Calculate the Shear stress, stiffness, and impact test. 3. Analyze the behavior of various structural components under different types of loading. 4. Evaluate the properties of materials by conducting experiment.
Mapped Program Outcomes : 1, 4, 9, 10	

PRACTICAL:
Minimum **Ten** practical to be performed from the list as below:-

1. To study the universal testing machine.
2. To study the extensometer.
3. To perform tension test on metal.
4. To determine flexural strength of timber beam.
5. To determine modulus of rigidity of M.S. bar by torsion test.
6. To determine impact value of metal by Charpy Impact Test and Izod Impact Test.
7. To determine Rockwell hardness number for M.S. and Aluminium bar.
8. To determine Brinell hardness number for M.S. and Aluminium bar.
9. To determine the stiffness of spring and modulus of rigidity.
10. To perform shear test on metals.
11. To determine the compressive strength of specimen.
12. To determine water absorption of roofing tiles, flooring tiles and bricks.

III Semester
CV2203 - Geotechnical Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Index properties of soil and its classification. 2. Engineering properties of soil. 3. Compaction of soil. 4. Vertical stresses and shear strength of soil.	Students will be able to 1. Determine index properties of soil and its classification 2. Compute Engineering properties of soil. 3. Predict Compaction of soil. 4. Calculate Vertical stresses and shear strength of soil
Mapped Program Outcomes : 1, 2, 3, 4, 8, 9, 10 **PSO:** ii	

UNIT–1 : **Introduction:** Formation of soil, residual & transported soil, Role of Geotechnical engineer in construction industry. **Phases of Soil:** Soil as three-phase system. Various soil weight & volume inter–relationship.	**[06 Hrs.]**
UNIT–2 : **Index Properties & Their Determination:** Water content, specific gravity, sieve analysis, particle size distribution curve, Density, Consistency of soil. **Classification of Soil:** Unified & I.S. classification system.	**[07 Hrs.]**
UNIT–3 : **Permeability:** Darcy"s law & its validity, Discharge & seepage velocity, factors affecting Permeability, Determination of coefficient of permeability by Laboratory, permeability of stratified soil. **Seepage:** Seepage pressure, quick sand condition, flow nets, flow nets, uplift pressure, piping. Principle of effective stress.	**[07 Hrs.]**
UNIT–4 : **Stress Distribution:** Stress distribution in soil mass, Boussinesq"s point load theory, uniformly loaded circular areas, Equivalent point load method, Newmark"s charts.	**[06 Hrs.]**
UNIT–5 : **Compaction:** Mechanics of compaction, factors affecting compaction, Standard & Modified Proctor Tests, Optimum Moisture Content, field compaction methods, Quality control. **Consolidation:** Terzaghi"s 1–D consolidation theory, various terms associated with consolidation, settlement rate, time rate of consolidation.	**[06 Hrs.]**
UNIT–6 : **Shear Strength:** Introduction, Mohr"s diagram, Mohr-Coulomb"s failure theory, Measurement of Shear strength by Direct shear test, Triaxial test, Unconfined compression test, Vane shear test, Shear test under different drainage conditions. Shear characteristics of sands and clays, stress paths, effective and total shear strength parameters	**[07 Hrs.]**

III Semester
CV2203 - Geotechnical Engineering

Text Books:

1. Soil Mechanics & Foundations, Punmia B. C., Jain A.K., Jain A.K., 16th edition, Laxmi Publications, New Delhi, 2005.
2. Geotechnical Engineering – Principles and Practices of Soil Mechanics and Foundation Engineering, Murthy V.N.S., CRC Press, 2003.
3. Basic and Applied Soil Mechanics, Gopal R., Rao A.S.R., 2nd edition, New Age International Publishers, New Delhi

Reference Books:

1. Soil Mechanics and Foundation Engineering, Purushothama Raj P., 1st edition, Pearson Education India, 2008
2. Geotechnical Engineering, Datta M, Gulhati S. K., 5th edition, Tata McGraw Hills Publications, New Delhi, 2005
3. Problems in Soil Engineering, Shamsher Prakash, Gopal Ranjan, Sarita Prakashan Publishers, Meerut, U.P., 1976.
4. Physical and Geotechnical Properties of Soils, Joseph E. Bowles, 2nd Revised edition (March 1984), McGraw-Hill College

III Semester
CV2204 - LAB : Geotechnical Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Index properties of soil and its classification. 2. Engineering properties of soil. 3. Compaction of soil. 4. Vertical stresses and shear strength of soil.	Students will be able to 1. Determine index properties of soil and its classification 2. Compute Engineering properties of soil. 3. Predict Compaction of soil. 4. Calculate Vertical stresses and shear strength of soil
Mapped Program Outcomes : 1, 2, 3, 4, 8, 9, 10 **PSO:** ii	

1. To determine Moisture content of given soil sample.
2. To determine Specific gravity of soil.
3. To perform Grain Size Analysis – (Dry Sieve Analysis)
4. To determine Atterberg"s Limits.
5. To determine coefficient of Permeability by (i) Constant head, and (ii) Falling head.
6. To perform Standard Proctor Compaction Test and to determine OMC.
7. Field Density determination by sand replacement method.
8. Field Density determination by core cutter method.
9. To perform Unconfined compression test.
10. To perform Direct shear Test.
11. To perform Triaxial Compression test (Demonstration)
12. To find F.S.W. and D.F.S. of soil. Identification of swelling Soil.
13. To study the Consolidation characteristics of soil

Text Books:

1. Soil Testing for Engineers, Mittal S., Shukla J.P., Khanna Publishers, New Delhi, 2006.
2. Manual of Soil Laboratory Testing, Head K. H., 3rd edition, Whittles Publishing, 2008

III Semester
CV2205 - Fluid Mechanics

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. The fundamentals of fluid properties, Fluid static, pressure measuring devices. 2. Motion of fluid without reference of force 3. Motion of fluid producing with reference of force 4. Flow measuring devices in pipe, channel and tank	Students will be able to 1. Calculate various fluid properties, Fluid pressure, forces on various surface 2. Determine various flow patterns of fluid produced without reference of force. 3. Examine the fundamental principles of fluid mechanics and related applications to fluid flow. 4. Compute the flow in pipe, channel and tank by using various devices.
Mapped Program Outcomes:- 1, 2, 3, 8, 9, 10	

UNIT–1 : **Fluids and Their Properties**: Definition of fluid, Differences between solids, liquids and gases , fluid properties, mass density, specific weight and specific gravity, viscosity, Newton"s equation, coefficients of dynamic and kinematic viscosity, Rheological Diagram, Ideal and real fluids. Compressibility and bulk modulus. Surface tension, capillarity, pressure inside a bubble and cylindrical jet, vapor pressure and cavitation. Effect of pressure and temperature on fluid properties.	**[07 Hrs.]**
UNIT–2 : **Fluids Pressure and its Measurement:** Fluid pressure, law of fluid pressure, variation of fluid pressure with depth, pressure and head, Atmospheric pressure and vacuum. Gauge and absolute pressures. Pressure measurement by manometers.	**[06 Hrs.]**
UNIT–3 : **Hydrostatics:** Total pressure & center of pressure, Forces on a Horizontal submerged surfaces, Vertical submerged surfaces, Inclined submerged surfaces, Curved submerged surfaces.	**[06 Hrs.]**
UNIT–4 : **Kinematics of Flow :** Lagrangian and Eularian approaches in fluid flow description. Steady, unsteady, uniform, Non–uniform flow. One, two and three dimensional flow, Rotational & Irrotational flow. Streamline, path line, streak line Velocity and its variation with space and time. Acceleration of fluid particles, Normal and tangential acceleration. Equation of continuity in Cartesian co-ordinates, stream functions, velocity potential function. Relationship between stream function and velocity potential, flow net.	**[07 Hrs.]**
UNIT–5 : **Kinetics of Flow:** Forces influencing motion, Euler"s equations of motion for one dimensional flow, Bernoulli"s equation for ideal fluids, Assumptions, derivation, limitation and application, Kinetic energy correction factor. Momentum equation, forces on pipe bends and closed conduits, Momentum correction factor. Discharge measurement by venturimeter, orifice meter.	**[06 Hrs.]**
UNIT–6 : **Flow through Orifices and mouthpieces:** Definition, types, hydraulic coefficients, factors affecting them and their experimental determination, time for emptying tank by orifices. Discharge through large and submerged orifices, external and internal mouth pieces, running free and running full, pressure at vena contracta, Discharge through a convergent- divergent mouthpiece.	**[07 Hrs.]**

III Semester
CV2205 - Fluid Mechanics

Text Books:

1. Fluid Flow in Pipes and Channels, Asawa, G.L., 1st edition, CBS Publishers and Distributers, 2009
2. Fluid Mechanics and Its Applications, Gupta V., Gupta S.K., John Wiley & Sons, 1984.
3. Hydraulics and Fluid Mechanics Including Hydraulics Machines, Modi P.N., Seth S.M., 14th edition, Standard Book House Publishers, New Delhi, 2009

Reference Books:

1. Fluid Mechanics, White F.M, 6th Edition, McGraw-Hill, 2007
2. Introduction to Fluid Mechanics, Fox R.W., McDonald A.T, 6th edition, John Wiley & Sons, 2003

III Semester
CV2206 - LAB : Fluid Mechanics

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. The fundamentals of fluid properties, Fluid static, pressure measuring devices. 2. Motion of fluid without reference of force 3. Motion of fluid producing with reference of force 4. Flow measuring devices in pipe, channel and tank	Students will be able to 1. Determine floating conditions of submerged body. 2. Explain various flow patterns of fluid produced without reference of force. 3. Examine the fundamental principles of fluid mechanics and related applications to fluid flow. 4. Compute the flow in pipe, channel and tank by using various devices.
Mapped Program Outcomes : 1, 2, 3, 4, 8, 9, 10	

PRACTICAL
Minimum of **Ten** practical from the list given below shall be performed.

1. Determination of metacentric height of a given ship models.
2. Verification of Bernoulli"s theorem
3. Velocity measurement by Pitot tube.
4. Discharge measurement by Venturimeter- determination of coefficient discharge.
5. Discharge measurement by pipe orifice, determination of Cd
6. Determination of hydraulic coefficient of a sharp edged circular orifice.
7. Determination of Cd of an external cylindrical mouth piece
8. Determination of Cd of a rectangular notch:
9. Determination of Cd of a triangular notch.
10. Determination of types of flow in pipe using Reynold"s apparatus.
11. Study of micrometer contraction gauge

Reference Books:
1. Laboratory work in Hydraulic Engineering, Asawa, G.L, New Age International Publishers

III Semester
CV2207 - Water Supply Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Water demand, components of public water supply scheme and population forecasting. 2. Conveyance of water, water quality and objectives of water treatment. 3. Working of various water treatment units and distribution system. 4. Solid waste management.	Students will be able to 1. Predict population forecasting including design of water conveyance system and raising main. 2. Explain different characteristics of water and water treatment methods. 3. Classify different methods and patterns of distribution of water. 4. Illustrate various methods of solid waste management.
Mapped Program Outcomes : 1, 3, 6, 7, 8, 9, 10, 12	

UNIT–1 : Introduction, Importance and necessity of water supply scheme, Water demand: Types of demand, factors affecting per Capita demand, variation in demand, design period and methods of population forecasting.	**[07 Hrs.]**
UNIT–2 : Conveyance of water: Types of pipes, joints in pipes, valves and fittings, Intake structures: Location types – river, lake, canal reservoir, Hydraulic design of rising mains. Pump: Classification, working, merits, demerits & selection of pumps.	**[06 Hrs.]**
UNIT–3 : Water quality: General idea of water borne diseases, Physical, Chemical, and bacteriological characteristics and analysis of water, Standards of drinking water. Water treatment: Objective of treatment, unit operations and processes, Flow sheet of conventional water treatment plant. Aeration: Purpose, types of aerators. Coagulation and Flocculation: Definition, Principles, types of coagulants and reactions, coagulant doses, types of mixing and flocculation devices.	**[06 Hrs.]**
UNIT–4 : Sedimentation: Principles, types of settling basins, inlet and outlet arrangements. Clariflocculators. Filtration: Mechanism of filtration, types of filters, working, operational problems in filters.	**[07 Hrs.]**
UNIT–5 : Disinfection: Purpose, Mechanism, criteria for good disinfectant, types of disinfectants, chlorination. Distribution systems: Requirements for a good distribution system, methods of distribution, systems and their layouts, Leakage and leak-detector. Storage reservoirs for treated water: Types, capacity of reservoir, mass curve.	**[06 Hrs.]**
UNIT–6 : Introduction to Municipal solid waste management: Generation sources, composition, Quality, Methods of Collection, transportation, treatment and disposal, 3 R"s of solid waste management.	**[07 Hrs.]**

III Semester
CV2207 - Water Supply Engineering

Text Books:

1. Water Supply Engineering (Vol.–I & II), Modi P.N., 2nd Edition, Standard Book House / Rajsons Publication, New Delhi.
2. Water Engineering, Punmia B. C., 2nd Edition, Laxmi Publication, New Delhi
3. Water Supply and Sanitary Engineering, Birdie G.S., Birdie J.S., 4th Edition, DhanpatRai Publication, New Delhi.
4. Water Supply Engineering, S. K. Garg, Khanna Publications.
5. Solid Waste Management for Developing country, A.D. Bhide & Sunderson, Indian National Scientific Documentation Centre, New Delhi

Reference Books:

1. Water supply and Sewarage, E.W. Steel, T.J.McGhee, 6 edition (31 January 1991), McGraw-Hill Education
2. Water and wastewater Engineering, Fair, Geyer and Okun, John Wiley & Sons Ltd

III Semester
CV2208 – LAB : Water Supply Engineering

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Water quality criteria and permissible standards. 2. Physical and chemical characteristics of water. 3. Biological characteristics of water 4. Analysis of various parameters related to water quality.	Students will be able to 1. Examine water quality standards. 2. Experiment on various characteristics of water 3. Compute different characteristics of water. 4. Relate water quality with permissible standards.
Mapped Program Outcomes : 1, 2, 4, 5, 8, 9, 10	

PRACTICAL
Minimum of **Ten** practical from the list given below shall be performed.

1. Determination of pH.
2. Determination of turbidity.
3. To perform Jar test.
4. Determination of available chlorine.
5. Determination of residual chlorine.
6. Determination of dissolved oxygen.
7. Determination of Hardness.
8. Determination of acidity
9. Determination of alkalinity
10. M.P.N. Test.
11. Plate count test.
12. B.O.D. test
13. C.O.D. test

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

4th Semester

Civil Engineering

28 June 2019

IV Semester
GE2204 – Advanced Mathematical Techniques

COURSE OBJECTIVE	COURSE OUTCOME
1. Numerical methods for solving transcendental equations, simultaneous equations and differential equations. 2. Random variable and probability distribution for determining statistical parameters. 3. Basic concept of fuzzy sets, Relations and fuzzy logic. 4. Mathematical formulation and solving methods of linear programing problems.	1. Apply numerical techniques to obtain approximate solutions of mathematical equations. 2. Formulate LPP in Mathematical form and determine the optimal solution of linear programming problems. 3. Determine the Statistical parameters for random variables. 4. Explain the basic concept of fuzzy sets, Relations and fuzzy logic.
Mapped Program Outcomes : 2, 3,	

UNIT–1 : Numerical Methods for Algebraic And Transcendental Equations: Errors in numerical calculation, Errors in series approximation, Rounding of error solutions of algebraic and transcendental equations, Iteration method, Bisection method, False position method, Newton Raphson method and their convergence Numerical Methods System of Algebraic Equations: Solution of System of linear equations, Gauss-Seidel method, Crouts method.	**[07 Hrs.]**
UNIT–2 : **Numerical Methods for Differential Equations:** Numerical solution of ordinary differential equation by Taylor"s series method, Picard's method, Runge"s second and third order method, Runge-Kutta 4th order method, Euler"s method, Euler"s modified method, Milne"s Predictor and Corrector method.	**[06 Hrs.]**
UNIT–3 : **Random Variables and Probability Distribution:** Discrete and continuous random variables, probability density function of one and two variables, Probability distribution function of one and two variables, Joint distributions and conditional distributions.	**[06 Hrs.]**
UNIT–4 : **Mathematical Expectation:** Definition of mathematical expectation, functions of one and two random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.	**[07 Hrs.]**
UNIT–5 : **Fuzzy Sets And Fuzzy Logic:** Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.	**[06 Hrs.]**
UNIT–6 : **Optimization Techniques:** Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method.	**[07 Hrs.]**

IV Semester
GE2204 – Advanced Mathematical Techniques

Text Books:

1. Computer based Numerical and Statistical Techniques, Paperback Firstedition 2003, M. Goyal, Laxmi Publication
2. Numerical Methods, Fourth Edition (2004), S.S. Sastri, PHI Publishers
3. Fuzzy Engineering, Softcover edition (2005), Bari Kosko, Prentice Hall PTR
4. Optimization Techniques, Year-2009.First Edition, C.Mohan and Kasum Deep, New Age International Publication

Reference Books:

1. Advanced Engineering Mathematics, 4th edition 2006, H.K. Dass, S. Chand Group
2. Advanced Engineering Mathematics, 9th Edition-2007, Kreyszig, JOHN WILEY & SONS
3. Mathematics for Engineers, 19th edition, 2007, Chandrika Prasad., JOHN WILEY & SONS
4. Advanced Mathematics for Engineers, 4th edition 2006, Chandrika Prasad, JOHN WILEY & SONS
5. Higher Engineering Mathematics, 40 edition 2010, B S Grewal, Khanna Publishers

IV Semester
CV2251 – Concrete Technology

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Properties of Cement, Fine aggregate and Coarse Aggregate. 2. Properties of Fresh Concrete, Harden Concrete and NDT. 3. Design of Concrete Mix for various grades. 4. Role of Admixture and Durability of Concrete.	Students will be able to 1. Explain the properties of the constituent materials of concrete. 2. Examine the properties of fresh and hardened concrete and tests to determine these properties. 3. Analyse the concrete mixes design and apply statistical quality control techniques 4. Explain admixtures, their role in concrete properties and various durability aspects in concrete.
Mapped Program Outcomes : 1, 3, 7, 8, 9, 10, 11, 12	

UNIT–1 : Introduction to related Indian standard of cement and aggregates. Constituents of cements, Hydration of cement. Water requirement, Physical properties and testing of cement. Effect of fineness, Initial, final and false setting of cement, Soundness test. Hardening and compressive strength, Grades and different types of cement, **Aggregates:** Coarse and fine aggregate, normal, light and heavy weight aggregates. aggregate characteristics and their significance in properties of concrete. Sampling, Particle shape and texture, Bond of aggregate, size & grading of aggregate, strength of aggregate. Mechanical properties and tests as per IS, bulking of sand. Crushed sand. Alkali aggregate reaction.	**[07 Hrs.]**
UNIT–2 : **Fresh Concrete:** Batching, Mechanical mixers, automatic batching and mixing plants. Efficiency of mixing, Workability and its Measurement, Factor affecting workability, setting time, Significance of w/c ratio, cohesiveness of concrete, Segregation, bleeding, voids, permeability. Hot weather concreting, Conveyance of concrete, placing of concrete, compaction, vibrators, curing of concrete, significance and methods, temperature effects on curing and strength gain, IS provisions, Maturity of concrete, Formwork for concrete- IS provisions. Introduction to Ready mix, pumped and self-compacting concrete. Introduction to relevant Indian standards.	**[06 Hrs.]**
UNIT–3 : **Strength of concrete:** Strength gain, factors affecting compressive strength, Tensile and flexural strengths, relation between compressive and tensile strength. Failure modes in concrete, cracking in compression. Impact strength, fatigue strength, shear, elasticity, Poisson"s ratio. Introduction to relevant Indian standards. **Testing of hardened concrete:** Compression test, cube strength and cylinder strength and their relation, effect of aspect ratio on strength. Flexural strength of concrete, determination of tensile strength, indirect tension test, splitting test, abrasion resistance, accelerated curing test. Introduction to relevant Indian standards. **Non Destructive test:** Significance, rebound hammer, ultra-sonic pulse velocity test, Advanced concrete testing equipment. Introduction to relevant Indian standards.	**[07 Hrs.]**
UNIT–4 : **Mix Design:** Process, statistical relation between main and characteristic strength, variance, standard deviation, factors affecting mix properties, grading of aggregates, aggregate/cement ratio etc. Degree of quality control, design of mix by IS method, introduction to road Note No. 4 (BS) and ACI method.	**[06 Hrs.]**

IV Semester
CV2251 – Concrete Technology

UNIT–5 : **Additives and admixtures:** Types of admixtures, natural products, diatomaceous earth, calcined clays of shales, volcanic glasses, byproducts–pozzolana, fly ash, silica fume, rice husk ash, metakaolin, G.G. blast furnace slag, admixtures- air entraining, water reducing, accelerators, retarders, plasticizers and superplasticizers, permeability reducing, grouting agents, surface hardeners. **Shrinkage**: Early volume changes, drying shrinkage, mechanism and factors affecting shrinkage, influence of curing conditions, differential shrinkage, carbonation, creep- factors influencing, relation between creep and time, nature of creep, effect of creep.	**[07 Hrs.]**
UNIT–6 : **Durability of concrete:** Significance, water as an agent of deterioration, permeability of concrete, sulphate attack and its control, sea water attack, acid attack, efflorescence, resistance to corrosion, abrasion and cavitation, process of rusting of steel.	**[06 Hrs.]**

Text Books:

1. Concrete Technology, M.S. Shetty, 6th edition, S. Chand & Company, Limited, 2008
2. "Concrete Technology, Gambhir M.L., 2013.
3. Properties of concrete, AM Neville, ELBS, London, 2006

Reference Books:

1. Concrete Microstrucutres: Properties and materials, PK Mehta and PJ Monterio
2. Concrete Technology, DF Orchard, Applied Sciences Publications

IV Semester
CV2252 – LAB : Concrete Technology

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Properties of Cement, Fine aggregate and Coarse Aggregate. 2. Properties of Fresh Concrete, Harden Concrete and NDT. 3. Design of Concrete Mix for various grades. 4. Role of Admixture and Durability of Concrete.	Students will be able to 1. Explain the properties of the constituent materials of concrete. 2. Examine the properties of fresh and hardened concrete and tests to determine these properties. 3. Analyse the concrete mixes design and apply statistical quality control techniques 4. Explain admixtures, their role in concrete properties and various durability aspects in concrete.
Mapped Program Outcomes : 1, 4, 5,	

PRACTICALS

Minimum of **Ten** practical from the list given below shall be performed.

1. To determine the normal consistency and initial setting time and final setting time by Vicat"s apparatus.
2. To determine the fineness of cement.
3. To perform soundness test of cement.
4. To determine fineness modulus for coarse and fine aggregates.
5. To determine the bulking of sand & plotting bulking curve.
6. To determine the compressive strength of cement.
7. To design the concrete mix of required characteristic strength according to I.S .method.
8. To determine the workability of concrete by slump cone, Vee bee apparatus, compaction factor and flow test.
9. To prepare and test the concrete cubes for compressive strength by Indian standard method.
10. Study of various Non-Destructive testing methods (NDT) in concrete Technology
11. To determine workability of cement mortar.
12. To determine the permeable voids of concrete.
13. To determine the permeability of mortar.

IV Semester
CV2253 – Surveying

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Compass, ranging rod, chain and its use in field. 2. Dumpy level, auto level, levelling staff and its various use in the field. 3. Theodolite, Consecutive and independent co-ordinates system of surveying. 4. Plane table, tacheometer and its use in the field.	Students will be able to 1. Discuss the basic concepts of surveying and use of conventional surveying equipment. 2. Calculate the horizontal, vertical angle and distances by using dumpy level and theodolite. 3. Explain the methods of plane table surveying and compute the volume of earthwork. 4. Compute the distance and elevation by using tachometric survey.
Mapped Program Outcomes : 1, 2, 5, 9, 10	

UNIT–1 : **Introduction, Chain and Compass Traversing** Introduction: - Classification, division of survey, Principle of survey, Chain Surveying : Basics, direct ranging and cross staff survey. Compass Surveying : Prismatic Compass, true and magnetic bearing, local attraction, Compass traversing.	**[07 Hrs.]**
UNIT–2 : **Direct Levelling** Levelling: Definitions, Study of Dumpy Level, temporary adjustments, principles of levelling, reduction of levels, classification of levelling, Curvature & Refraction corrections ,Reciprocal levelling.	**[06 Hrs.]**
UNIT–3 : **Contouring and Trignometrical Levelling** Contouring: Definitions, Characteristics, uses, and methods of locating contours, interpolation of contours Trignometrical Levelling: Indirect levelling, elevation of a point with base of an object accessible and inaccessible (with instrument station in/not in the same vertical plane as the elevated object)	**[06 Hrs.]**
UNIT–4 : **Theodolite Surveying** Theodolite: Introduction, Type of theodolite, temporary adjustment, Principle Axes and relationship, measurement of horizontal and vertical angles, Traverse Computation : Consecutive and independent co-ordinates, adjustment of closed traverse, Area calculation by co-ordinate.	**[07 Hrs.]**
UNIT–5 : **Plane Table Surveying & Computation of Area & Volume** Plane Table Survey: Equipment"s, advantages and disadvantages, orientation, methods of plane tabling, two point and three point problems in plane tabling. Computation of Area and Volume: Trapezoidal and Simpsons Rule,	**[06 Hrs.]**
UNIT–6 : **Tachometric Survey.** Tachometric Surveying :Classification, Principle of stadia method, Distance and elevation Calculation by Stadia method,	**[07 Hrs.]**

Text Books:

1. Surveying and Leveling (Vol-I&II), Kanitkar T.P., Kulkarni S.V., Pune Vidyarthi Griha Prakashan, Pune
2. Surveying and Leveling (Vol–I & II), Punmia B.C., Jain A.K., Jain A.K., 15th Edition, Laxmi Publication (P) Ltd. New Delhi, 2005

Reference Books:

1. Surveying and Leveling, Basak N. N., 1st Edition, Tata McGraw–Hill Publishing company Ltd. New Delhi

IV Semester
CV2254 – LAB : Surveying

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Compass, ranging rod, chain and its use in field 2. Dumpy level, auto level, levelling staff and its various use in the field 3. Theodolite, Consecutive and independent co-ordinates system of surveying 4. Plane table, tacheometer and its use in the field.	Students will be able to 1. Discuss the basic concepts of surveying and use of conventional surveying equipment. 2. Calculate the horizontal, vertical angle and distances by using dumpy level and theodolite. 3. Explain the methods of plane table surveying and compute the volume of earthwork. 4. Compute the distance and elevation by using tachometric survey.
Mapped Program Outcomes : 1, 2, 5, 9, 10	

PRACTICALS
Minimum of **Ten** practical from the list given below shall be performed.

1. Measurement of bearing of sides of traverse with prismatic compass and computation of correct included angles.
2. Locating given building by chain and compass traversing (1 full size drawing sheet)
3. Determination of elevation of various points with dumpy level by collimation plane method and rise and fall method.
4. Fixing the bench mark with respect to temporary bench mark with dumpy level by fly leveling and check leveling.
5. Measurement of horizontal angle with theodolite by method of repetition.
6. Measurement of vertical angle with theodolite.
7. Determination of horizontal distance between two inaccessible point with theodolite.
8. Locating given building by theodolite traversing. (One full size drawing sheet)
9. Determination of elevation of point by trigonometric leveling.
10. Determination of constants of Tacheometer.
11. Determination of elevation of points by Tacheometric surveying.
12. Determination of elevation of points and horizontal distance between them by Tacheometrical survey.
13. Determination of gradient of given length of road by Tacheometric survey.

IV Semester
CV2255 – Structural Analysis

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Analysis of continues beams using three moment theorem, moment distribution method, slope deflection method 2. Analysis of plane frames using moment distribution method, slope deflection method, Strain Energy Method 3. Influence line diagrams for beam and about buckling of columns and analysis of arches	Students will be able to 1. Explain basic concepts of structural analysis, strain gauges and strain measurements. 2. Apply various theoretical concepts of different methods of structural analysis. 3. Analyze different types of structures like beam, column, parabolic arches and trusses theoretically and experimentally.
Mapped Program Outcomes : 1, 2, 4, 8, 9, 10, **PSO** : i	

UNIT–1 : Analysis of fixed and continuous beams by theorem of three moments including effect of sinking of support.	**[08 Hrs.]**
UNIT–2 : Analysis of continuous beams and simple portals (Non sway) by using Moment Distribution method, effect of sinking of support for beam.	**[09 Hrs.]**
UNIT–3 : Influence lines for reactions, bending moments and shear forces in simply supported beams, cantilevers, beams with overhangs subjected to different types of loadings.	**[09 Hrs.]**
UNIT–4 : Slope deflection method as applied to indeterminate beams & continuous beams, portal frames.	**[08 Hrs.]**
UNIT–5 : Buckling of Columns, Euler"s and Rankine"s formula. Analysis of Two and Three Hinged parabolic arches, shear force and normal thrust.	**[08 Hrs.]**
UNIT–6 : Strain energy method as applied to the analysis of simple and redundant frames, redundant trusses up to two degrees. Determination of deflection of trusses, Castigliano"s theorems, Maxwell"s reciprocal theorem, Betti"s theorem, Muller Breslauw Principle	**[09 Hrs.]**

Text Books:

1. Structural Analysis, Pandit G.S and Gupta S.P., Tata McGraw-Hill Publishing company LTD, New Delhi, 1997
2. Theory of Structure, Timoshenko S.P. and D.H. Young, Tata McGraw Hill Publication, Delhi

Reference Books:

1. Theory of structures, Ramamruthum S.S. and Narayan R., DhanpatRai and Sons New Delhi 2010
2. Analysis of structures, Vazirani V.N and Ratwani M.M, Khanna Publishers New Delhi 1994
3. Structural Analysis (volume II) , Bhavikatti S.S, Vikas publishing House LTD Delhi 2011
4. Intermediate structural analysis, Kinney J.S, Oxford and IBH Publishing o.PVT.LTD, New Delhi.

IV Semester
CV2256 – LAB : Structural Analysis

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Basic concept of strain measurements, 2. Various methods for finding deflection in truss analytically and graphically. 3. Analysis of the arches and various properties of beam like flexural rigidity, slope, deflection, bending moment etc. 4. Behaviour of column curved member and portal frame.	Students will be able to 1. Explain basic concepts of structural analysis, strain gauges and strain measurements. 2. Apply various theoretical concepts of different methods of structural analysis. 3. Analyze different types of structures like beam, column, parabolic arches and trusses theoretically and experimentally.
Mapped Program Outcomes : 1, 2, 4, 8, 9, 10, **PSO :** i	

Any TEN experiments from the following are required to be conducted:

1. To study various types of electrical resistance strain gauges.
2. To measure the strain in the cantilever beam subjected to point load at tip and to check this value with theoretical value.
3. To determine slope and deflection at center of each span for a two span continuous beam subjected to point load W at center of each span and to check these values with theoretical values.
4. To verify Maxwell"s Reciprocal Theorem for simply supported beam.
5. To determine the value of flexural rigidity of given beam and to compare it with theoretical value.
6. To determine the elastic displacements of the curved members experimentally and to check these values with theoretical values.
7. To study the behavior of different types of struts and to calculate the Euler"s buckling load for each case.
8. To determine the horizontal thrust and to draw the influence line diagram for horizontal thrust of two hinged parabolic arch.
9. To determine the horizontal thrust and to draw the influence line diagram for horizontal thrust of three hinged parabolic arch.
10. To determine deflection of cantilever end of cantilever truss by Willot Mohr"s diagram and to check this value with theoretical value.
11. To study the behavior of a portal frame under different end conditions.
12. To find the deflection of a pin-connected truss experimentally and to verify the result theoretically.
13. To obtain the influence line for bending moment of prismatic fixed beam for cases (a) one end hinged (b) both ends fixed.
14. To determine experimentally and analytically the reactions in the three suspension rods supporting an elastic beam with a concentrated load hung midway between two of the suspension rods when the suspension rods are attached at their upper end to rigid support.
15. To verify Castigliano"s Theorem for simply supported beam

IV Semester
CV2257 – Transportation Engineering

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Concepts of highway and railway engineering. 2. Geometric elements and construction and maintenance of road. 3. Properties of highway materials. 4. Bridge engineering, estimate flood discharge and forces acting on bridges.	Students will be able to 1. Explain the concepts of highway and railway engineering. 2. Compute geometric elements and explain construction and maintenance procedures for road pavements. 3. Describe and compute properties of highway materials. 4. Investigate flood discharge and forces acting on bridges.
Mapped Program Outcomes : 1, 2, 3, 4, 8, 9, 10	

UNIT–1 : Introduction and importance of transportation, Road transport characteristics, Classification of roads, network patterns, Principles of alignment. **Traffic Engineering:** 3E"s of traffic engineering, Various Traffic Surveys, Intersection-types, parking.	**[06 Hrs.]**
UNIT–2 : **Geometric Design:** Road user & road vehicle characteristics, Factors affecting design standards. Cross Section elements, Stopping & overtaking sight distance overtaking zones. Horizontal alignment, Curves, design of super elevation, extra widening, transition curves, vertical alignments, I.R.C. Standards for geometric Design.	**[07 Hrs.]**
UNIT–3 : Introduction to pavement materials **Aggregates:** Physical & Mechanical properties, tests on aggregates, Bituminous materials; classification, sources, properties and tests. Cutback bitumen& Emulsions, IRC/IS standards.	**[07 Hrs.]**
UNIT–4 : **Construction & Maintenance:** IRC, MOST specifications for quality & quantity of materials, techniques, tools and plant for the Earthwork, sub base, base and wearing/ surface course of flexible pavements with gravel, WBM, stabilized Bitumen & Concrete as Construction materials, Drainage, shoulders, maintenance & repairs.	**[06 Hrs.]**
UNIT–5 : **Bridges:** Introduction, Components, classification and identification, Data Collection, site selection, Economic Span, Estimation of flood discharge, waterway, scours depth, depth of foundation, Afflux, clearance and free board, Loads, Forces and Stresses for Bridges.	**[06 Hrs.]**
UNIT–6 : **Railways:** Classification, lines and their track standards, gauges, track section, railway terminology, permanent way. **Sleepers:** Function, types, merits and demerits, sleeper density, ballast cushion, ballast section.	**[07 Hrs.]**

IV Semester
CV2257 – Transportation Engineering

Text Books:

1. Highway engineering, Khanna& Justo, Nem Chand & Bros
2. Highway Engineering, K. L. Bhanot, S. Chand &Company (P) Ltd. New Delhi
3. Highway Engineering, T. D.Ahuja, Standard Book House Delhi
4. Bridge Engineering, S.P. Bindra, DhanpatRai Publication
5. Traffic and Highway Engineering, J. Garber and L. A. Hoel, 2002, Thomson Learning, Inc
6. A Text Book of Railway Engineering, S. C. Saxena and S. P. Arora, 2005, DhanpatRai Sons New Delhi

Reference Books:

1. Indian Road Congress, IRC handbooks ,International Code Council International Code Council
2. Ministry of surface/road transportation, MOST.
3. Textbook on Transportation Engineering, S. P. CHANDOLA, 200, S. Chand Publishers, New Delhi

IV Semester
CV2258 – LAB : Transportation Engineering

COURSE OBJECTIVE	COURSE OUTCOMES
Students will be introduced to 1. Basic concepts of highway and railway engineering. 2. Geometric elements and explain construction and maintenance procedures for road pavements. 3. Basic properties of highway materials. 4. Basics of bridge engineering and estimate flood discharge and forces acting on bridges.	Students will be able to 1. Explain the basic concepts of highway and railway engineering. 2. Compute geometric elements and explain construction and maintenance procedures for road pavements. 3. Describe and compute basic properties of highway materials.
Mapped Program Outcomes : 1, 2, 8, 9, 10	

Any TEN experiments from the following are required to be conducted:

1. To determine specific gravity of aggregates.
2. To determine impact value of given aggregate sample.
3. To determine crushing value of given aggregate sample.
4. To determine flakiness index of given aggregate sample.
5. To determine abrasion value by Los Angeles test.
6. To perform water absorption test on given aggregate sample.
7. To find softening point of given bitumen sample.
8. To perform penetration test for given bitumen sample.
9. To perform flash and fire point for given bitumen sample.
10. To perform ductility test on given bitumen sample.
11. To perform viscosity test on bitumen.
12. To perform CBR test on given soil sample.
13. To perform Marshall Stability Test on bituminous concrete.
14. Bridge site visit.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

5th Semester

Civil Engineering

28 June 2019

V Semester
GE2311 - Fundamentals of Management

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. The Fundamentals and Legal Provision of Management 2. Human Resource and Financial practice of Organization 3. Project Management 4. Marketing activities of Management	Students will be able to 1. Interpret Legal provision and various Principles of Management 2. Classify the working of Human Resource and Financial Management in the organization. 3. Illustrate the Procedure and methods of Project Management 4. Analyse techniques of marketing of goods and services
FMapped Program Outcomes : 9, 11, 12	

UNIT–1 : **Principle of Management** Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership	**[06 Hrs.]**
UNIT–2 : **Legal Aspects of Management** The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company	**[07 Hrs.]**
UNIT–3 : **Human Resource Management** Human Resource Management-Meaning and Scope, Principles of HRD, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Grievance Redressal Procedure.	**[06 Hrs.]**
UNIT–4 : **Project Management** Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Tools and Techniques of Project Management, Network techniques - Introduction and Use of CPM &PERT for planning, SWOT Analysis, Project Risk Analysis, Project Control.	**[07 Hrs.]**
UNIT–5 : **Marketing Management** Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting	**[07 Hrs.]**
UNIT–6 : **Financial Management** Definition & Functions of Finance department, Sources of finance, Types of capital, Profit maximization vs. Wealth maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet.	**[06 Hrs.]**

V Semester
GE2311 - Fundamentals of Management

Text book and Reference

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

V Semester
CV2301 - Reinforced Concrete Structures

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. The structural properties of steel and concrete and their applications in structural planning. 2. The Design philosophies of RCC structures. 3. The Design of RC structural elements by limit state method. 4. The concepts of prestressed concrete.	Students will be able to 5. Explain the structural properties of steel and concrete and their applications in structural planning. 6. Apply the knowledge of various methods of structural design. 7. Analysis, design and carry out the detailing of RC structural elements. 8. Illustrate the concept and application of prestressed concrete
FMapped Program Outcomes : 1, 2, 3, 8, 9, 10, 12 **PSO** : i	

UNIT–1 : Properties of different grades of concrete and steel, Permissible stresses, load factors, Structural planning & understanding the behavior of R.C.C. members. Load distribution of frame structure for beam, Slabs, Column, and footing. Introduction to IS 456-2000, SP: 34, SP: 16 and specification for beam, slab, column.	**[06 Hrs.]**
UNIT–2 : Working stress method: Behavior of beam under flexure, Stress distribution diagram, Basic concept in design for flexure, assumptions, design constant, analysis of rectangular singly reinforced sections. Limit state method: Characteristic values, partial safety factor, stress strain relationship, stress block parameters, failure criteria. Limit state of collapse in flexure, basic assumptions.	**[07 Hrs.]**
UNIT–3 : Limit state analysis and design of singly reinforced rectangular section. Analysis and design of doubly reinforced rectangular section, Analysis and design of T beam for flexure.	**[06 Hrs.]**
UNIT–4 : Limit state of serviceability, deflection control of beam and slab. Design for Shear and Bond. Design of one way, two way slab, Introduction to cantilever slabs.	**[07 Hrs.]**
UNIT–5 : Limit state of collapse in compression; basic assumptions. Analysis and design of columns subjected to axial load, uni-axial and biaxial moments. Design of isolated footing for column subjected to axial loads. Introduction to under-reamed pile foundation and combined footing.	**[07 Hrs.]**
UNIT–6 : Introduction to prestressed concrete, types of prestressing, Advantages and limitations of Prestressing, systems and devices, materials, Introduction to losses in Prestress, IS1343 –2012 codal provisions.	**[06 Hrs.]**

V Semester
CV2301 - Reinforced Concrete Structures

Text Books :

12. P.C. Vergese, Limit State Design of Reinforced Concrete, Prentice Hall Publishers, 2nd edition, 2008
13. Shah and Karve, Reinforced Concrete Structures, Structures Publishers, Pune, 5th edition, 2015.
14. Sinha S.N, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Limited, New Delhi, 2007
15. Ashok K. Jain, Reinforced Concrete – Limit State Design, Nem chand and Brothers, 7th edition,2012

Reference Books :

1. P.C. Varghese, Advanced Design of Structures, Prentice Hall Publishers,2009
2. Punmia B.C., Jain A.K., Jain A.K, Reinforced Concrete Structures (Vol-I), Laxmi Publications Pvt Ltd, New Delhi, 2007
3. N. Krishana Raju, Prestressed Concrete, Tata McGraw Hill Publishing Company Limited, New Delhi, 5th edition 2012

V Semester
CV2302 - Advanced Structural Analysis

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Basic principles of the matrix method of structural analysis 2. Analysis of non-prismatic structures (beams and frames) using column analogy method 3. Analysis of sway frames using moment distribution method. 4. Analysis of multistoried frame structures using approximate methods	Students will be able to 1. Explain the matrix methods of structural analysis and its applications. 2. Relate the column analogy method with other analysis method and apply its application to beam structure. 3. Analyze the frame structure by moment distribution method. 4. Apply the approximate method for analysis of multistoried frame structures
Mapped Program Outcomes : 1, 2, 4, 8, 9, 10, 12 **PSO** : i	

UNIT–1 : Introduction to Flexibility Method; analysis of continuous beam with and without sinking of support with maximum **TWO** degree of static indeterminacy.	**[06 Hrs.]**
UNIT–2 : Introduction to Stiffness Method; development of stiffness matrix for bar element; analysis of pin jointed frame structure with maximum **THREE** Degree of kinematic Indeterminacy.	**[07 Hrs.]**
UNIT–3 : Development of stiffness matrix for a beam member without axial deformation; analysis of continuous beam with maximum **THREE** degree of kinematic indeterminacy.	**[06 Hrs.]**
UNIT–4 : Introduction to Column Analogy; calculation of stiffness factors and carryover factor for non-prismatic members; analysis of fixed beams by Column Analogy method.	**[07 Hrs.]**
UNIT–5 : Moment Distribution Method; Analysis of one bay one story frame with sway, Analysis of one leg inclined frame with sway.	**[06 Hrs.]**
UNIT–6 : Approximate methods of structural analysis; substitute frame method; portal frame method; cantilever method (maximum **THREE** bay **THREE** story).	**[07 Hrs.]**

Text Books :

1. Pandit G.S and Gupta S.P, "Structural Analysis (Matrix Approach)", Tata McGraw Hill Publishing company LTD, New Delhi, 2006.
2. C .S Reddy, "Basic structural Analysis", Tata McGraw Hill Publication, New Delhi, 8th Edition
3. Timoshenko S.P. and D.H. Young, "Theory of Structure", Tata Mc Graw Hill Publication, Delhi.2nd Edition
4. Gere and Weaver, "Matrix Method of Structural Analysis", CBS Publication, 2004

Reference Books :

1. Bhavikatti S.S, "Structural Analysis - Volume II", Vikas publishing House LTD, Delhi, 2nd Edition (2011).
2. Meghre A.S. & Deshmukh S.K., "Matrix Method of Structural Analysis", Charotar publishing house, Anand, 1st Edition (2003).

V Semester
CV2303 – LAB : Analysis and Design Studio

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Modelling of beam, plane truss and frame in the software package, applying the required properties, boundary conditions and forces in the developed models. 2. Analysis of beams, Plane truss, Frames using standard software package without any error. 3. Analysis and design of the RCC structural elements using standard software package without any error. 4. The comparison of result between manual analysis and design and software analysis and design	Students will be able to 1. Develop and execute the Beams, Plane truss, Frames in the software package without any error. 2. Analyze the Beams, Plane truss, Frames in the software package without any error. 3. Analyze and design the RCC structural elements in the software package without any error. 4. Compare the result between manual analysis and output result of the software.
Mapped Program Outcomes : 1, 2, 4, 5, 8, 9, 10, 12 **PSO** : i	

Minimum Ten Practical to be performed

1. Analyze a ***continuous beam with and without sinking of support*** with maximum **two degree of static indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **Flexibility Matrix Method.** Conclude it from both the result.
2. Analyze a ***plane truss*** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use S**tiffness Matrix method**. Conclude it from both the result.
3. Analyze a ***continuous beam*** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result with manual analysis result. For manual analysis use **Stiffness Matrix Method.** Conclude it from both the result.
4. Analyze a ***non-prismatic fixed beam (beam splits into three parts)*** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **Column Analogy Method**. Conclude it from both the result.
5. Analyze a ***rigid sway frame one bay one story*** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **Moment Distribution Method.** Conclude it from both the result.
6. Analyze a ***multi storied frame structure*** subjected to **vertical forces** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **Substitute Frame Method.** Conclude it from both the result.

V Semester
CV2303 – LAB : Analysis and Design Studio

7. Analyze a ***multi storied frame structure*** subjected to **horizontal forces** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **Cantilever Method or Portal Frame Method.** Conclude it from the result.
8. Design a simply supported beam using software package. Compare the software result of design with manual design result.
9. Design a short column using software package. Compare the software result of design with manual design result.
10. Design a slab using software package. Compare the software result of design with manual design result.
11. Design an isolated footing using software package. Compare the software result of design with manual design result.
12. Analyze and Design a multistoried building (G+2) using software package.

Text Books :

1. Pandit G.S and Gupta S.P, "Structural Analysis (Matrix Approach)", Tata McGraw-Hill publishing company LTD, New Delhi. 27th reprint 2006.
2. Meghre A.S. & Deshmukh S.K.; "Matrix Method of Structural Analysis", Charotar publishing house, 1st edition (2003).
3. Gere and Weaver; "Matrix Method of Structural Analysis", CBS publication, 2004
4. P.C. Vergese, Limit State Design of Reinforced Concrete, Prentice Hall Publishers, 2nd edition, 2008
5. Shah and Karve, Reinforced Concrete Structures, Structures Publishers, Pune, 5th edition, 2015.
6. Sinha S.N, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Limited, New Delhi, 2007

Reference Books :

1. Bhavikatti S.S, "Structural Analysis (volume II)", Vikas publishing House LTD, Delhi, 2nd edition (2011).
2. Dr. S.R. Karve & Dr. V.L. Shah, "Illustrated Design of Reinforced Concrete Buildings (Design of G+3 Storeyed Buildings + Earthquake Analysis & Design)", Standard Publisher Distributors, 7th edition, 2014
3. P.C. Varghese, Advanced Design of Structures, Prentice Hall Publishers,2009
4. Punmia B.C., Jain A.K., Jain A.K, Reinforced Concrete Structures (Vol-I), Laxmi Publications Pvt Ltd, New Delhi, 2007

V Semester
CV2311 - PE-I : Advance Surveying

COURSE OBJECTIVE	COURSE OUTCOMES
Students will be introduced to 1. Theodolite, ranging rod, chain, tape and its use in field. 2. Basic principle and application of geodetic surveying. 3. Basic principle and application of electronic surveying. 4. Photo scale, flight planning for aerial surveying.	Students will be able to 1. Distinguish the horizontal and vertical curve. 2. Classify the triangulation system 3. Illustrate the basic concepts of electronic surveying 4. Explain the basic concepts of photographic surveying
Mapped Program Outcomes: 1, 2, 5, 9, 10	

UNIT–1 : **Simple and Compound Curves** a) **Simple Curves**: Elements of simple curves, Types of Horizontal curve Methods of Curve ranging. b) **Compound Curves**: Elements of compound Curves, setting out the curve.	**[06 Hrs.]**
UNIT–2 : **Transition and vertical curve** a) Transition Curves: Elements of transition curves, Super elevation, Length of transition curve, setting out the transition curve. b) Vertical Curves: Elements of vertical curves, Types, Tangent Correction, Location of highest or lowest point.	**[07 Hrs.]**
UNIT–3 **Geodetic Surveying and Triangulation Adjustment (a,b,d)** a) Geodetic Surveying: Classification of triangulation survey, Station marks, Signal and tower, Inter visibility of stations b) Triangulation Adjustment: Definitions, , Laws of weights, Station adjustment.	**[07 Hrs.]**
UNIT–4 : **ELECTRONIC SURVEYING** Introduction, electromagnetic wave theory – electromagnetic application, Modulation, types of EDM instrument, distance measuring system-Principle of working and EDM instrument, distomat, errors in EDM.	**[06 Hrs.]**
UNIT–5 : **TOTAL STATION SURVEYING** Introduction, basic principle, types of total station, characteristics, feature of total station, component of total station, working of total station, sources of error, care and maintenance of total station instrument, advantages of total station over conventional instrument.	**[06 Hrs.]**
UNIT–6 : **Advanced surveying techniques** **Photographic Surveying:** Basic definitions, Terrestrial and aerial photography, Scale of vertical photograph, ground coordinate flight planning, study of photo theodolite and stereoscope, Displacement due to ground relief.	**[07 Hrs.]**

Text Books:

1. Punmia B.C., Jain A.K., Jain A.K, Surveying, (Vol. 2 & Vol. 3), Laxmi Publication, New Delhi. 1, 15th Edition.
2. Kanetkar T.P. & Kulkarni S. V, Surveying & Levelling (Vol.2 & Vol. 3), Pune Vidhyarthi Gruha Prakashan, Pune.
3. Reddy M. A., Remote sensing & GIS, B. S. Publication, Hyderabad.
4. Dr. A.M. Chandra, Higher Surveying, New age international publishers , New Delhi

Reference Books:

1. Thomas M. L., Ralph W. K., Jonathan W., Remote Sensing and Image Interpretation, Chipman Wiley & Sons, 5th Edition (2010).

V Semester
CV2312 – PE-I : LAB - Advance Surveying

COURSE OBJECTIVE	COURSE OUTCOMES
Students will be introduced to 1. Theodolite, ranging rod, chain, tape and its use in field. 2. Basic principle and application of geodetic surveying. 3. Basic principle and application of electronic surveying. 4. Photo scale, flight planning for aerial surveying.	Students will be able to 1. Distinguish the horizontal and vertical curve. 2. Classify the triangulation system 3. Illustrate the basic concepts of electronic surveying 4. Explain the basic concepts of photographic surveying
Mapped Program Outcomes : 1, 2, 5, 9, 10	

PRACTICALS
Any Eight Experiments out of the following.

1. Setting out simple circular curve by offset from long chord.
2. Setting out of simple circular curve by offsets from chord produced method
3. Setting out of simple circular curve by Rankine method.
4. Setting out of compound curve using field measurement.
5. Setting out Simple circular curve offset from tangent method.
6. Study of Handling, Operation and Basic Concept of Total Station.
7. To find the R.L. of first floor building using total station.
8. Determination of height of a building using total station.
9. To find the area of closed traverse using total station
10. Study of stereoscope

Text Books:

1. Punmia B.C., Jain A.K., Jain A.K, Surveying, (Vol. 2 & Vol. 3), Laxmi Publication, New Delhi. 1, 15th Edition.
2. Kanetkar T.P. & Kulkarni S. V, Surveying & Levelling (Vol.2 & Vol. 3), Pune Vidhyarthi Gruha Prakashan, Pune.
3. Reddy M. A., Remote sensing & GIS, B. S. Publication, Hyderabad.
4. Dr. A.M. Chandra, Higher Surveying, New age international publishers , New Delhi

V Semester
CV2313 - PE-I : Computer Application In Civil Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Basic concepts of C Programming language 2. Computer programs for the solution of Civil Engineering problems. 3. Programs for the solution of numerical methods and civil engineering	Students will be able to 1. Explain the basic concepts of C Programming language 2. Apply the knowledge of C program to write simple programs. 3. Develop computer programs for the solution of numerical methods and civil engineering problems
Mapped Program Outcomes : 1, 2, 3, 4, 8, 9, 10	

UNIT–1 : Introduction : C-Fundamentals, character set data type constant and variables, Declaration of constants & variables, Expression, Statements, Symbolic constants. Operator and Expression, Arithmetic operator, Unary operator, Relation and Logical operator, Assignment operators, the conditional operator. Data input & output.	**[06 Hrs.]**
UNIT–2 : Control Statements:-Control statement and its application, the WHILE statements, do-while, for nested loop, if –else, switch break, continue, go to statement.	**[07 Hrs.]**
UNIT–3 : Advance Topics:-User defined Functions, Library functions, Storage class, Arrays, Pointers, structures and Unions, Data files, File Handling.	**[06 Hrs.]**
UNIT–4 : Fundamental of Numerical Methods, Interpolation & extrapolation. Numerical Integration (Simpson"s method, Trapezoidal method, Newton"s Gauss Quadrature method), Interactive Computer Program Development.	**[07 Hrs.]**
UNIT–5 : Computer program based on Transportation Engineering, Geotechnical Engineering, Hydraulic Engineering, Irrigation Engineering, Surveying, Estimating & costing.	**[07 Hrs.]**
UNIT–6 : Computer program based on Structural analysis, Structural Design, Environmental Engineering, Matrix algebra, Use of excel in structural design, estimating & costing	**[06 Hrs.]**

Reference Books :

1. C programming language, 2th Edition 1996, Dennis Ritchie, Pearson
2. C: The Complete Reference, 4thEdititon 2017, Herbert Schildt, McGraw Hill

V Semester
CV2314 – PE-I : LAB - Computer Application In Civil Engineering

COURSE OBJECTIVE	COURSE OUTCOMES
Students will be introduced to 1. Basic concepts of C Programming language 2. Computer programs for the solution of Civil Engineering problems. 3. Programs for the solution of numerical methods and civil engineering	Students will be able to 1. Explain the basic concepts of C Programming language 2. Apply the knowledge of C program to write simple programs. 3. Develop computer programs for the solution of numerical methods and civil engineering problems
Mapped Program Outcomes : 1, 2, 3, 4, 8, 9, 10	

At-least **one** assignment from each and maximum **two** assignments to be submitted from following topics using **Programming Language**.

1. Determination of Bending Moment. Deflections for different loading conditions for a Simply Supported Beam and Cantilever Beam. Determination of fixed end moments for different loading conditions of a fixed beam.
2. Determination of Water demand, empirical formulae, variation in demand, design of period and population forecasting methods.
3. Determination of coefficient of permeability, Degree of Consolidation and Shear Strength. Estimation of Settlement of foundations in Cohesive Soil, Stability Analysis of Slopes. Estimation of Earth Pressures in Cohesive and Cohesion less soils.
4. Computation of water surface profiles in open channel flows. Estimation of Friction factor for Laminar and Turbulent flows, Minor losses in pipe flow. Application of problems in Hydraulics such as Hardy cross method in the Analysis of pipe network,
5. Geometric design of roads, stopping and overtaking distances, design of super-elevation, design of summit and valley curves, Horizontal and vertical curves.
6. Design of Slabs using I.S. Code method. Analysis and Design of Beams using Limit state method. Design of columns subjected to axial load and Uni-axial Moment. Design of Isolated Footing. Design of rolled steel columns, built up columns, Beams and built up Beams.
7. Interpolation & extrapolation methods, Solution of non Linear Equations (Newton Raphson Schemes), Solution of Linear Algebric Equations, Gauss Elimination method.
8. Numerical Integration (Simpson"s method, Trapezoidal method) , Initial & Two point boundary value problem , Euler"s Runge-kutta, Milnes etc.
9. Preparation of Estimating & Costing in Excel Develop design module of Structural design in Excel.

Text Books:

1. Yeshwant Kanetkar, LET US C, BPB Publications.
2. S.K. Parikh, Computer Applications in Civil Engineering, Tata McGraw Hill, New Delhi.
3. M. K. Jain, Numerical Methods, New Age International.

V Semester
CV2315 - PE-I : Building Construction Materials

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Investigate the soil condition , deciding and design of suitable foundation for different structure 2. Understand the selection of material , design and supervision of suitable type of floor and roof 3. Gain knowledge about doors, windows, plastering, painting, dam proofing, scaffolding, shoring, underpinning and to take suitable engineering measures. 4. Administer construction work of a residential building	Students will be able to 1. Explain different aspects of building construction and their importance 2. Draw and explain about various building elements and material and their uses in building construction 3. Illustrate various provision in IS codes related to building construction
Mapped Program Outcomes : 1, 6, 8, 9, 10, 11, 12	

UNIT–1 : **Foundations :** Necessity and types of foundation, Details shallow foundations. Bearing capacity of soils and its assessment, Loads on foundation, Causes of failures of foundation and remedial measures, Foundation on black cotton soils Setting out foundation trenches, excavation timbering of foundation trenches. Load bearing and framed structures.	**[06 Hrs.]**
UNIT–2 : **Brickwork :** Qualities of good bricks, classification of bricks tests on bricks as per as codes. Terms used in brickwork , commonly used types of bonds in brickwork such as header, stretcher, English and flamish bonds, principles of construction. Reinforced brickwork, brick knogging. Parapets, coping, sills and corbels, brief introduction to cavity walls , load bearing and partition walls. Masonry construction using cement concrete blocks and clay walls, load bearing and partition walls. Masonry construction using cement concrete blocks and clay blocks.	**[07 Hrs.]**
UNIT–3 : **Stone Work :**Stone, cutting and dressing , selection of stones types of stone masonary, principles of construction joints in masonary. Lifting heavy stones, common building stones in India. **Arches and Lintels :** Terminology in contraction , types chajjas and canopies, pre cast Lintels & Arches. **Damp Proofing :** Causes and effect of dampness .Various methods of damp proofing Damp proofing in plinth protection, New Techniques of Damp proofing Damp Proofing in Plinth Protection, New Techniques of damp proofing, Epoxy etc.	**[07 Hrs.]**
UNIT–4 : **Floors And Roofs :** Floors :General principle , types and method of construction upper floors finisheem quality and floor tiles, synthetic & Creamic Tiles. **Roofs :** Flat and pitches roofs, roof covering types AND their construction features. Thermal Insulation.	**[06 Hrs.]**
UNIT–5 : **Stairs** : Types of stairs, functional design of stairs. **Doors and Windows :** Purpose materials of construction and types.	**[07 Hrs.]**
UNIT–6 : **Plastering and Pointing :** Necessity ,types and methods. **Temporary Timbering :** Centering and formwork shoring, underpining and scaffolding. **Painting :** White washing, colour washing and distempering new materials & Technioues.	**[06 Hrs.]**

		June 2020	1.00	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
CV2315 - PE-I : Building Construction Materials

Text Books :

1. Sushil Kumar "Building Materials and construction", 20th edition, reprint 2015, Standard Publishers
2. Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Building Construction, Laxmi Publications (P) ltd., New Delhi.
3. Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India.

Reference Books :

1. S.K. Duggal, "Building Materials", (Fourth Edition)New Age International (P) Limited, 2016
2. National Building Code(NBC) of India
3. P C Vergese, "Buliding Materials", PHI Learning Pvt. Ltd
4. Building Materials and Components, CBRI, 1990, India
5. Jagadish K.S, "Alternative Building Materials Technology", New Age International, 2007.
6. M.S. Shetty, "Concrete Technology", S. Chand & Co. New Delhi.

V Semester
CV2316 – PE-I : LAB - Building Construction Materials

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Importance of IS code in building construction. 2. Develop and apply basic skills in exterior finish work. 3. The supervision of different types of masonry work.	Students will be able to 1. Explain different aspects of building construction and their importance 2. Draw and explain about various building elements and material and their uses in building construction 3. Illustrate various provision in IS codes related to building construction
Mapped Program Outcomes : 1, 3, 8, 9, 10, 11, 12	

PRACTICALS

1. Study of IS-code on bricks
2. Free Hand Sketches of basic component of Building
3. Free Hand Sketches of various types of foundation with detail specification.
4. Detailed of various types of bond.
5. Study of IS 875-1987.
6. Design of dog legged staircase.
7. Free hand sketches of different types of Pointing.
8. Presentation on "Building construction materials"

Text Books :

1. Sushil Kumar "Building Materials and construction", 20th edition, reprint 2015, Standard Publishers
2. Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Building Construction, Laxmi Publications (P) ltd., New Delhi.
3. Rangawala S. C. "Engineering Materials", Charter Publishing House, Anand, India.

Reference Books :

1. S.K. Duggal, "Building Materials", (Fourth Edition)New Age International (P) Limited, 2016
2. National Building Code(NBC) of India
3. P C Vergese, "Buliding Materials", PHI Learning Pvt. Ltd
4. Building Materials and Components, CBRI, 1990, India
5. Jagadish. K.S, "Alternative Building Materials Technology", New Age International, 2007.
6. M. S. Shetty, "Concrete Technology", S. Chand & Co. New Delhi.

V Semester
CV2317 - PE-I : LAB - Matrix Analysis of Structures

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Basic concepts of direct stiffness method. 2. Analysis of continuous beam, plane truss, plane frame neglecting axial deformation, plane frame considering axial deformation by stiffness method. 3. Analysis of various structures subjected to special effects. 4. Modern techniques and storage techniques.	Students will be able to 1. Apply the stiffness method for structural analysis. 2. Analyze continuous beams, plane truss, plane frame neglecting axial deformation, plane frame considering axial deformation. 3. Evaluate continuous beams, plane truss with special effects. 4. Explain various storage techniques used in computer programming for structural analysis.
Mapped Program Outcomes : 1, 2, 4, 5, 8, 9, 10 **PSO** : i	

UNIT–1 : Basic terminology, degree of freedom, basic concept of direct stiffness method, derivation of all stiffness coefficients, formulation of compatibility equations, rotation transformation matrix.	**[06 Hrs.]**
UNIT–2 : **Analysis of Beam (without axial deformation):** Formulation of elemental stiffness matrix for Beam, transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated load, uniformly distributed load and moment, assembly of global load matrix, solution to problem without sinking of support with maximum three degrees of freedom.	**[07 Hrs.]**
UNIT–3 : **Analysis of Plane Truss:** Formulation of elemental stiffness matrix and global stiffness matrix, assembly of global stiffness matrix, member load matrix due to concentrated load, assembly of global load matrix, solution to problem of plane truss with maximum three degrees of freedom.	**[07 Hrs.]**
UNIT–4 : **Analysis of Plane Frame (Without axial deformation):** Formulation of elemental stiffness matrix and, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane frame problems with maximum three degrees of freedom, inclined member problem.	**[06 Hrs.]**
UNIT–5 : **Analysis of Plane frame (With axial deformation):** Formulation of elemental stiffness matrix and transformation matrix, assembly of global stiffness matrix, member load matrix due to concentrated loads, uniformly distributed loads and moments, assembly of global load matrix, solution to plane frame problems with maximum three degrees of freedom, inclined member problem.	**[06 Hrs.]**
UNIT–6 : Analysis of member for sinking of supports in beam, temperature loading, lack of fit and inclined roller in truss with maximum three degrees of freedom, storing of global stiffness matrix, full storage, banded storage and band minimization.	**[07 Hrs.]**

V Semester
CV2317 - PE-I : Matrix Analysis of Structures

Text Books :

1. Gere and Weaver, Matrix Method of Structural Analysis, McGraw Hill. 2004
2. Kanchi M.B., Matrix Method of structural Analysis, New age International,1993
3. Martin H.C. Introduction to Matrix Method of Structural Analysis, 1966
4. Pandit Gupta, Structural Analysis: A Matrix Approach, Tata McGraw-Hill, 2001

Reference Books :

1. Meghre A.S. &Deshmukh S.K., Matrix Method of Structural Analysis, Charotar Publishing House Pvt. Limited, 2003
2. Flemming Computer Analysis of Structures, McGraw-Hill Education, 1996
3. Wang C K,, Intermediate Structural Analysis, McGraw-Hill Education, 2010
4. S. Rajasekaran, G. Sankarasubramanian Computational Structural Mechanics, PHI Learning Private Limited, 2004

V Semester
CV2318 – PE-I : LAB - Matrix Analysis of Structures

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Developing models of various structures in the software package, and apply the required properties, boundary conditions and forces in the developed models. 2. Analysis of various structural elements by stiffness method of structural analysis. 3. Execution of computer programme using standard software package without any error. 4. Comparison of results between manual analysis and software package analysis.	Students will be able to 1. Develop the beam model, plane truss model, and plane frame model with and without axial deformation in the software package without any error. 2. Analyze the beam model, plane truss model, and plane frame model with and without axial deformation in the software package without any error. 3. Compare the result between manual analysis and output result of the software package, and the application of software package and limitation of manual analysis.
Mapped Program Outcomes : 1, 2, 4, 5, 8, 9, 10, 12 **PSO** : i	

Analysis of Structures Using Standard Software Packages.

1. Analyze a **continuous beam** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.
2. Analyze a **continuous beam with sinking of support** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.
3. Analyze a **plane truss** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.
4. Analyze a **plane truss subjected to inclined roller support** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.
5. Analyze a **plane truss subjected to temperature effect** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.
6. Analyze a **plane truss subjected to lack of fit** with maximum **THREE degree of Kinematic Indeterminacy** using software package. Compare the software result of analysis with manual analysis result. For manual analysis use **stiffness matrix method**. Conclude it from both the result.
7. Analyze a **plane frame neglecting axial deformation** with maximum **THREE degree of Kinematic Indeterminacy**, using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.
8. Analyze a **plane frame considering axial deformation** with maximum **THREE degree of Kinematic Indeterminacy**, using software package. Compare the software result of analysis with manual analysis result. For manual analysis use stiffness matrix method.

V Semester
CV2318 – PE-I : LAB - Matrix Analysis of Structures

Text Books :

1. Gere and Weaver, Matrix Method of Structural Analysis, McGraw Hill. 2004
2. Kanchi M.B., Matrix Method of structural Analysis, New age International,1993
3. Martin H.C. Introduction to Matrix Method of Structural Analysis, 1966
4. Pandit Gupta, Structural Analysis: A Matrix Approach, Tata McGraw-Hill, 2001

Reference Books :

1. Meghre A. S. &Deshmukh S.K., Matrix Method of Structural Analysis, Charotar Publishing House Pvt. Limited, 2003
2. Flemming Computer Analysis of Structures, McGraw-Hill Education, 1996
3. Wang C.K., Intermediate Structural Analysis, McGraw-Hill Education, 2010
4. S. Rajasekaran, G. Sankarasubramanian Computational Structural Mechanics, PHI Learning Private Limited, 2004

V Semester
CV2319 – PE-I : Advanced Concrete Technology

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Properties of Cement, Fine aggregate and Coarse Aggregate. 2. Properties of Fresh Concrete, Harden Concrete and NDT. 3. Design of Concrete Mix for various grades. 4. Role of Admixture and Durability of Concrete.	Students will be able to 1. Explain the properties of the constituent materials of concrete. 2. Examine the properties of fresh and hardened concrete and tests to determine these properties. 3. Analyse the concrete mixes design and apply statistical quality control techniques 4. Explain admixtures, their role in concrete properties and various durability aspects in concrete.
Mapped Program Outcomes : 1, 3, 7, 8, 9, 10, 11, 12	

UNIT–1 : Review of properties of cement, their physical and chemical properties, special purpose cements, Classification and properties of aggregates, soundness of aggregates, alkali aggregate reaction, thermal properties of aggregates, Importance of shape and Surface area and grading, gap graded and aggregates.	**[07 Hrs.]**
UNIT–2 : Rheological behaviour of concrete, requirements of workability of concrete, Effect of environmental conditions, Strength properties of hardened concrete, Impact, Dynamic and fatigue behaviour of concrete, shrinkage and creep of concrete, behaviour of concrete under fire.	**[06 Hrs.]**
UNIT–3 : Permeability and Durability of concrete, Parameters of durability of concrete, chemical attack on concrete, Production of concrete; batching mixing, transportation, placing, compaction of concrete. Special methods of concreting and curing of concrete, Hot weather and cold weather concreting, Guniting (Shotcreting).	**[06 Hrs.]**
UNIT–4 : Concrete mix design, Basic considerations and choice a mix proportions, various methods of mix designs including IS Code method. Quality control and quality assurance of concrete, Acceptance criteria.	**[07 Hrs.]**
UNIT–5 : Quality management in concrete construction, Inspection and testing of concrete. Non-destructive testing of concrete, core test and load test. Admixtures & construction chemicals, Use of Fly Ash, Silica Fumes, Metakaolin & GGBS in concrete.	**[07 Hrs.]**
UNIT–6 : Special concrete such as high strength, Lightweight, heavy weight, vacuum processed concrete. Mass concrete, high performance concrete, Pumpable concrete, Self Compacting concrete, Air entrained concrete, Ferro cement, fiber reinforced concrete, Polymer impregnated concrete. Jet concrete. Deterioration and repair technology of concrete, Distress and type of repairs, crack sealing techniques.	**[06 Hrs.]**

V Semester
CV2319 – PE-I : Advanced Concrete Technology

Text Books :

1. Gambhir M.L: Concrete Technology Tata McGraw Hill (Second Edition) 1995.
2. M.S. Shetty, Concrete Technology S. Chand & Company New Delhi 2005.

Reference Books:

1. P.Kumar Mehata, Paulo & J.M. Monteiro, Concrete microstructure, properties & materials, Prentice Hall INC & Mcgraw Hill USA.
2. Short & Kenniburg, Light Weight Concrete, Asia Publishing House, Bombay 1963.
3. Chen Orchard D.F.; Concrete Technology-Vol I. & II Applied Science Publishers (Fourth Edition) 1979.
4. Neville A.M., J.J. Brook Properties of Concrete Addison Wesley 1999.

V Semester
CV2320 – PE-I : LAB - Advanced Concrete Technology

COURSE OBJECTIVE	COURSE OUTCOME
Students will be introduced to 1. Properties of Cement, Fine aggregate and Coarse Aggregate. 2. Properties of Fresh Concrete, Harden Concrete and NDT. 3. Design of Concrete Mix for various grades. 4. Role of Admixture and Durability of Concrete.	Students will be able to 1. Explain the properties of the constituent materials of concrete. 2. Examine the properties of fresh and hardened concrete and tests to determine these properties. 3. Analyse the concrete mixes design and apply statistical quality control techniques 4. Explain admixtures, their role in concrete properties and various durability aspects in concrete.
Mapped Program Outcomes : 1, 4, 5	

Any Five practical from the following are required to be conducted:

1. Study of IS code related to mix design.
2. Determine Compressive strength of High grade concrete by using different admixture.
3. Study and performance on Rebound Hammer.
4. Study and performance on Ultrasonic Pulse Velocity.
5. Study and performance on Profometer.
6. Study and performance on Crack scope.
7. Study of Self Compacting Concrete.

V Semester
CV2321 – PE-I : Water Treatment

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Various treatment processes and their fundamentals. 2. Various water treatment units and their working. 3. Design of water treatment units.	Students will be able to 1. Understand working of water treatment units and their significance in water treatment. 2. Understand fundamentals of unit processes and analyse data related to the processes. 3. Design different water treatment units.
Mapped Program Outcomes : 1, 3, 7	

UNIT–1 : **Introduction:** Water treatment objectives, Water quality standards and regulations, **Aeration:** Objectives, Principles, Various methods, Design of aerators.	**[06 Hrs.]**
UNIT–2 : **Coagulation:** Need for coagulation, chemistry of coagulation, various coagulants used in the process, Factors affecting efficiency of coagulation process. Design of flash mixer **Flocculation:** Theory of flocculation, slow mixing devices.	**[07 Hrs.]**
UNIT–3 : **Sedimentation:** Stoke"s law, working of ideal sedimentation tank, Types of sedimentation tanks, design of rectangular sedimentation tank, Working and Design of clariflocculator. Operational problems in sedimentation tanks.	**[07 Hrs.]**
UNIT–4 : **Filtration:** Theory of filtration, Types of filters, Slow and rapid sand filters, Operation of rapid sand filters, Operational difficulties, Design of rapid sand filter.	**[06 Hrs.]**
UNIT–5 : **Disinfection:** Various methods of disinfection, Chlorination, Chemistry of chlorination, Methods of chlorination.	**[07 Hrs.]**
UNIT–6 : **Other Processes:** Adsorption, Theory, Granular and powder activated carbon, Performance and reactivation. Application in water treatment Deflouridation, Effects of fluorides on human health. Different methods of removal, Ion Exchange, Materials and reactions.	**[06 Hrs.]**

Text Books :

1. P.N. Modi, Water Supply and treatment, Standard Book House.
2. CPHEEO Manual on Water Supply and Treatment.

Reference Books :

1. Fair, Geyer and Okun, Water and wastewater engineering Vol. 2, John Wiley and Sons, New York
2. Franklin Burton, Stensel, Waste Water Engineering, Tata Mc Graw Hill.
3. Dr. B.C. Punmia, Waste Water Engineering, Firewall Media.

V Semester
CV2322– PE-I : LAB - Water Treatment

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Various water quality standard. 2. Determination of various characteristics of water. 3. Design of water treatment units.	Students will be able to 1. Understand working of water treatment units and their significance in water treatment. 2. Understand fundamentals of unit processes and analyse data related to the processes. 3. Design different water treatment units.
Mapped Program Outcomes : 1, 3, 7	

A. Any SIX experiments of the following will be performed.

1. To determine Alkalinity of a water sample.
2. To determine Dissolved Oxygen concentration in given water sample.
3. To determine Sulphates concentration in given water sample.
4. To determine Maximum Probable Number (MPN) of coli form bacteria present in water sample by Multiple Tube Dilution (MTD) technique-presumptive test and confirmation tests
5. To determine Density of bacteria in a water sample pour plate (Standard Plate Count) method.
6. To determine concentration of Chlorides in a given water sample.
7. To determine effective size and co-efficient of uniformity of a given sand sample and to separate required sand from given stack of sand for required effective size and coefficient of uniformity.
8. To determine total, dissolved and suspended solids in given water sample.

B. To Design various Water Treatments Units (Any Three)

V Semester
CV2323– PE-I : Environmental Management

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Various analysis tools of environmental management 2. Role of impact assessment studies in environmental management 3. Importance of environmental legislations and audit 4. Natural resources, challenges & prospects for sustainable development.	Students will be able to 1. Explain the importance of environmental management tools. 2. Illustrate the procedures impact assessment studies in environmental management 3. Explain environmental legislations and policies for environmental resources. 4. Explain the need of resource management and its challenges for sustainable development
Mapped Program Outcomes : 6, 7, 8, 9, 10, 12	

UNIT–1 : Introduction to Environmental Management Development and Environment, environmental attributes, nature of impact – primary, secondary, tertiary, shot –term long-term, local and regional, reversible & Irreversible impacts. **Overview of impacts** –directly & indirectly measurable impacts with respect to air, noise, land, biological & socio-economic environment.	**[06 Hrs.]**
UNIT–2 : Introduction to Environmental Impact Assessment: need for EIA, concept of EIA, elements of EIA Role and Status of EIA in India EIA Procedures, Environmental Impact Statement, Methodologies of EIA.	**[07 Hrs.]**
UNIT–3 : MoEF questionnaire for environmental clearance, critical environmental issues and formulation of strategies of EMP, environmental management plan, development of action plans for critical environmental education programmers. EMS.	**[07 Hrs.]**
UNIT–4 : Environmental legislation – basic concepts, critical issues, civil liability, various enactment and their provisions – Water Act (1974, 1988), forest Conservation Act (1980), Air Act (1981, 1988), Water (Cess) Act 1977, Environmental Protection Act 1986, public Liability & Insurance Act, Motor Vehicle Act 1989, Rules, Role of State & Central boards of pollution control, local government social action groups, and environmental policies.	**[07 Hrs.]**
UNIT–5 : Environmental Audit- Concept of EA, procedural aspects of conducting environmental audit, Eco-Labeling, LCA.	**[06 Hrs.]**
UNIT–6 : Resource Management: depletion of resources – causes & effects, resource utilization, , optimal use of resources.	**[06 Hrs.]**

Text Books :

1. Anand Bal, An Introduction to Environmental Management, Himalaya Publishing House.,2009
2. John Rau & Wooten, Environmental Impact Assessment, Mc Graw Hill.
3. Larry Canter, Environmental Impact Assessment, McGraw Hill.
4. Harry W. Gehm, Jacob I. Bregman, handbook on pollution Control Acts, Central Pollution Control Board, New Delhi.
5. R.K. Sapra, S. Bhardwaj, the New Environmental Age, Ashish Pub. House, New Delhi.

References Books :

1. Rosencrannz, S. Divan, M.L. Nobal, Environmental Law and Policy in India, Cases, Materials and Statutes, Tripathi Pvt. Ltd. Bombay.

V Semester
CV2324– PE-I : LAB - Environmental Management

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Various analysis tools of environmental management 2. Role of impact assessment studies in environmental management 3. Importance of environmental legislations and audit 4. Natural resources, challenges & prospects for sustainable development	Students will be able to 1. Explain the importance of environmental management tools. 2. Illustrate the procedures impact assessment studies in environmental management 3. Explain environmental legislations and policies for environmental resources. 4. Explain the need of resource management and its challenges for sustainable development
Mapped Program Outcomes : 6,7,8,9,10,12	

PRACTICALS

The practicals will be in the form of assignments which will be submitted by the students based on actual case studies.

V Semester
CV2325– PE-I : Soil Characterization & Identification

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Properties of the expansive and soft soil 2. Characteristics of Liquefiable and filled up Soils 3. Geotechnical properties of organic, peaty Soils, collapsible soils. 4. Stabilizing soils using various techniques for of different soil.	Students will be able to 1. Examine properties of the expansive and soft soil 2. Explain characteristics of Liquefiable and filled up Soils 3. Identify Geotechnical properties of organic, peaty Soils, collapsible soils 4. Apply various techniques for stabilization of different soil.
Mapped Program Outcomes : 1, 2, 3, 4, 8, 10 **PSO :** ii	

UNIT–1 : Expansive Soils: Geology, engineering properties, swelling, swelling pressure, strength and compressibility, permeability stabilization methods, foundation types.	**[07 Hrs.]**
UNIT–2 : Soft Clays :Geology of soft marine clays, mineralogy, physical properties, shear strength and compressibility, foundation types.	**[06 Hrs.]**
UNIT–3 : Liquefiable Soils: Identification, Factors affecting Liquefaction, Methods for improving resistance of soils to Liquefaction.	**[07 Hrs.]**
UNIT–4 : Filled up Soils: Characterization, Methods for Strengthening Filled up material for supporting structures, Foundation practices in Filled up areas.	**[06 Hrs.]**
UNIT–5 : Organic and Peaty Soils, Collapsible soils : Geotechnical properties, foundation types.	**[07 Hrs.]**
UNIT–6 : Advanced methods of stabilization admixtures, special chemicals, fly ash, waste materials and Geosynthetics.	**[06 Hrs.]**

Text Books :

1. Ground Improvement Techniques by P. Purushothama Raj, Lakshmi Publications Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
2. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.
3. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors

Reference Books :

1. Tropical soils in engineering practice by S. A. Ola, Balkema publications, Holland Principles of Foundation Engineering: Das B.M., PWS publishing co., (1999)
2. Soil stabilization principles and practice by Ingles, O. G. and Metcalf, J. B., Butterworth,1972

V Semester
CV2326– PE-I : LAB - Soil Characterization & Identification

COURSE OBJECTIVE	COURSE OUTCOMES
Students will be introduced to 1. Properties of the expansive and soft soil 2. Characteristics of Liquefiable and filled up Soils 3. Geotechnical properties of organic, peaty Soils, collapsible soils. 4. Stabilizing soils using various techniques for of different soil.	Students will be able to 1. Examine properties of the expansive and soft soil 2. Explain characteristics of Liquefiable and filled up Soils 3. Identify Geotechnical properties of organic, peaty Soils, collapsible soils 4. Apply various techniques for stabilization of different soil.
Mapped Program Outcomes : 1, 2, 3, 4, 8, 9, 10 **POS:** 2	

Following Practical's will be conducted:

1. Determination of Index properties.
2. Determination of Liquid limit and Plastic limit of soil
3. Determination of shrinkage factors of soil
4. Determination of Swelling index of soil
5. Determination of compaction properties
6. Determination of consolidation properties
7. Determination shear strength parameters
8. Determination of California Bearing Ratio (CBR)
9. Performing Laboratory plate load test
10. Performing Laboratory Standard Penetration test.
11. Case Study.

V Semester
CV2327– PE-I : Geographical Information Systems

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Fundamentals and components of Geographic Information System 2. Various types of Spatial and Non-Spatial data and its measurement techniques. 3. Various data Spatial and Non-Spatial models, coordinate systems, map projections, types of surfaces and operations in GIS. 4. Application of GIS in civil engineering problems.	Students will be able to 1. Explain basic concepts, components and terminologies related to GIS. 2. Differentiate various types of data and its measurement techniques. 3. Explain various data models, coordinate systems, map projections, types of surfaces and operations in GIS. 4. Examine the application GIS in civil engineering problems.
Mapped Program Outcomes : 1, 8, 9, 10	

UNIT–1 : Introduction - A Brief History of GIS - Geographical concepts and terminology - Essential components of GIS -utility of GIS- Hardware, Software, Data, People, Methods – Proprietary and open source Software Various GIS packages.	**[06 Hrs.]**
UNIT–2 : Data: Spatial and Non-Spatial Data Spatial Data: Points, Lines, Polygons/Area and Surface - Non-Spatial Data - Scales/Levels of Measurement. Data Base: Data sources, Data Base Structure models.	**[07 Hrs.]**
UNIT–3 : Data acquisition: Vector Data Models, Raster data model, Data Compression, arc-node data structure - Raster to vector conversion - Topology and spatial relationships - Data storage verification and editing.	**[07 Hrs.]**
UNIT–4 : Coordinate systems, Datums- Map projections - Coordinate transformation, Georeferencing, Digitization- Methods of digitization, Common errors in digitization.	**[06 Hrs.]**
UNIT–5 : Discrete and continuous surfaces- Digital elevation models, sources of DEM, TIN structure, Extraction of topographic parameters: slope, aspect, delineation of watershed and drainage network - DEM applications.	**[06 Hrs.]**
UNIT–6 : Operations in GIS - Overlay, Buffers, Spatial analysis, Network analysis, Application of GIS to various natural resources mapping and monitoring and other civil engineering related problems.	**[07 Hrs.]**

Text Books :

1. Lo C.P. and Yeung
2. A.K.W., Concepts and Techniques of Geographic Information Systems, Prentice-Hall, Inc., NJ, 2002.
3. An Introduction to Geographical Information Systems (4th Edition) by Ian Heywood, Sarah Cornelius and Steve Carver, 2012
4. Burrough, P.A. and McDonnell, R.A. (1998) Principles of Geographical Information Systems. Oxford University Press, Oxford.
5. Introduction to Geographic Information Systems by Chang Kang-tsung (Karl), 2006
6. Geographic Information Systems: An Introduction by Tor Bernhardsen, 2005

Reference Books :

1. M. Anji Reddy BS Publications Remote Sensing and Geographical Information Systems Third Edition
2. Geographic Information System and Environment Modeling Keith C. Clerk, Bradely O Parks, Michel P Crane Pritince Hall of India 2002.

V Semester
CV2328 – PE-I : LAB - Geographic Information Systems

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Fundamentals and components of Geographic Information System 2. Various types of Spatial and Non-Spatial data and its measurement techniques. 3. Various data Spatial and Non-Spatial models, coordinate systems, map projections, types of surfaces and operations in GIS. 4. Application of GIS in civil engineering problems.	Students will be able to 1. Explain basic concepts, components and terminologies related to GIS. 2. Differentiate various types of data and its measurement techniques. 3. Explain various data models, coordinate systems, map projections, types of surfaces and operations in GIS. 4. Examine the application GIS in civil engineering problems.
Mapped Program Outcomes : 1, 5, 8, 9, 10	

PRACTICALS

Minimum 4 Practicals out of following will be performed

1. Introduction to Arc-GIS System.
2. Coordinate Systems and Map Projections
3. Georeferencing and Image Registration
4. Digitization
5. Map Preparation.
6. Urban Spatial Analysis
   A. Working with Tables.
   B. Attribute Querying
   C. Spatial Querying
   D. Creating Heatmaps
7. Introduction to Q-GIS Plugins
8. Terrain Data Analysis
9. Exercise on Geocoding
10. Project on any task related to GIS

Reference Books :

1. ESRI (1990) Understanding GIS.
2. Heywood I, Cornelius S. and Carver, S. (1998) An Introduction to Geographical Information Systems, Longman publishers, pp. 279-283.
3. Longley, P.A., Goodchild, M. F., Maguire, D. J. and Rhind, D. W. (eds.) (1999) Geographic Information Systems, Volumes 1 & 2, Wiley publishers.

V Semester
CV2331 – OE-I : Building Services Engineering

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Basic concepts of various building services. 2. Aspects of natural light and ventilation. 3. Methods of acoustics, sound insulation and fire protection 4. Equipments and installations used in building services	Students will be able to 1. Associate relevance of ventilation, acoustics & to understand the methodologies. 2. Explain special installations in buildings such as electrical, air conditioning, heating 3. Relate specifications & usage of mechanical installations like lifts, security systems etc. 4. Articulate causes of fires in buildings & their preventive and protective strategies.
Mapped Program Outcomes : 1, 6, 7, 8, 9, 10, 12	

UNIT–1 : **Lighting**: Day lighting, Fenestration, Daylight Factor. **Ventilation:** Functions of ventilation, Stack effect, wind effect, Air flow through buildings, cross-ventilation.	**[07 Hrs.]**
UNIT–2 : **Acoustics, Sound Insulation and Noise Control:** Basic terminology and definitions, Physics of sound. Behaviour of sound in an enclosed space. Requisites for acoustic environment, Noise and its control.	**[06 Hrs.]**
UNIT–3 : **Electrical Installations:** Different types of wiring need of Earthing, comparison between fuse and MCB, substation, types of lightening fixtures, Building protection against lightening.	**[07 Hrs.]**
UNIT–4 : **Air Conditioning**: Requirement of air conditioning, air conditioning system, Pressure-Enthalpy (heat) diagram of vapour compression cycle, refrigeration effect, Thermodynamics of human body. Psychometric chart.	**[06 Hrs.]**
UNIT–5 : **Mechanical Equipment & Installation**: Installation of lifts and escalators, Hot Water Provision (Solar and Electrical), Special features required for physically handicapped and elderly, Conveyors, Vibrators, Concrete mixers.	**[07 Hrs.]**
UNIT–6 : **Fire protection :** Causes of fire in building, Fire classification, Portable extinguishers, fire escapes, Fire detectors and alarm system.	**[06 Hrs.]**

Text Books :

1. Building services, B.S. Patil, Orient Longman.
2. Building Services Engineering, Fred Hall, Roger Greeno, Butterworth-Heinemann, 2007.
3. Building Services Engineering, David V. Chadderton, Taylor & Francis Group, 2007.

Reference Books :

1. E.R. Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. R.G. Hopkinson and J.D. Kay, "The Lighting of buildings", Faber and Faber, London, 1969.
4. William H. Severns and Julian R. Fellows, "Air-conditioning and Refrigeration", John Wiley and Sons, London, 1988.
5. A.F.C. Sherratt, "Air-conditioning and Energy Conservation", the Architectural Press, London, 1980.
6. National Building Code.

V Semester
CV2332 – OE-I : Construction Techniques

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Fundamentals of cement & concrete. 2. Construction Equipment used in Engineering. 3. Analysis of various types of structure. 4. Construction techniques and Safety methods.	Students will be able to 1. Explain various constituents of Cement & Concrete. 2. Apply Equipements & Machinery used in Construction. 3. Apply construction methods for various types of structure. 4. Examine new techniques used in construction, evaluation & safety methods adopted in construction operations
Mapped Program Outcomes : 1, 5, 7, 8, 9, 10, 12,	

UNIT–1 : **Introduction to Cement and Concrete :** Introduction to various types of cement, mortar, Ferro cement, Ready mix concrete, pumped concrete, self-compacting concrete, light weight concrete.	**[07 Hrs.]**
UNIT–2 : **Introduction to :** Various construction Equipments with its Advantages, Disadvantages and its Uses.	**[06 Hrs.]**
UNIT–3 : **Type of structure :** Load bearing, Frame & Composite. **Sub Structure Construction:** - Foundation: Necessity and types of foundations, Footings and its Types, and Introduction to Underwater Construction.	**[07 Hrs.]**
UNIT–4 : **Super structure construction** : Introduction to Stone Masonary and Brick Masonary, formwork and its types, pointing and plastering, roofs, painting, varnishing, Partitions, arches, lintels, stairs and distempering etc.	**[06 Hrs.]**
UNIT–5 : **New Construction Techniques :** Fibers and its types, Pre - Engineered Building and its Application & Advantages.	**[07 Hrs.]**
UNIT–6 : **Safety in Construction Operations :** Introduction to various types of Hazards and its Safety measurement on construction site.	**[06 Hrs.]**

Text Books :

1. M.S. Shetty, " Concrete Technology": S Chand & Co., 6th edition, S. Chand & Company, Limited, 2008
2. Rangwala, Building Construction, 32nd Edition, Charotar Publishing House Pvt. Ltd.2014

Reference Books :

1. Construction Planning, Equipment and methods – Peurifoy-Tata McGraw Hill Publication
2. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008
3. Sushil Kumar, Building Construction, 19th Edition, Standard Publisher Distributors 2001, New Delhi, 2001.
4. Elements of Civil Engineering: By S. S. Bhavikatti, Vikas Publishing House Pvt Limited, 2004
5. Basic Civil Engineering: By Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Firewall Media, 2003
6. SP 70 (2001): Handbook on Construction Safety Practices.

V Semester
CV2333 – OE-I : Introduction To Environmental Management

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Various analysis tools of environmental management 2. Role of impact assessment studies in environmental management 3. Importance of environmental legislations and audit 4. Natural resources, challenges & prospects for sustainable development.	Students will be able to 1. Explain the importance of environmental management tools. 2. Illustrate the procedures impact assessment studies in environmental management 3. Explain environmental legislations and policies for environmental resources. 4. Explain the need of resource management and its challenges for sustainable development.
Mapped Program Outcomes : 6, 7, 8, 9, 10, 12	

UNIT–1 : Introduction to Environmental Management: Quality of life, Objectives and components of Environmental Management, Environmental Management in Socio-economic context. Development and Environmental for Sustainable Development.	**[06 Hrs.]**
UNIT–2 : Introduction to Environmental Impact Assessment: Role and Status of EIA in India EIA Procedures, Environmental Impact Statement, Methodologies of EIA.	**[07 Hrs.]**
UNIT–3 : MoEF questionnaire for environmental clearance, critical environmental issues and formulation of strategies of EMP, environmental management plan, development of action plans for critical environmental education programmers. ISO 14001	**[07 Hrs.]**
UNIT–4 : Environmental Laws and legislation –various enactment and their provisions, Role of State & Central boards of pollution control, Cleaner Technology of production.	**[07 Hrs.]**
UNIT–5 : Environmental Audit- Concept of EA, procedural aspects of conducting environmental audit, EMS. Introduction to life cycle assessment	**[06 Hrs.]**
UNIT–6 : Resource Management: depletion of resources – causes & effects, resource utilization, optimal use of resources.	**[06 Hrs.]**

Text Books :

1. Anand Bal, An Introduction to Environmental Management, Himalaya Publishing House.,2009
2. John Rau & Wooten, Environmental Impact Assessment, Mc Graw Hill.
3. Larry Canter, Environmental Impact Assessment, McGraw Hill.
4. Harry W. Gehm, Jacob I. Bregman, handbook on pollution Control Acts, Central Pollution Control Board, New Delhi.
5. R.K. Sapra, S. Bhardwaj, the New Environmental Age, Ashish Pub. House, New Delhi.

References Books :

1. Rosencrannz, S. Divan, M.L. Nobal, Environmental Law and Policy in India, Cases, Materials And Statutes, Tripathi Pvt. Ltd. Bombay.

V Semester
CV2334 - OE-I : Basics of Transportation Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Various modes of transportation. 2. Various characteristics of individual transportation modes. 3. Regulations as per various organizations and government bodies for the transportation sector in India. 4. Recent development in the transportation sector.	Students will be able to 1. Explain importance of various modes of transportation. 2. Compare various characteristics of individual transportation modes. 3. Distinguish appropriate regulations as per various organizations and government bodies for the transportation sector in India. 4. Discus recent development in the transportation sector.
Mapped Program Outcomes : 1, 8, 9, 10	

UNIT–1 : Importance of Transportation in Nation Development, Different modes of Transportation, Introduction to Road Transportation.	**[06 Hrs.]**
UNIT–2 : Traffic Engineering: users, regulations, signs, signals.	**[07 Hrs.]**
UNIT–3 : Introduction to various organizations and government bodies for transportation sector in India.	**[06 Hrs.]**
UNIT–4 : Introduction to Railway transportation and its development.	**[07 Hrs.]**
UNIT–5 : Introduction to Air transportation and its development.	**[07 Hrs.]**
UNIT–6 : Introduction to Water transportation and its development.	**[06 Hrs.]**

Text Books :

1. Khanna & Justo, Highway engineering, Nem Chand & Bros.
2. K.L. Bhanot, Highway Engineering, S. Chand &Company (P) Ltd. New Delhi
3. Railway Engineering, Saxena, Dhanpat Rai Publication.
4. Airport Planning & Design, Goyal & Praveen Kumar, Galgotia Publication
5. Rangwala, Railway Engineering, Charotar Publishing House, 1995.
6. Rangwala, Airport Engineering, Charotar Publishing House, 1996.
7. Srinivasan R. Harbour, "Dock and Tunnel Engineering", 26th Edition 2013.

Reference Books :

1. Indian Road Congress, IRC handbooks ,International Code Council International Code Council
2. Textbook on Transportation Engineering, S. P. CHANDOLA, 200, S. Chand Publishers, New Delhi
3. Planning and Design of Airports, Robert Horonjeff, Francis Mckelvey, William Sproule, Seth Young, Fifth Edition 2010, McGraw Hill Professionals

V Semester
CV2335 - OE-I : Basics of Water Resource Engineering

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Hydrological processes and components of hydrological cycle. 2. Runoff and hydrographs. 3. Concepts of geo-hydrology and ground water recharge.	Students will be able to 1. Explain the basic concept of hydrology and various processes. 2. Compute various components of the hydrological processes. 3. Calculate geo-hydrological parameters. 4. Illustrate various methods of groundwater recharge.
Mapped Program Outcomes : 1, 7, 9, 12	

UNIT–1 : **Introduction:** Engineering Hydrology, Hydrological Cycle, Hydrological Equation, Importance of Temperature, Wind and Humidity in Hydrological Studies, Latent Heat, Vapour Pressure, Bulb Pressure. **Precipitation:** Definition, Types and Forms of Precipitation, Factors Affecting Precipitation, Measurement of Precipitation by using Rain-gauges, Optimum Number of Rain-gauge Stations and consistency of data.	**[07 Hrs.]**
UNIT–2 : **Infiltration:** Factors Affecting Infiltration, Infiltration Indices and Numerical. **Evaporation:** Factors Affecting Evaporation, Estimation of Evaporation and Evaporation Control. Transpiration and Evapo-transpiration and water balance equation.	**[06 Hrs.]**
UNIT–3 : **Runoff:** Runoff, Sources of Runoff, Components of Runoff, Classification of Streams, Factors Affecting Runoff, Rainfall Runoff Relationships, Numerical on runoff estimation. Introduction to Interception Storage and Depression Storage.	**[06 Hrs.]**
UNIT–4 : **Hydrograph :** Components of hydrograph, types of basin, factors affecting hydrograph, Numerical on Hydrograph.	**[06 Hrs.]**
UNIT–5 : **Geo-hydrology:** Introduction, Occurrence and Distribution of Groundwater, Aquiclude, Aquitard, Aquifers, Types and Properties of Aquifer, Specific Yield, Specific Retention, Porosity, Permeability, Water Table, Darcy"s law and Introduction to Hydraulics of Wells.	**[07 Hrs.]**
UNIT–6 : **Ground Water Recharge**: Introduction, Selection of Recharge Sites, Recharging Methods, Spreading Method, Induced Recharge Method, Recharge Well Method, Sub-surface Dams, Waste Water Recharge and Recharge through Rain Water Harvesting.	**[07 Hrs.]**

Text Books:

1. Ojha, C.S.P., Berndtsson, R., and Bhunya, P., Engineering Hydrology, Oxford University Press, 2008.
2. Raghunath H.M., Hydrology, New Age International Publishers, 1985.
3. Reddy R., Hydrology, Tata McGraw-Hill New Delhi, 2012.
4. VenTe Chow, David, Larry, Applied Hydrology, Mac Graw Hill Publications,1988.
5. Dr. Jaya Rami Reddy, Hydrology, Laxmi Publications. 2008.

Reference Books:

1. Todd, D.K., Ground Water Hydrology, John Wiley & Sons, 2005.
2. Subramnaya, K., Engineering Hydrology,Tata McGraw-Hill Publishing Company Limited, 2017.
3. Sharma R.K., Sharma T.K., Hydrology & Water Resources Engineering, DhanpatRai Publications, 2002.
4. Linsley, R.K., Kohler, M.A. and Paulhus,Hydrology for Engineers, Tata McGraw-Hill Publishing Company Limited,1975.

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V Semester
CV2336 - OE-I : Elements of Water Power Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Hydropower Engineering, power station, hydropower schemes, and hydropower potential. 2. Intake structure and surge tank. 3. Hydraulic Turbine& Generator. 4. Pump Storage Plants.	Students will be able to 1. Examine fundamentals of hydropower and hydropower potential. 2. Explain components of intake structure and surge tank. 3. Determine the flow parameters of turbines. 4. Explain the pump storage plant and its economics.
Mapped Program Outcomes : 1, 8, 9, 10, 12	

UNIT–1 : Introduction: Sources of energy, types of power station, choice of type of generation, components of water power project, types and general layouts of various hydropower schemes, General arrangements of a power station, powerhouse, sub-structure and super structure, underground power station–necessity, principal, types, development.	**[07 Hrs.]**
UNIT–2 : power potential, storage and structures related to hydro-power, Nature of demand: Load curve, load duration curves, load factor, plant factor, plant use factor, firm power secondary power.	**[06 Hrs.]**
UNIT–3 : Intake structures: Types, level of intake, hydraulics of intake structures, trash rack, transition, intake gates. Conduits: Types, economic section, power canals, pen-stock types and diameter pipe supports, anchor blocks, tunnels classification, location and tunnel linings.	**[06 Hrs.]**
UNIT–4 : Surge Tank: Functions and behavior of the surge tanks, location, types of surge tanks, basic design criteria of simple surge tank, fore-bay.	**[06 Hrs.]**
UNIT–5 : Turbines: Classification of turbines, characteristics of different types, choice of type of turbine, turbine setting and cavitation"s, Tail race: Functions, types, channel and tunnel, draft tubes-function and principal types.	**[07 Hrs.]**
UNIT–6 : Pumped storage plants, purpose and general layout of pumped storage schemes, main types, typical arrangements of the upper reservoirs, economics of pumped storage plants.	**[07 Hrs.]**

Text Books :

1. Dandekar M. M. & Sharma K. N, Water Power Engineering, Vikas Publishing House Pvt. Ltd., New Delhi.
2. Sharma R.K. & Sharma T.K., Water Power Engineering, S. Chand Publication.
3. S. K Garg, Irrigation Engineering & Hydraulic Structure (Volume-I & II), Khanna Publications.
4. Arora K. R., Irrigation, Water Power & Water Resources Engineering, Standard Publishers Distributors.

V Semester
CV2341 - OE-II : Elements of Earthquake Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Geological study of earth and interior. 2. Various causes of earthquakes and their characteristics. 3. Behavior of different types of structures under earthquake loading. 4. Earthquake disaster management, mitigation, and different retrofitting techniques.	Students will be able to 1. Express the necessity and importance of earthquake engineering. 2. Illustrate the damages caused due to past earthquakes in & outside India and remedial measures 3. Examine the provision of IS codes used for earthquake-resistant design and strengthening of the structure. 4. Explain the social aspects of earthquake disasters & their management.
Mapped Program Outcomes : 1, 6, 7, 8, 9, 10	

UNIT–1 : Introduction to earthquakes : Geology of earth, configuration of tectonic plates in a globe, behavior of plates, their motion and effects, causes of earthquake and their characteristics, Earthquake parameters, magnitudes, intensity.	**[07 Hrs.]**
UNIT–2 : Seismic waves, recording of earthquakes, analysis and interpretation of earthquake data, determination of magnitude, location of epicenter, focal depth.	**[06 Hrs.]**
UNIT–3 : Seismicity of the world, history of earthquakes in India and abroad, case studies of effects of earthquakes, causes and sources of earthquake damage.	**[06 Hrs.]**
UNIT–4 : Non-engineered earthquake resistant structures, load bearing structures, masonry structures, seismic zoning of India (IS 1893:2002 Part I), seismic coefficients for different zones, definitions, irregularities in buildings, consequences of irregularities.	**[07 Hrs.]**
UNIT–5 : Strengthening, rehabilitation and retrofitting of earthquake damaged structures.	**[06 Hrs.]**
UNIT–6 : Earthquake disaster management, mitigation and social aspects of earthquakes, lessons from past earthquake: - study of damages caused due to past earthquake and remedial measures.	**[07 Hrs.]**

Text Books :

1. Agrawal & Shrikhande, „Design of Earthquake Resistant Structures", 3rdEdition, 2006, Prentice – Hall of India Pvt. Ltd.
2. Jai Krishna, Chandrasekaran & Brijesh Chandra, „ Elements of Earthquake Engineering", 2nd Edition, Standard Publishers Distributors, New Delhi
3. Roberto Villaverde, „Fundamental Concepts of Earthquake Engineering", 2009, CRC Press
4. Asadour H. Hadjian, „Basic Elements of Earthquake Engineering", 2015, Wiley

Reference Books:

1. C.V.R. Murty, Earthquake Tips, 2005, NICEE, IITK
2. www.nicee.org, „NICEE Guidelines for Earthquake Resistant Non-Engineered Construction', 2004, National information center of Earthquake engineering Indian Institute of Technology Kanpur Kanpur 208016, India
3. Robin K. McGuire, Seismic Hazard and Risk Analysis, 2004, Earthquake Engineering Research Institute; First edition.

		June 2020	1.00	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
CV2342 - OE-II : Introduction To Finite Element Method

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. General steps of FEM. 2. Derivation for shape functions. 3. Parametric formulation in FEM. 4. Storage techniques and numerical integration.	Students will be able to 1. Explain the concepts of FEM. 2. Illustrate elemental equations using the concepts of FEM. 3. Analyze engineering problems using FEM. 4. Apply numerical integration using FEM.
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10, 12	

UNIT–1 : Introduction : Development, Historical background, Applications, Advantages and Disadvantages of FEM, General steps of FEM, direct equilibrium approach, Variational approach , weighted residual approach, local and global FEM, application to simple problems.	**[07 Hrs.]**
UNIT–2 : Shape functions : Introduction, requirement of Ideal displacement functions, Derivation of shape functions using Cartesian Coordinates, Lagrange and Serendipity elements.	**[06 Hrs.]**
UNIT–3 : Application of FEM to 1D Problems : Derivation of element property matrix and influence vector, application, Application to bar, truss, steady state heat conduction, steady state flow through porous medium problems.	**[06 Hrs.]**
UNIT–4 : Application of FEM to 2D problems : Equilibrium equations, Triangular and Rectangular element formulation using Cartesian Coordinates, Application to two-dimensional stress analysis.	**[07 Hrs.]**
UNIT–5 : Natural coordinates, Isoparametric elements, Application to 1D and 2D Problems.	**[07 Hrs.]**
UNIT–6 : Numerical integration, Modeling, storage and solution techniques.	**[06 Hrs.]**

Text Books :

1. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
2. Godbole P.N, Introduction to Finite Element Method, I. K. International Publishing House Pvt. Ltd., New Delhi, 2013
3. Desai Y.M., Eldho T.I. and Shah A. H., Finite Element Method s and Application to Engineering, Pearson, 2011.

Reference Books :

1. Krishnamoorthy C S, "Finite Element Analysis – Theory and Programming", Tata McGraw Hill Publishing Co., New Delhi, 1994.
2. Cook R D, Malkus D S, Plesha M E and Witt R J, "Concepts and Applications of Finite Element Analysis", John Weily & sons inc, New York, Fourth Edition, 2003.
3. Rajasekaran S, "Finite Element Analysis in Engineering Design". S Chand & Co., 2003.

V Semester
CV2343 - OE-II : Air Pollution and Solid Waste Management

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Air pollution episodes, air pollutants, their sources & effects. 2. Meteorological parameters, air sampling & measurement of pollutants. 3. Air pollution controlling technologies, air pollution due to automobiles & general Idea of noise pollution 4. Solid waste management by processing, treatment, disposal & reuse of solid waste.	Students will be able to 1. Classify the type, sources & effect of air pollutants. 2. Explain the parameters affecting air pollution and various methods of measurement. 3. Illustrate various air pollution control equipments & pollution caused due to automobile exhaust and basics of noise pollution. 4. Interpret the concepts of solid waste management, treatment and disposal methods.
Mapped Program Outcomes : 1, 3, 5, 7, 8, 9, 10	

UNIT–1 : Introduction to air pollution: Air pollution episodes, Atmosphere and its zones, classification and sources of air pollutants, effects of air pollutants on man, plants animal & materials.	**[06 Hrs.]**
UNIT–2 : Meteorological Aspects: Atmospheric stability, plume behaviour, Ambient air sampling and stack sampling, collection of particulates and gaseous pollutants, methods of estimation.	**[07 Hrs.]**
UNIT–3 : Air pollution control methods and equipment: Principle of control methods for particulates and gaseous pollutants, gravity settlers, electrostatic precipitators, bag filters cyclones, wet scrubbers, automobile exhaust: Pollution due to diesel and petrol engines, exhaust treatment and abatement, noise Pollution: Sources, ill effects, control measures.	**[06 Hrs.]**
UNIT–4 : Introduction to solid waste management, sources, quantification and characterization, classification and components, sampling and analysis Method of collection.	**[07 Hrs.]**
UNIT–5 : Equipment used for collection and transportation, transfer stations, solid waste processing and management.	**[06 Hrs.]**
UNIT–6 : Treatment and disposal methods: composting, sanitary landfills, Incineration – concept, components and applications, leachate management.	**[07 Hrs.]**

Text Books :

1. M.N. Rao & H.V.N. Rao, 1988, Air Pollution, Tata McGraw Hill Publishing Co. Ltd.
2. C.S. RAO, 2007, Environmental Pollution Control Engineering, New Age International, Wiley Estern Ltd. New Delhi.
3. Stern A. C., 1973, Air pollution, Academic Press.
4. A.D. Bhide & Sunderesan B.B., 1983, Solid Waste Management in Developing countries, INSDOC, New Delhi.
5. Tohobanoglous, 1993, Intgrated Solid Waste Management Engineering Principle and Management Issues, McGraw-Hill publication Ltd.
6. K. V. S. G. Murlikrishna, 1995, Air Pollution, Kaushal & Company.

Reference Books :

1. P. Aarne Vesilind, William Worrell & Debra Reinhart, 2002, Solid Waste Engineering, Cengage Learning India pvt. Ltd.
2. Dr. Y Anjaneyulu, 2002, Air Pollution and Control Technologies, Allied Publisher pvt. Ltd. Waste Management: A Reference Handbook. Contributors: Jacqueline Vaughn - Author. Publisher: ABC-Clio.

V Semester
CV2344 - OE-II : Environmental & Social Impact Assessment

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Evolution of EIA. 2. Methods of impact assessment and assessment of impact of air and noise environment. 3. Assessment of impact on cultural and socioeconomic environment. 4. EIA notification.	Students will be able to 1. Explain the EIA process, analyse major environmental issues for development projects. 2. Examine model tasks within an EIA cycle. 3. Construct portions of environmental documents through administrative and legal requirements. 4. Illustrate the standards of professional practice about EIA.
Mapped Program Outcomes : 1, 2, 6, 7, 8, 9, 10	

UNIT–1 : **Evolution of EIA:** Concepts, Nature & Type of impacts, Need of EIA, Participation in EIA, New concepts- Life cycle assessment.	**[07 Hrs.]**
UNIT–2 : **Methods for impact assessment:** Screening, Scoping, Base line studies, Check list, Mitigation, Matrices, Interaction of network methodologies.	**[06 Hrs.]**
UNIT–3 : **Assessment of impact for air and noise environment:** Basic information of air quality, identification of type and quantity of air pollutant, impact prediction and assessment.	**[07 Hrs.]**
UNIT–4 : **Assessment of impact for water and soil environment:** Basic information of water Quality, identification of impact, prediction of impact and assessment, mitigations.	**[06 Hrs.]**
UNIT–5 : **Assessment of impact on cultural and socioeconomic environment:** Public participation in EIA, Cumulative environmental effects Monitoring and auditing: after the decision.	**[07 Hrs.]**
UNIT–6 : **EIA notification by Ministry of Environment and Forest (Govt. of India):** Provisions in the EIA notification, Categorization of Industries for seeking environmental clearance from concerned authorities, Environmental management plan post environmental monitoring. Case studies in EIA.	**[06 Hrs.]**

Text Book :

1. Anand Bal, An Introduction to Environmental Management, Himalaya Publishing House.
2. Canter L.W. 1977. Environmental Impact Assessment. McGraw Hill, Inc. Printed in the United States of America.
3. Peter Watten (Eds.) – "Environmental Impact Assessment Theory and Practice", Unwin Hyman, London (1988).

Reference Books:

1. John G. Rau and David C Hooten (Ed)., "Environmental Impact Analysis Handbook", McGraw-Hill Book Company, 1990.
2. "Environmental Assessment Source book", Vol. I, II & III. The World Bank, Washington, D.C., 1991.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II", Blackwell Science, 1999.
4. Bass, Herson and K. Bogdon, 2001, The NEPA Book: A step-by-step guide on how to comply with the National Environmental Policy Act, Solano Press.
5. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.

V Semester
CV2345 - OE-II : Disaster Management

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. The nature & types of disaster, 2. Role of different government &social agencies in disaster management 3. Risk &cost assessment of disaster management 4. Disaster management cycle.	Students will be able to 1. Distinguish the nature & types of disaster. 2. Report its preparedness, role of different government &social agencies. 3. Predict the extent of risk and cost assessment. 4. Conclude provisions, management of disaster, post disaster condition & its management
Mapped Program Outcomes : 1, 2, 6, 11,	

UNIT–1 : **Understanding Natural Disasters**: Natural disasters, which have been categorized as hydrological, wind-related, geo-physical, hydro-geological and climatic, discuss the causes and impacts, along with past illustrations and geographical distribution. Flood, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic Eruptions, Heat and Cold Waves, Climate Change: Global Warming, Sea Level Rise, Ozone Depletion.	**[08 Hrs.]**
UNIT–2 : **Man-Made Disasters:** Nuclear Disasters, Chemical Disasters, Biological Disasters, Building Fire, Coal Fire, Forest Fire, Oil Fire, Air Pollution, Water Pollution, Deforestation, Industrial Pollution, Road Accidents, Rail Accidents, Air Accidents, Sea Accidents.	**[05 Hrs.]**
UNIT–3 : **Risk & Cost Assessment:** Geographical conditions, Population, Living habits, Threats, Extent of damages to the lives, agricultural area, industrial units, Awareness & Safety Program. Relief arrangement & essential components, Shelters, Rescue & search tools &equipment, transport facilities. Cost assessment of each unit and funding.	**[06 Hrs.]**
UNIT–4 : **Disaster Preparedness:** Concept and Nature, Planning, Disaster Preparedness for People with Special Needs/Vulnerable Groups, Disaster Preparedness with Relevance to Housing, Infrastructure and Livestock, Community Based Disaster Preparedness Plan, Role of Information, Education, Communication, and Training, Disaster Preparedness: Role Play by Government and Social Groups. Information Technology: Role in Disaster Preparedness with Special Reference to Geographical Information System, Use and Application of Emerging Technologies in Disaster Preparedness.	**[07 Hrs.]**
UNIT–5 : **Disaster Response:** Disaster Response Plan, Communication, Participation, and Activation of Emergency Preparedness Plan, Logistics Management, Needs and Damage Assessment, Psychological Response, Trauma and Stress Management. Rumour and Panic Management, Minimum Standards of Relief, Managing Relief, Funding Relief, Recovery.	**[06 Hrs.]**
UNIT–6 : **Reconstruction and Rehabilitation :** Damage Assessment, Management and Development Information Structural, Parameters of Vulnerability, Development of Physical and Economic Infrastructure, Creation of Long-term Job Opportunities and Livelihood Options, Funding Arrangements for Reconstruction, Nature of Damage to Houses and Infrastructure due to Disasters, Disaster Resistant House Construction, Role of Housing / Building Authorities, Education and Awareness Role of Information Dissemination, Participative Rehabilitation Process: Some Case Studies Long-term Recovery.	**[07 Hrs.]**

V Semester
CV2345 - OE-II : Disaster Management

Text Books:

1. Satish Modh: Introduction to Disaster Management, Macmillan, 2009
2. Amit Awasthy: Disaster Management: Warning Response and Community Relocation, Global India Publications, 2009
3. Jyoti Purohit :Disaster Management in India: Structure and Challenges, 2013
4. Prakash Singh: Disaster Response in India, www.MilitaryBookshop.Companyuk, 2011

Reference Books:

1. D.B.N. Murthy: Disaster Management: Text and Case Studies, Deep and Deep Publications, 2007
2. National Policy on Disaster Management, NDMA, New Delhi, 2009.
3. A Global Report - Reducing Disaster Risk, A Challenge for Development; UNDP Publication, 2004.
4. Disaster Management Act. (2005), Ministry of Home Affairs, Government of India, New Delhi, 2005.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

6th Semester

Civil Engineering

28 June 2019

VI Semester
GE2312 - Fundamentals of Economics

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. The concept of economics and provides knowledge about consumer"s rational behavior. 2. Learn the various factors of production and its role in production. 3. Knowledge of market structure, demand and revenue curves. 4. National income, its counting with respect to various factors. 5. Functioning of money, financial institution and various sources of public finance/revenue. 6. International economics, foreign trade and various international financial institution.	Students will be able to 1. Discover the knowledge of various fundamental concepts of economics. 2. Interpret the concept of microeconomics. 3. Generalize the ideas of macroeconomic. 4. Describe national and international trade.
Mapped Program Outcomes : 1, 7, 11, 12	

UNIT–1 : Introduction to Economics and Consumers" Behaviors: Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer"s equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand.	**[06 Hrs.]**
UNIT–2 : Production and Costs: Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation.	**[07 Hrs.]**
UNIT–3 : Market structures - equilibrium output and price: Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination.	**[06 Hrs.]**
UNIT–4 : National income accounting: Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation.	**[07 Hrs.]**

VI Semester
GE2312 - Fundamentals of Economics

UNIT–5 : Money, Banking and Public Finance: Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes- Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc.) and Indirect Taxes (GST, Import duties), Revenue and capital expenditure.	**[06 Hrs.]**
UNIT–6 : International Trade and Institutions: Definitions of closed vs. open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions.	**[07 Hrs.]**

Text Books:

1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher, 2007

Reference Books:

1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007. Economics: Samuelson,
4. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
5. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

VI Semester

CV2351 - Steel Structures

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Structural steel components & its connection. 2. Tension member, compression member, lacing and batten built-up sections. 3. Laterally restrained and unrestrained beams 4. Pre-Engineered Building and column bases	Students will be able to 5. Explain type of structure and its design methodology 6. Calculate different types of loading with respect to structural parameters. 7. Apply Indian Standard code for design of steel structure components. 8. Analyze and design Steel simple, built-up sections and column bases
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10 **PSO :** i	

UNIT–1 : **Steel as a Structural Material:** Physical and mechanical properties of Structural Steel, Merits and Demerits of Steel as a Structural Material, Grades of Structural Steel, Structural Steel Sections, IS 800:2007, Introduction to Limit State Method.	**[06 Hrs.]**
UNIT–2 : **Connection:** Types and Failure of Connections, Riveted Connection, Bolted Connection, Welded Connection, Strength and Efficiency of Joint.	**[07 Hrs.]**
UNIT–3 : **Tension Member:** Types of Tension Member, Stresses, Design of Tension Member **Compression Member:** Effective length, Slenderness ratio, Design of Compression Member.	**[06 Hrs.]**
UNIT–4 : **Column:** Design of Axially loaded columns, Design of Laced and Battened Columns (Design of Built-up Columns) with Bolted and Welded End Connection.	**[07 Hrs.]**
UNIT–5 : **Design of Beam:** Types of Beams, Lateral Stability of beams, Types of section, Stresses on Beam, Design of Laterally Supported Beam, Design of Laterally Unsupported Beam, Built-up Beams.	**[06 Hrs.]**
UNIT–6 : **Column Bases** Types of Column Bases, Slab Base, Gusset Base, Design of Slab Base and Gusseted Base. **Introduction to pre Engineered Building (PEB).**	**[07 Hrs.]**

Text Books:

6. Fundamentals of Structural Steel Design, By M. L. Gambhir, McGraw Hill Education, 2013
7. Design of Steel Structures, By N. Subramanian, OXFORD University Press, First Edition, 2008
8. Limit State Design of Steel Structures, By S. K. Duggal, McGraw Hill Education Private Limited, 2011

Reference Books:

1. Design of Steel Structures, LSM, By S. S. Bhavikatti, I. K. International Publication House Pvt. Ltd. 2009
2. Structural Steel Design, By Jack C. McCormac), Stephen F. Csernak, 5th Edition Pearson Education Limited, 2013

VI Semester
CV2352 – LAB : Building Design and Drawing

COURSE OBJECTIVE	COURSE OUTCOMES
Students will be introduced to 1. Turbulent flow through pipe running under full condition & Uniform flow, non-uniform flow in open Channel 2. Analysis of the water distribution network and flow around the submerged body. 3. Practical flow profiles in open channel 4. Flow profile length in open channel	Students will be able to 1. Draw various orthographic views of a building using drawing instruments and by free hand sketches. 2. Apply principles of planning and building bye-laws to draw working and submission drawings of a building. 3. Draw perspective view of a building and its elements. 4. Use software used for building drawing to draw submission and working drawings
Mapped Program Outcomes : 1, 2, 3, 4, 8, 9, 10	

Following Practicals will be conducted:

1. Development of Line plan for a residential building. **(01 Assignments)**
2. Submission drawing of a residential building. **(01 Assignments)**
3. Line Plan of public building on A1 size graph sheet. **(01 Assignment)**
4. Two Point Perspective of a building or its element **(01 Assignment)**
5. Submission drawing of a residential building using AutoCAD. **(01 Assignment)**
6. Free Hand Sketches (minimum 30) of various elements of building in **A3 size sketchbook**.

VI Semester
CV2353 – Hydraulic Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Turbulent flow through pipe running under full condition & Uniform flow, non-uniform flow in open Channel 2. Analysis of pipe network in water distribution system and most efficient channel section for conveyance of water 3. Fundamental study of physical quantity and relation between various physical quantity. 4. Flow over notches and weirs in channel	Students will be able to 1. Calculate various losses, discharges, pressure, in flow through pipe and various flow parameter in open channel 2. Analyze the water distribution network by using Hardy Cross Method and most efficient channel section for conveyance of water 3. Apply Buckingham"s Pi theorem to establish relation between various physical quantities. 4. Compute the discharges in channel by using notches and weirs
Mapped Program Outcomes : 1, 2, 3, 5, 8, 9, 10	

UNIT–1 : Flow Through Pipes: Frictional resistance to flow of fluid, loss of energy in pipe, Darcy-Weis-bach& Hazen William"s equation for frictional head loss, Hydro-dynamically smooth and rough surfaces, Hydraulic gradient and energy gradient lines: Pipes in series and parallel, equivalent pipe.	**[07 Hrs.]**
UNIT–2 : Flow Through Pipes: Syphon, Branched pipes, Three reservoir, pipe networks, Hardy – Cross method, Water hammer pressure.	**[06 Hrs.]**
UNIT–3 : Introduction, fundamental quantity, derived quantity, dimensions, dimensional homogeneity, methods of dimensional analysis, repeated variable, Buckingham pi method.	**[06 Hrs.]**
UNIT–4 : Notches and weirs: Definition and types, flow over rectangular notch, triangular notch end contraction, coefficient of discharge and its determination. Error in measurement of head. Velocity of approach and its effects, Cippoletti, Broad crested and submerged weirs. Types non-conventional weirs.	**[07 Hrs.]**
UNIT–5 : Uniform flow in Open Channel: Types of channel and their geometrical properties, Types of flow in open channel. Chezy"s and Manning"s equations for computations of normal depth of flow, Hydraulically most efficient rectangular, triangular, trapezoidal, circular sections.	**[06 Hrs.]**
UNIT–6 : Critical Flow and Rapidly Varied Flow: Specific energy and specific energy diagram, alternate depths, Computations of critical depth, section factor for critical flow, Conditions of critical flow, Definition, application of hydraulic jump, Classifications of jump, energy loss, Belanger momentum equation.	**[07 Hrs.]**

Text Book :

1. Modi& Seth, Fluid mechanics and Machineries, Standard Book House, Delhi.
2. K.G., Flow through open channels, 1998, Tata McGraw Hill Publications.
3. Subramanya K., Flow in open channels, 2009, Tata McGraw Hill Publication
4. C.S.P. ojha, R Berndtsson, Oxford university press, New Delhi110001, India.
5. Hanif Choudhary, Hanif, Applied Hydraulic Transients, 3rd edition, Springer New York, Heidel Berg Dordrecht, London.
6. Rajesh Shrivastav, Flow Through Open Channels, Oxford University Press, New Delhi, 2008.

Reference Books :

1. VenTe Chow Open channel hydraulics, International Student Edition. McGraw Hill.

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VI Semester
CV2354 – LAB : Hydraulic Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Turbulent flow through pipe running under full condition & Uniform flow, non-uniform flow in open Channel 2. Analysis of the water distribution network and flow around the submerged body. 3. Practical flow profiles in open channel 4. Flow profile length in open channel	Students will be able to 1. Calculate various losses, velocity, discharges, pressure, in flow through pipe and various flow parameter in open channel 2. Analyze water distribution network and flow around the submerged body 3. Analyze various flow profiles, in open channel 4. Calculate profile length by using Direct step method
Mapped Program Outcomes : 1, 2, 3, 4, 8, 9, 10	

Practicals:

Minimum **TEN** Experiments from the following will be performed:

1. Study of flow around immersed bodies.
2. Determination of Darcy – Weisbach friction factor for given pipes.
3. Determination of Manning"s or Chezy"s constant for uniform flow in an open channel.
4. Study of hydraulic jump in a horizontal rectangular channel.
5. Development of specific energy diagram for rectangular channel.
6. Study of flow over horizontal contraction.
7. Determination of minor losses in pipes.
8. Determination of velocity in open channels flow by using current meter.
9. Design problems of pipe network analysis.
10. Sketch the various profiles in open channels flow
11. Computation of water surface length in open channel by using direct step method.

Reference Books:

1. Laboratory work in Hydraulic Engineering, 2006, Asawa, G.L., New Age International Publishers.

VI Semester
CV2355 – Foundation Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Geotechnical site investigation. 2. Bearing capacity of foundations 3. Lateral earth pressure and stability of slopes. 4. Different methods of ground improvement.	Students will be able to 1. Explain planning and implementation of a site investigation. 2. Evaluate the bearing capacity for shallow and deep foundation design. 3. Calculate the lateral earth pressure for retaining wall. 4. Describe different techniques for ground improvement and slopes stability analysis
Mapped Program Outcomes: 1, 2, 3, 4, 8, 10 **PSO :** ii	

UNIT–1 : GEOTECHNICAL EXPLORATION : Importance and objectives of field exploration, principal methods of subsurface exploration, open pits & shafts, types of boring, number, spacing and depth of boring for different structures, type of soil samples & samplers, collection & shipment of samples, bore logs and sampling record.	**[06 Hrs.]**
UNIT–2 : SHALLOW FOUNDATIONS : Bearing capacity of soils (IS: 6403), types of shear failure in foundation soil, Terzaghi"s theory, its validity and limitations, bearing capacity factors, effect of water table on bearing capacity, Standard Penetration Test, Plate load test, Settlement of foundation.	**[07 Hrs.]**
UNIT–3 : PILE FOUNDATION : Classification and types of piles, constructional features of cast–in–situ & pre-cast concrete piles, pile driving methods, load transfer mechanism of axially loaded piles. Pile capacity by Static formula & Dynamic formula, pile load test and interpretation of data, group action in piles- spacing of piles in groups, group efficiency, settlement of pile group by simple approach, negative skin friction and its effect on pile capacity, under reamed piles.	**[06 Hrs.]**
UNIT–4 : LATERAL EARTH PRESSURE : Fundamentals of earth pressure at-rest, active & passive pressures, general & local states of plastic equilibrium in soil, Rankine"s and Coulomb"s theories of earth pressure, effects of soil type, surcharge, submergence, graphical solutions of Rebhan and Culmann for active case.	**[07 Hrs.]**
UNIT–5 : STABILITY OF SLOPES : Causes and types of slope failure, stability analysis of infinite slopes and finite slopes including effect of seepage, Swedish slip circle, Friction circle, Taylor"s stability numbers & stability charts, methods of improving stability of slopes.	**[07 Hrs.]**
UNIT–6 : GROUND IMPROVEMENT: Method of soil stabilization, reinforced earth, geotextile materials-types, function and applications, deep compaction-impact, vibroflotation, sand drain, pre-loading and surcharging.	**[06 Hrs.]**

VI Semester
CV2355 – Foundation Engineering

Text Books :

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books :

1. Design Aids in Soil Mechanics and Foundation Engineering,1988, Kaniraj R.,McGraw Hills, New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan, Meerut.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C, Prentice Hall & Co., New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian Standards.

VI Semester
CV2360 - Industry Visit and Its Report

COURSE OBJECTIVE	COURSE OUTCOMES
1. Problems on Mathematics, Profit and loss, ratio and proportion, simple and compound interest etc. 2. Coding decoding, cubes cutting, syllogisms, data interpretation etc. 3. Articles, Sentence correction, para jumbles, vocabulary, verbal reasoning 4. Logical development through program solving, python basics, Matrix, number system etc.	1. Make detailed notes and reports. 2. Compute the problems on quants 3. Illustrate the problems on logical,technical and verbal 4. Apply the field knowledge to the practical applications.
Mapped Program Outcomes : 1, 2, 5, 8, 9, 10, 11	

The students are expected to visit minimum Six Different live construction project sites covering various construction methodologies.

The students shall prepare the report based on such visits. The reports should include the technical details on all aspects of the project including plant, material, machinery, HR, Quality Assurance etc. being followed at the site for construction.

The evaluation will be based on seminar and the site visit report submitted by the students.

VI Semester
CV2361 - PE-I : Building Services

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Concepts of building services. 2. Aspects of natural light, ventilation, acoustics 3. Equipment and installations used in building services 4. Causes of Fires and protective strategies	Students will be able to 1. Articulate relevance of plumbing services, causes of fire and protection strategies. 2. Simulate special installations in buildings. relevance of lighting, ventilation & acoustics 3. Illustrate specifications, usage of mechanical installations and facilities for physically challenged, aged people. 4. Explain water treatment services.
Mapped Program Outcomes : 1, 6, 7, 8, 9, 10, 12	

UNIT–1 : **Plumbing Services:** Domestic water system, flushing, sewage water system, rain water system, water treatment, sewage water treatment, all piping & sanitary fixtures that provide water for any Use (drinking, cooking, bathing, laundry, process, etc.)	**[07 Hrs.]**
UNIT–2 : **Fire Protection:** Causes of fire in building, Fire resisting properties of materials. Fire resistant construction. Fire protection requirements for multistoried building. Safety against fire in theaters and cinema halls. Fire detecting and extinguishing system.	**[06 Hrs.]**
UNIT–3 : **Electrical Installations:** Different types of wiring need of Earthing, comparison between fuse and MCB, substation, types of lightening fixtures, Building protection against lightening. **Air Conditioning:** Requirement of air conditioning, air conditioning system, Pressure-Enthalpy (heat) Diagram of vapor compression cycle, refrigeration effect, Thermodynamics of human body. Psychometric chart.	**[07 Hrs.]**
UNIT–4 : **Lighting** : Day lighting, Fenestration, Daylight Factor. **Ventilation :** Functions of ventilation, Stack effect, wind effect, Air flow through buildings, cross-ventilation. **Acoustics, Sound Insulation and Noise Control :** Basic terminology and definitions, Physics of sound. Behaviour of sound in an enclosed space, Noise and its control.	**[07 Hrs.]**
UNIT–5 : **Mechanical Equipment & Installation:** Vertical transportation such as stairs, elevators, escalators, ramp, Conveyors, Vibrators, Concrete mixers, facilities for physically handicapped and elder.	**[07 Hrs.]**
UNIT–6 : **Water Services :** Introduction, Water treatment, Base exchange, Demineralization, Cold-water services, Hot-water services, Pipe sizing, Materials for water services, water supply sanitation, Drain systems.	**[06 Hrs.]**

Text Books :

1. B.S. Patil, Building services, Orient Longman.
2. Fred Hall, Roger Greeno, Building Services Engineering, Butterworth-heinemann.
3. David V. Chadderton, Building Services Engineering, Taylor & Francis Group.

Reference Books :

1. E.R. Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. R.G. Hopkinson and J.D. Kay, "The Lighting of buildings", Faber and Faber, London, 1969.

VI Semester
CV2362 - PE-II : New Engineering Materials

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Discuss various civil engineering materials. 2. Differentiate various methods of testing of materials. 3. Learn principles of the composite section and its uses.	Students will be able to 1. Discuss various civil engineering materials. 2. Differentiate various methods of testing of materials. 3. Learn principles of the composite section and its uses.
Mapped Program Outcomes : 1, 5, 7, 8, 9, 10, 12	

UNIT–1 : Introduction to Cold Formed steel, Pre - Engineered Steel Buildings its applications and advantages, aluminum profiles its Characteristics and applications.	**[07 Hrs.]**
UNIT–2 : Introduction to SCC, Light weight concrete, Ferro cement concrete.	**[07 Hrs.]**
UNIT–3 : Fly ash blended concrete, effect of fly ash on Fresh concrete, replacement procedures, effect of Admixtures, durability, Advantages and Disadvantages and its applications, Red Mud.	**[06 Hrs.]**
UNIT–4 : High strength concrete, high performance concrete, Vacuumed dewatered concrete.	**[06 Hrs.]**
UNIT–5 : Introduction to FRP, FRC and other types of fibers and their applications.	**[06 Hrs.]**
UNIT–6 : Introduction to steel concrete composite section, Introduction to shear connectors, Thermal and Sound insulating materials. use of IS: 11384.	**[07 Hrs.]**

Text Books :

1. Properties of Concrete, Neville A. M., Pearson Education Limited
2. Special Concretes, Rafatsiddhequi, Galgotia Publications
3. Concrete Technology, M Gambhir, Tata Mcgraw Hill Education Private Limited.

Reference Books :

1. Mehta P, Concrete Technology, Tata Mcgraw Hill Education Private Limited.
2. Shetty M. S, Concrete Technology, S. Chand Publisher.
3. Composite Construction Engineering by Gajanan M. Sabnis

VI Semester
CV2363 - PE-II : Construction Management and Machinery

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. The concepts related with Construction industry, management and legal laws. 2. Basic principles of Construction Management & networking techniques (CPM and PERT) of project controlling in the context of various construction aspects. 3. Project resources and its scarcity, management functions to control and analysis of equipment and material management. 4. Various equipment of drilling-blasting techniques, concrete equipment and basics of economics.	Students will be able to 1. Understand and analyze scope and role of civil engineer in developing economy of Nation and construction industry. 2. Evaluate the development of network technique of major projects, material and equipment and its safety management. 3. Develop knowledge about quality and finance management system carried out in industry. 4. Classify various major construction equipment used in construction and economics of demand and supply.
Mapped Program Outcomes : 1, 4, 8, 9, 10, 11, 12	

UNIT–1 : **Construction Industry**: Nature, Characteristics, size and structures. Role in economic development of nation, Employment generation and Infrastructure development related to other industries. **Construction Management**: Necessity, Application of management functions viz. Planning, Organizing, Staffing, Leading and controlling to the construction. **Construction manager**: Role, Qualities, Ethics, Duties, Responsibilities, Authorities. **Legal Aspect and Laws Applicable to Construction Industry**: Works contract act, Child labour act, Workman"s compensation Act, Employees provided fund Act 1952, Minimum wages Act, Payment of bonus Act 1965, Maternity leave Act.	**[06 Hrs.]**
UNIT–2 : Project management: Introduction, Types of projects, Various phases of project, Project Proposal, Components of planning, Objectives of planning, Factors affecting planning, Organizational setup, Typical layout of a few major construction projects. **Job Planning**: Bar diagrams & Bar charts, Application of Network techniques (CPM & PERT) for planning. Estimation of critical path and project duration. Resource planning, Resource Allocation, Resource leveling, Optimization of project cost, Cost slope concept.	**[07 Hrs.]**
UNIT–3 : **Material management**: Functions, objectives, purchasing, procedures, records, stock taking, inventory control, EOQ, ABC analysis, material storing. **Equipment managemen**t: Classification of construction equipments, factors affecting selection, Operation & Maintenance cost, Depreciation & Replacement cost, Economic life, Down time cost, Cost of owning equipment. **Safety Management**: Construction hazards, safety in construction, industry & at work site. National safety council, safety organization, accidents, its cost, cause, types & preventions, losses during natural calamities, floods &fire, preventive measures. Safety equipment, Preparation of safety programmes for construction works.	**[06 Hrs.]**
UNIT–4 : **Construction Equipment:** Introduction to Construction Equipment: Their contribution and importance in construction Industry. Classification of Equipment. **Money & Banking**: Functions Commercial & Central Banks. **Financial Management:** Objectives, Law of flow of funds. Financial Accounting Systems, Accounting methods- cash basis, Actual Basis, Percentage completion basis, Completed contract basis.	**[07 Hrs.]**

VI Semester
CV2363 - PE-II : Construction Management and Machinery

UNIT–5 : **Equipments for major projects**: Excavating machines such as Power shovels, Drag Line, Bulldozer, Scrapper, Drilling & blasting equipments, material transporting & handling equipment such as cranes, hoists, conveyer belts, dumpers, cableways, rail system (size, performance & limitations). **Concrete equipments**: Different types of mixers, vibrators, batch mixing plants, Transportation of concrete, concrete pumps & placers, Shotcreting, Guniting & its equipment.	**[07 Hrs.]**
UNIT–6 : **Economics**: Nature & scope of Economics & relationship with Engineering. Supply and Demand Mechanism. Application of MIS: System Development, Data processing, Flow-charting, DBM, Data communication System Developments, Data processing, Application in Civil Engineering Industry. Study of Introduction and Application of construction management software (any one) in civil engineering Industry.	**[06 Hrs.]**

Text Books :

1. Shrivastava U.K., Construction Planning and management, Galgotia publication.
2. Khanna O.P, Industrial Engineering & Management, Dhanpat Rai & Sons, New Delhi, 1992.
3. Verma Mahesh, Equipment Management, S.Chand &Sons
4. Punmia B.C. & Khandelwal K.K., Project Planning & Control with PERT&CPM, Laxmi Publications, New Delhi,1990.
5. BL Gupta, Amit Gupta, Construction Management & Machinery, Standard Publishers Distributors, 2010.

Reference Books :

1. Peurifoy, M.H, Construction Management, McGraw Hill, New York.
2. Srinath L, CPM & PERT, Affiliated East-West Press Pvt. Ltd., New Delhi.
3. P.S. Gahlot & B.M.Dhir, Construction Planning and Management, New Age International.
4. Chaudhary Roy, Project Management, Tata McGraw Hill, New Delhi.

VI Semester
CV2364 - PE-II : Earthquake Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Geological study of earth and interior. 2. Various aspects of tall structures. 3. Detailing of RCC members for ductile behavior as IS code provisions. 4. Various effects of earthquakes on structures.	Students will be able to 1. Explain the fundamentals and Importance of Earthquake Engineering 2. Analyze and design the earthquake resistant structures and construction in accordance with the Provisions of Indian Standard Codes 3. Explain special aspects in Multi-story buildings. 4. Illustrate the damages caused due to past Earthquake in & outside India and remedial Measures
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10, 12, **PSO :** i	

UNIT–1 : Origin of earthquakes, engineering geology, seismicity of the world, faults, earthquake waves, quantification of earthquake (magnitude, energy, intensity of earthquake), measurements of earthquake, analysis of earthquake records and its interpretation.	**[07 Hrs.]**
UNIT–2 : Determination of magnitude, epicenter, epicenter distances, focal depth, seismic zoning, ground motion and their characteristics, factors affecting ground motions, causes or sources of earthquake damages, evaluation of seismic hazards.	**[06 Hrs.]**
UNIT–3 : Study of IS: 1893-2016, IS: 13920-2016 for analysis and ductile detailing of RCC structures and other related codes, concept of earthquake resistant design, design philosophy, virtues of earthquake resistant design. Calculation of base shear distribution to various floors.	**[06 Hrs.]**
UNIT–4 : Design and detailing of RCC members, beam, column for ductility as per IS 13920-2016.Introduction to shear wall building and beam-column joints for ductile behaviors.	**[07 Hrs.]**
UNIT–5 : Special aspects in multi-storey buildings, effect of torsion, flexible first storey, P-delta effect, and soil-structure interaction on building response, drift limitation, soil liquefaction during earthquakes.	**[07 Hrs.]**
UNIT–6 : Load bearing structures, masonry structures, strengthening and rehabilitation of non-engineered building for earthquake, lessons from past earthquakes.	**[06 Hrs.]**

Text Books :

1. Agrawal &Shrikhande, Design of Earthquake Resistant Structures, 3rd 2006, Prentice – Hall of India Pvt. Ltd.
2. Roberto Villaverde, Fundamental Concepts of Earthquake Engineering, 2009, CRC Press
3. Asadour H. Hadjian, Basic Elements of Earthquake Engineering, 2015, Wiley

References Books :

1. C.V.R. Murty, Earthquake Tips, 2005, NICEE, IITK
2. www.nicee.org / iaee / E_FrontCover.pdf, NICEE Guidelines for Earthquake Resistant Non-Engineered Construction, 2004, National information center of Earthquake engineering Indian Institute of Technology Kanpur Kanpur 208016, India.
3. Robin K. McGuire, Seismic Hazard and Risk Analysis, 2004, Earthquake Engineering Research Institute; First edition.
4. Farzad Naeim, Handbook on Seismic Analysis and Design of Structures, 2001, Kluwer Academic Publisher
5. Paulay, T. &Prestiley M.J.N., Seismic design of R C & Masonry Buildings, 2nd 1999, John Willey & Sons

VI Semester
CV2365 - PE-II : Optimization Techniques

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Optimization problems & Formulation of structural problems. 2. Classical optimization techniques. 3. Linear Programming for optimization. 4. Non - Linear Programming for One dimensional minimization.	Students will be able to 1. Explain the need of optimization techniques in engineering. 2. Examine the optimization techniques used in engineering design 3. Apply the optimization techniques in engineering problem. 4. Analyze Nonlinear programing one dimensional minimization.
Mapped Program Outcomes : 1, 2, 3, 5, 8, 9, 10	

UNIT–1 : Introduction, types of optimization problems, Statement of the problem, design vector, constraints, objective function. Classification of optimization problems.	**[06 Hrs.]**
UNIT–2 : Formulation of some structural problems as programming problems like Minimum weight and optimum cost considerations in Structural design, Minimum weight design of Trusses and Frames based on elastic and limit state criteria Optimum reinforcement design of reinforced and prestressed concrete beams and slabs.	**[07 Hrs.]**
UNIT–3 : Classical optimisation techniques: Single variable optimisation, multivariable optimisation, with no constraints. Multivariable optimisation with equality and the inequality constraints.	**[06 Hrs.]**
UNIT–4 : Linear Programming : Introduction, Standard form of the problem, feasible, basic and I solution, Canonical form of system of equations. Simplex method - Algorithm, two phases of the method, Identifying an optimal point, unbounded solution, degenerate solution.	**[07 Hrs.]**
UNIT–5 : Non - Linear Programming : One dimensional minimization: Introduction, Unimodal function. Elimination methods-Various search methods, Fibonacci and Golden section methods.	**[06 Hrs.]**
UNIT–6 : Non - Linear Programming : Unconstrained Optimization Techniques: Introduction, Direct Search methods-Random search, Univariate method. Descent methods-Steepest descent method, Conjugate gradient method, Variable metric method.	**[07 Hrs.]**

Text Books :

1. Rao S.S, Engineering Optimization: Theory and Practice, New Age International (P) Ltd., New Delhi.
2. Arora J S., Introduction to Optimum Design, McGraw Hill.

Reference Books :

1. Fox R. L, Principles of Operation Research, Prentice Hall of India.
2. Wagner H.M., Principles of Operation Research, Prentice Hall of India

VI Semester
CV2366 - PE-II : Introduction To Remote Sensing

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Fundamentals of Remote sensing, GIS and GPS 2. Elements of Remote sensing, GIS and GPS. 3. The knowledge of Geoinformatics for various surveys, information extraction. 4. The application of Remote sensing and GIS in various fields.	Students will be able to 1. Illustrate the principles of Remote sensing, GIS and GPS 2. Explain the role of various elements of Remote sensing, GIS and GPS. 3. Interpret the process of data acquisition in remote sensing,GIS and GPS. 4. Illustrate the use of remote sensing and GIS in various Civil Engineering Applications.
Mapped Program Outcomes : 1, 2, 5, 8, 9, 10, 12	

UNIT–1 : Basics of Remote Sensing : Definition of Remote sensing, Principles of Remote Sensing, Electromagnetic spectrum, Interaction of EM Radiation with atmosphere, and target, Atmospheric Widows, Spectral signature of various land cover features.	**[06 Hrs.]**
UNIT–2 : Elements of Remote Sensing System: Platforms : Types of platforms, ground, airborne, and space born platforms, Orbit of satellites, satellites for Earth observations studies, Sensors : Types and classification of sensors, sensor resolutions. Scanners : Types of scanners push broom scanner, whiskbroom scanner.	**[07 Hrs.]**
UNIT–3 : Basics of Aerial Photogrammetry, Determination and calculation of elevation from RS data, Relief displacement, image parallax and vertical exaggeration, Visual Image Interpretation: Elements of interpretation, interpretation key.	**[07 Hrs.]**
UNIT–4 : Digital Image Processing : Basics of DIP, Image Rectification and Registration, Image Enhancement, Image Classification . Remote Sensing Data Formats.	**[07 Hrs.]**
UNIT–5 : Introduction to Geographical Information System, Introduction to Global Positioning System (GPS)	**[06 Hrs.]**
UNIT–6 : Role of Remote Sensing and GIS in Natural Resources Management, Environmental Impact Assessments, Agriculture, Land use & Land Cover, Disaster Management.	**[06 Hrs.]**

Text Books :

1. Remote sensing and GIS: Basudeb Bhatta, Oxford University Press
2. Remote sensing and GIS: Anji Reddy ISBN publication.
3. Higher surveying volume III: Dr B C Punmia

Reference Books :

1. Remote Sensing Principles and Interpretation by Sabins F F
2. Remote Sensing and Image Interpretation by Lilles and T M and Kieffer R W.

VI Semester
CV2367 - PE-II : Environmental Geotechniques

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Geo-environmental engineering. 2. Soil-water interaction 3. Waste Containment System and contaminant site remediation. 4. Soil characterization.	Students will be able to 1. Analyse Geoenviromental problems. 2. Examine soil-water interaction and its implications. 3. Explain Waste Containment System and contaminant site remediation. 4. Illustrate soil characterization.
Mapped Program Outcomes : 1, 2, 3, 7, 8, 9, 10	

UNIT–1 : **Fundamentals of Geoenviromental Engineering:** Scope of Geoenviromental engineering - multiphase behavior of soil – role of soil in Geoenviromental applications – importance of soil physics, soil chemistry, hydrogeology, biological process – sources and type of ground contamination – impact of ground contamination on Geoenviromental - case histories on Geoenviromental problems.	**[07 Hrs.]**
UNIT–2 : **Soil mineralogy characterization and its significance in determining soil behavior –** soil-water interaction and concepts of double layer – forces of interaction between soil particles. Concepts of unsaturated soil – importance of unsaturated soil in Geoenviromental problems - measurement of soil suction - water retention curves - water flow in saturated and unsaturated zone.	**[06 Hrs.]**
UNIT–3 : **Soil-water-contaminant interactions and its implications –** Factors effecting retention and transport of contaminants.	**[06 Hrs.]**
UNIT–4 : **Waste Containment System** Evolution of waste containment facilities and disposal practices – Site selection based on environmental impact assessment –different role of soil in waste containment – different components of waste containment system and its stability issues – property evaluation for checking soil suitability for waste containment – design of waste containment facilities.	**[07 Hrs.]**
UNIT–5 : **Contaminant Site Remediation** Site characterization – risk assessment of contaminated site - remediation methods for soil and groundwater – selection and planning of remediation methods – some examples of in-situ remediation	**[07 Hrs.]**
UNIT–6 : **Advanced Soil Characterization** Contaminant analysis - water content and permeability measurements – electrical and thermal property evaluation – use of GPR for site evaluation - introduction to geotechnical centrifuge modeling.	**[06 Hrs.]**

VI Semester
CV2367 - PE-II : Environmental Geotechniques

Text Books :

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books :

1. Reddi L.N. and Inyang, H. I., "Geoenvironmental Engineering, Principles and Applications" Marcel Dekker Inc. New York, 2000
2. Sharma H.D. and Reddy K.R., "Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies" John Wiley & Sons, Inc., USA, 2004
3. Fredlund D.G. and Rahardjo, H., "Soil Mechanics for Unsaturated Soils" Wiley- Interscience, USA, 1993
4. Ghildyal, B.P. and Tripathi R. P., "Soil Physics", 2nd Edition, New Age Publishers.

VI Semester
CV2368 - PE-II : Traffic Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Calculations of spot speed, journey time & running time. 2. Different statistical methods such as Binomial, Normal Poission, Chisquare to know the probabilities at various levels. 3. Analysis and designs of rotary intersections, Parking& Accidents 4. Different traffic signs , methods of design of traffic signals & Queuing theory	Students will be able to 1. Compute the measurement of spot speed journey speed & running speed for different methods 2. Analyse the different Statistical methods used in various traffic studies 3. Illustrate Rotary Intersections, Parking & accidents 4. Calculate the total time at Signals at various intersections.
Mapped Program Outcomes : 1, 2, 3, 6, 8, 9, 10	

UNIT–1 : General: Road, road user &road vehicle characteristics. Traffic Surveys: speed, journey time and delay studies, methods of measurement of spot speed, measurements of running and journey speeds, highway capacity, level of service.	**[07 Hrs.]**
UNIT–2 : Traffic Events: Statistical method for interpretation, regression, application of binomial normal and Poisson"s distributions, test of significance–Chi-square &„T" test.	**[07 Hrs.]**
UNIT–3 : Road geometry: Hierarchy of urban roads and their standards, diverging, merging, crossing, weaving, maneuver"s and conflict points, types of road junction**, traffic calming**, traffic rotary design, drive ways.	**[06 Hrs.]**
UNIT–4 : Traffic controlling devices: Traffic signs, traffic signals, design of signalized intersections &signalling systems, Queing theory.	**[06 Hrs.]**
UNIT–5 : Traffic Safety: Driver"s error, collection and interpretation of accident data and recording in standard Format, speed and weather effects on accidents, analysis of accidents, pedestrian, 3E"s of traffic management.	**[07 Hrs.]**
UNIT–6 : Parking: Parking surveys, on and off-street parking & parking systems, parking demand, design of on & off-street parking lot, underground & multi-storeyed parking.	**[06 Hrs.]**

Text Books :

1. Highway Engineering, Khanna S.K. and Justo C.E.G., 1991, Nem Chand & Bros.
2. Traffic engineering and transportation planning, Kadiyali, Khanna Publications, 1987
3. Transportation Engineering: An Introduction, C. JotinKhisty , B. Kent Lall
4. Transportation Engineering and Planning ,C.S. Papacostas, P.D. Prevedouros

Reference Books :

1. Highway Engineering, Rangawala B.S. Charotar Publishing House, 2011
2. IRC Handbook and MOST Specifications, Indian Road Congress, 2012

VI Semester
CV2369 - PE-II : Water Transmission & Distribution System

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Pipe flow, valves and its operation, pumps, reservoirs and its capacity. 2. Analysis of water distribution network 3. Design of water distribution network and rising main 4. Optimization of water distribution network	Students will be able to 1. Compute discharges in three reservoir, multi reservoir system, capacity of reservoir and design of Rising main. 2. Analyze the water distribution network by using Hardy cross method, Newtonian Raphson method and Node flow analysis 3. Apply Graph Theory, Critical path method and Spanning tree concept for design of water distribution network. 4. Analyze optimized solution of water distribution network by using Cost Head Loss ratio Method
Mapped Program Outcomes : 1, 2, 3, 5, 8, 9, 10	

UNIT–1 : General Hydraulic Principles, major losses,& minor losses, Head loss formulae- Darcy-Weisbach formula, Hazen – Williams formula, continuity equation, Equivalent length of Pipes, three Reservoirs, multi reservoir, Pumps and Valves in Water distribution systems.	**[07 Hrs.]**
UNIT–2 : Types of network, Formulation of Equations for looped Water Distribution Networks, Analysis of flow in looped networks using Hardy-Cross method and Newton-Raphson method.	**[06 Hrs.]**
UNIT–3 : Node flow analysis of water distribution networks (NFA): Necessity of node flow analysis, classification of node according to HGL, classification of node according to flow, compatibility, node head-discharge relationship, Application of NFA technique to serial networks.	**[07 Hrs.]**
UNIT–4 : Estimation of reservoir capacity, Optimal and Economical diameter of pumping main. Design of pumping main considering rising main diameter as continuous as well as discrete variable and explicit function.	**[06 Hrs.]**
UNIT–5 : Design of water distribution networks: Design of single source branching network using Critical path method, Determining number of branching configuration for a looped network by graph theory, Use of path concept and minimum spanning tree concept.	**[07 Hrs.]**
UNIT–6 : Optimal Design Water Distribution Networks: Cost head loss Ratio (CHR) method – CHR criterion, Problem formulation CHR methodology (for single source branching networks).	**[06 Hrs.]**

Text Books:

1. Bhave P. R Optimal design of water distribution networks, Narosa publishing house pvt. Ltd 2003
2. Bhave P.R., & Gupta R. Analysis of Water Distribution Networks, Narosa publishing house pvt. Ltd 2006
3. Walski T.M. (1984) "Analysis of Water Distribution System" Van Nostrand Reinhold Co. New York, N.Y. USA.

Reference Books:

1. Bhave P.R Analysis of flow in water distribution networks, Technomic publishing co, INC, Lancaster, USA.

VI Semester
CV2370 - PE-II : Construction Management

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Construction project management processes. 2. Principles and Techniques of construction scheduling 3. Overview of construction cost estimating and cost control 4. Financial aspects involved in construction project management	Students will be able to 1. Analyze the construction project management processes. 2. Apply the knowledge of construction scheduling. 3. Apply the knowledge of construction cost estimating and cost control. 4. Explain the financial aspects involved in construction project management..
Mapped Program Outcomes : 1, 6, 7, 8, 9, 10, 11, 12	

UNIT–1 : **Construction Project Management**: Course Overview, Construction Industry Overview, Project Delivery, Lean Project Delivery, Sustainability in the Construction Industry, Environment, Health and Safety of Construction Processes, Building Information Modeling and Technology Trends in Construction, International View of Construction Projects, Role of a Construction Manager, Introduction to Project Planning.	**[06 Hrs.]**
UNIT–2 : **Construction Scheduling I:** Introduction to Construction Scheduling, The Role of the Scheduler in Construction Management, Linear Construction Operations and Line of Balance, Technology Applications for Scheduling, Scheduling for Large Programs, Risk Allocation and Planning, Lean Design in Construction Scheduling.	**[06 Hrs.]**
UNIT–3 : **Construction Scheduling II:** Bar (Gantt) Charts, Activity Precedence Diagrams, Types of Construction Activity Relationships, Forward and Backward Pass Calculations, Critical Path, Activity Floats, Understanding Work Dates and Calendar Dates, Activity on Arrow, Program Evaluation & Review Technique (PERT) and Range Estimating.	**[07 Hrs.]**
UNIT–4 : Construction Cost Estimating and Cost Control I:Construction Cost Estimating and Cost Control Overview, Understanding Design in the Construction Industry, Introduction to the Types of Cost Estimates, Quantity Take-Off and Measurement, Pricing.	**[07 Hrs.]**
UNIT–5 : Construction Cost Estimating and Cost Control II: Building the Estimate Procurement, Post Contract and Cost Estimation within a Project, Construction cost Control methods, Earned Value Method (EVM), Close Out Period, Cost Estimation in Practice, Project Cash Flow, Technology Trends in Cost Estimating and Cost Control, Program Cost Estimating, Lean in Cost Control	**[07 Hrs.]**
UNIT–6 : Construction Finance: Introduction To The Construction Finance Course, The Mathematics of Money, Real Estate Finance for Development Projects, Financial Plans for Development Projects, Project Finance, Risk In Project Finance, Public - Private Partnerships.	**[06 Hrs.]**

VI Semester
CV2370 - PE-II : Construction Management

Text Books :

1. Construction Planning and Management – Purifoy
2. Construction Planning and Management – Dr U K Shrivastava, Galgotia Publ.
3. Project Planning & Management – B C Punmia
4. Laws related to buildings and engineering contracts in India- Gajaria G T, LexisNexis Butterworths India Publisher, 2000.
5. Punmia B.C. & Khandelwal K.K., Project Planning & Control with PERT&CPM, Laxmi Publications, New Delhi,1990.

Reference Books :

1. Construction Contracts- Jimmie Hinze McGraw Hill,
2. Contracts and the legal Environment for Engineers and Architects- Joseph T Bockrath, McGraw Hill,
3. Srinath L, CPM & PERT, Affiliated East-West Press Pvt. Ltd., New Delhi.
4. P.S. Gahlot & B.M. Dhir, Construction Planning and Management, New Age International.
5. Chaudhary Roy, Project Management, Tata McGraw Hill, New Delhi.

VI Semester
CV2371 – OE-III : Building Services Engineering

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Basic concepts of various building services. 2. Aspects of natural light and ventilation. 3. Methods of acoustics, sound insulation and fire protection 4. Equipments and installations used in building services	Students will be able to 1. Associate relevance of ventilation, acoustics & to understand the methodologies. 2. Explain special installations in buildings such as electrical, air conditioning, heating 3. Relate specifications & usage of mechanical installations like lifts, security systems etc. 4. Articulate causes of fires in buildings & their preventive and protective strategies.
Mapped Program Outcomes : 1, 6, 7, 8, 9, 10, 12	

UNIT–1 : **Lighting**: Day lighting, Fenestration, Daylight Factor. **Ventilation:** Functions of ventilation, Stack effect, wind effect, Air flow through buildings, cross-ventilation.	**[07 Hrs.]**
UNIT–2 : **Acoustics, Sound Insulation and Noise Control:** Basic terminology and definitions, Physics of sound. Behaviour of sound in an enclosed space. Requisites for acoustic environment, Noise and its control.	**[06 Hrs.]**
UNIT–3 : **Electrical Installations:** Different types of wiring need of Earthing, comparison between fuse and MCB, substation, types of lightening fixtures, Building protection against lightening.	**[07 Hrs.]**
UNIT–4 : **Air Conditioning**: Requirement of air conditioning, air conditioning system, Pressure-Enthalpy (heat) diagram of vapour compression cycle, refrigeration effect, Thermodynamics of human body. Psychometric chart.	**[06 Hrs.]**
UNIT–5 : **Mechanical Equipment & Installation**: Installation of lifts and escalators, Hot Water Provision (Solar and Electrical), Special features required for physically handicapped and elderly, Conveyors, Vibrators, Concrete mixers.	**[07 Hrs.]**
UNIT–6 : **Fire protection :** Causes of fire in building, Fire classification, Portable extinguishers, fire escapes, Fire detectors and alarm system.	**[06 Hrs.]**

Text Books :

1. Building services, B.S. Patil, Orient Longman.
2. Building Services Engineering, Fred Hall, Roger Greeno, Butterworth-Heinemann, 2007.
3. Building Services Engineering, David V. Chadderton, Taylor & Francis Group, 2007.

Reference Books :

1. E.R. Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. R.G. Hopkinson and J.D. Kay, "The Lighting of buildings", Faber and Faber, London, 1969.
4. William H. Severns and Julian R. Fellows, "Air-conditioning and Refrigeration", John Wiley and Sons, London, 1988.
5. A.F.C. Sherratt, "Air-conditioning and Energy Conservation", the Architectural Press, London, 1980.
6. National Building Code.

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VI Semester
CV2372 – OE-III : Construction Techniques

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Fundamentals of cement & concrete. 2. Construction Equipment used in Engineering. 3. Analysis of various types of structure. 4. Construction techniques and Safety methods.	Students will be able to 1. Explain various constituents of Cement & Concrete. 2. Apply Equipements & Machinery used in Construction. 3. Apply construction methods for various types of structure. 4. Examine new techniques used in construction, evaluation & safety methods adopted in construction operations
Mapped Program Outcomes : 1, 5, 7, 8, 9, 10, 12,	

UNIT–1 : **Introduction to Cement and Concrete :** Introduction to various types of cement, mortar, Ferro cement, Ready mix concrete, pumped concrete, self-compacting concrete, light weight concrete.	**[07 Hrs.]**
UNIT–2 : **Introduction to :** Various construction Equipments with its Advantages, Disadvantages and its Uses.	**[06 Hrs.]**
UNIT–3 : **Type of structure :** Load bearing, Frame & Composite. **Sub Structure Construction:** - Foundation: Necessity and types of foundations, Footings and its Types, and Introduction to Underwater Construction.	**[07 Hrs.]**
UNIT–4 : **Super structure construction** : Introduction to Stone Masonary and Brick Masonary, formwork and its types, pointing and plastering, roofs, painting, varnishing, Partitions, arches, lintels, stairs and distempering etc.	**[06 Hrs.]**
UNIT–5 : **New Construction Techniques :** Fibers and its types, Pre - Engineered Building and its Application & Advantages.	**[07 Hrs.]**
UNIT–6 : **Safety in Construction Operations :** Introduction to various types of Hazards and its Safety measurement on construction site.	**[06 Hrs.]**

Text Books :

1. M.S. Shetty, " Concrete Technology": S Chand & Co., 6th edition, S. Chand & Company, Limited, 2008
2. Rangwala, Building Construction, 32nd Edition, Charotar Publishing House Pvt. Ltd.2014

Reference Books :

1. Construction Planning, Equipment and methods – Peurifoy-Tata McGraw Hill Publication
2. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008
3. Sushil Kumar, Building Construction, 19th Edition, Standard Publisher Distributors 2001, New Delhi, 2001.
4. Elements of Civil Engineering: By S. S. Bhavikatti, Vikas Publishing House Pvt Limited, 2004
5. Basic Civil Engineering: By Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Firewall Media, 2003
6. SP 70 (2001): Handbook on Construction Safety Practices.

VI Semester
CV2373 – OE-III : Introduction To Environmental Management

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Various analysis tools of environmental management 2. Role of impact assessment studies in environmental management 3. Importance of environmental legislations and audit 4. Natural resources, challenges & prospects for sustainable development.	Students will be able to 1. Explain the importance of environmental management tools. 2. Illustrate the procedures impact assessment studies in environmental management 3. Explain environmental legislations and policies for environmental resources. 4. Explain the need of resource management and its challenges for sustainable development.
Mapped Program Outcomes : 6, 7, 8, 9, 10, 12	

UNIT–1 : Introduction to Environmental Management: Quality of life, Objectives and components of Environmental Management, Environmental Management in Socio-economic context. Development and Environmental for Sustainable Development.	**[06 Hrs.]**
UNIT–2 : Introduction to Environmental Impact Assessment: Role and Status of EIA in India EIA Procedures, Environmental Impact Statement, Methodologies of EIA.	**[07 Hrs.]**
UNIT–3 : MoEF questionnaire for environmental clearance, critical environmental issues and formulation of strategies of EMP, environmental management plan, development of action plans for critical environmental education programmers. ISO 14001	**[07 Hrs.]**
UNIT–4 : Environmental Laws and legislation –various enactment and their provisions, Role of State & Central boards of pollution control, Cleaner Technology of production.	**[07 Hrs.]**
UNIT–5 : Environmental Audit- Concept of EA, procedural aspects of conducting environmental audit, EMS. Introduction to life cycle assessment	**[06 Hrs.]**
UNIT–6 : Resource Management: depletion of resources – causes & effects, resource utilization, optimal use of resources.	**[06 Hrs.]**

Text Books :

1. Anand Bal, An Introduction to Environmental Management, Himalaya Publishing House.,2009
2. John Rau & Wooten, Environmental Impact Assessment, Mc Graw Hill.
3. Larry Canter, Environmental Impact Assessment, McGraw Hill.
4. Harry W. Gehm, Jacob I. Bregman, handbook on pollution Control Acts, Central Pollution Control Board, New Delhi.
5. R.K. Sapra, S. Bhardwaj, the New Environmental Age, Ashish Pub. House, New Delhi.

References Books :

1. Rosencrannz, S. Divan, M.L. Nobal, Environmental Law and Policy in india, Cases, Materials And Statutes, Tripathi Pvt. Ltd. Bombay.

VI Semester
CV2374 - OE-III : Basics of Transportation Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Various modes of transportation. 2. Various characteristics of individual transportation modes. 3. Regulations as per various organizations and government bodies for the transportation sector in India. 4. Recent development in the transportation sector.	Students will be able to 1. Explain importance of various modes of transportation. 2. Compare various characteristics of individual transportation modes. 3. Distinguish appropriate regulations as per various organizations and government bodies for the transportation sector in India. 4. Discus recent development in the transportation sector.
Mapped Program Outcomes : 1, 8, 9, 10	

UNIT–1 : Importance of Transportation in Nation Development, Different modes of Transportation, Introduction to Road Transportation.	**[06 Hrs.]**
UNIT–2 : Traffic Engineering: users, regulations, signs, signals.	**[07 Hrs.]**
UNIT–3 : Introduction to various organizations and government bodies for transportation sector in India.	**[06 Hrs.]**
UNIT–4 : Introduction to Railway transportation and its development.	**[07 Hrs.]**
UNIT–5 : Introduction to Air transportation and development.	**[07 Hrs.]**
UNIT–6 : Introduction to Water transportation and its development.	**[06 Hrs.]**

Text Books :

1. Khanna& Justo, Highway engineering, Nem Chand & Bros.
2. K.L. Bhanot, Highway Engineering, S. Chand &Company (P) Ltd. New Delhi
3. Railway Engineering, Saxena;, Dhanpat Rai Publication.
4. Airport Planning & Design, Goyal& Praveen Kumar, Galgotia Publication
5. Rangwala, Railway Engineering, Charotar Publishing House, 1995.
6. Rangwala, Airport Engineering, Charotar Publishing House, 1996.
7. Srinivasan R. Harbour, "Dock and Tunnel Engineering", 26th Edition 2013.

Reference Books :

1. Indian Road Congress, IRC handbooks ,International Code Council International Code Council
2. Textbook on Transportation Engineering, S. P. CHANDOLA, 200, S. Chand Publishers, New Delhi
3. Planning and Design of Airports, Robert Horonjeff, Francis Mckelvey, William Sproule, Seth Young, Fifth Edition 2010, McGraw Hill Professionals

VI Semester
CV2375 - OE-III : Basics of Water Resource Engineering

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Hydrological processes and components of hydrological cycle. 2. Runoff and hydrographs. 3. Concepts of geo-hydrology and ground water recharge.	Students will be able to 1. Explain the basic concept of hydrology and various processes. 2. Compute various components of the hydrological processes. 3. Calculate geo-hydrological parameters. 4. Illustrate various methods of groundwater recharge.
Mapped Program Outcomes : 1, 7, 9, 12	

UNIT–1 : **Introduction:** Engineering Hydrology, Hydrological Cycle, Hydrological Equation, Importance of Temperature, Wind and Humidity in Hydrological Studies, Latent Heat, Vapour Pressure, Bulb Pressure. **Precipitation:** Definition, Types and Forms of Precipitation, Factors Affecting Precipitation, Measurement of Precipitation by using Rain-gauges, Optimum Number of Rain-gauge Stations and consistency of data.	**[07 Hrs.]**
UNIT–2 : **Infiltration:** Factors Affecting Infiltration, Infiltration Indices and Numerical. **Evaporation:** Factors Affecting Evaporation, Estimation of Evaporation and Evaporation Control. Transpiration and Evapo-transpiration and water balance equation.	**[06 Hrs.]**
UNIT–3 : **Runoff:** Runoff, Sources of Runoff, Components of Runoff, Classification of Streams, Factors Affecting Runoff, Rainfall Runoff Relationships, Numerical on runoff estimation. Introduction to Interception Storage and Depression Storage.	**[06 Hrs.]**
UNIT–4 : **Hydrograph :** Components of hydrograph, types of basin, factors affecting hydrograph, Numerical on Hydrograph.	**[06 Hrs.]**
UNIT–5 : **Geo-hydrology:** Introduction, Occurrence and Distribution of Groundwater, Aquiclude, Aquitard, Aquifers, Types and Properties of Aquifer, Specific Yield, Specific Retention, Porosity, Permeability, Water Table, Darcy"s law and Introduction to Hydraulics of Wells.	**[07 Hrs.]**
UNIT–6 : **Ground Water Recharge**: Introduction, Selection of Recharge Sites, Recharging Methods, Spreading Method, Induced Recharge Method, Recharge Well Method, Sub-surface Dams, Waste Water Recharge and Recharge through Rain Water Harvesting.	**[07 Hrs.]**

Text Books:

1. Ojha, C.S.P., Berndtsson, R., and Bhunya, P., Engineering Hydrology, Oxford University Press, 2008.
2. Raghunath H.M., Hydrology, New Age International Publishers, 1985.
3. Reddy R., Hydrology, Tata McGraw-Hill New Delhi, 2012.
4. VenTe Chow, David, Larry, Applied Hydrology, Mac Graw Hill Publications,1988.
5. Dr. Jaya Rami Reddy, Hydrology, Laxmi Publications. 2008.

Reference Books:

1. Todd, D.K., Ground Water Hydrology**,** John Wiley & Sons**,** 2005.
2. Subramnaya, K., Engineering Hydrology**,**Tata McGraw-Hill Publishing Company Limited, 2017.
3. Sharma R.K., Sharma T.K., Hydrology & Water Resources Engineering, DhanpatRai Publications, 2002.
4. Linsley, R.K., Kohler, M.A. and Paulhus**,**Hydrology for Engineers**,** Tata McGraw-Hill Publishing Company Limited,1975.

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VI Semester
CV2376 - OE-III : Elements of Water Power Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Hydropower Engineering, power station, hydropower schemes, and hydropower potential. 2. Intake structure and surge tank. 3. Hydraulic Turbine& Generator. 4. Pump Storage Plants.	Students will be able to 1. Examine fundamentals of hydropower and hydropower potential. 2. Explain components of intake structure and surge tank. 3. Determine the flow parameters of turbines. 4. Explain the pump storage plant and its economics.
Mapped Program Outcomes : 1, 8, 9, 10, 12	

UNIT–1 : Introduction: Sources of energy, types of power station, choice of type of generation, components of water power project, types and general layouts of various hydropower schemes, General arrangements of a power station, powerhouse, sub-structure and super structure, underground power station–necessity, principal, types, development.	**[07 Hrs.]**
UNIT–2 : power potential, storage and structures related to hydro-power, Nature of demand: Load curve, load duration curves, load factor, plant factor, plant use factor, firm power secondary power.	**[06 Hrs.]**
UNIT–3 : Intake structures: Types, level of intake, hydraulics of intake structures, trash rack, transition, intake gates. Conduits: Types, economic section, power canals, pen-stock types and diameter pipe supports, anchor blocks, tunnels classification, location and tunnel linings.	**[06 Hrs.]**
UNIT–4 : Surge Tank: Functions and behavior of the surge tanks, location, types of surge tanks, basic design criteria of simple surge tank, fore-bay.	**[06 Hrs.]**
UNIT–5 : Turbines: Classification of turbines, characteristics of different types, choice of type of turbine, turbine setting and cavitation"s, Tail race: Functions, types, channel and tunnel, draft tubes-function and principal types.	**[07 Hrs.]**
UNIT–6 : Pumped storage plants, purpose and general layout of pumped storage schemes, main types, typical arrangements of the upper reservoirs, economics of pumped storage plants.	**[07 Hrs.]**

Text Books :

1. Dandekar M. M. & Sharma K. N, Water Power Engineering, Vikas Publishing House Pvt. Ltd., New Delhi.
2. Sharma R.K. & Sharma T.K., Water Power Engineering, S. Chand Publication.
3. S. K Garg, Irrigation Engineering & Hydraulic Structure (Volume-I & II), Khanna Publications.
4. Arora K. R., Irrigation, Water Power & Water Resources Engineering, Standard Publishers Distributors.

VI Semester
CV2381 - OE-IV : Elements of Earthquake Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Geological study of earth and interior. 2. Various causes of earthquakes and their characteristics. 3. Behavior of different types of structures under earthquake loading. 4. Earthquake disaster management, mitigation, and different retrofitting techniques.	Students will be able to 1. Express the necessity and importance of earthquake engineering. 2. Illustrate the damages caused due to past earthquakes in & outside India and remedial measures 3. Examine the provision of IS codes used for earthquake-resistant design and strengthening of the structure. 4. Explain the social aspects of earthquake disasters & their management.
Mapped Program Outcomes : 1, 6, 7, 8, 9, 10	

UNIT–1 : Introduction to earthquakes : Geology of earth, configuration of tectonic plates in a globe, behavior of plates, their motion and effects, causes of earthquake and their characteristics, Earthquake parameters, magnitudes, intensity.	**[07 Hrs.]**
UNIT–2 : Seismic waves, recording of earthquakes, analysis and interpretation of earthquake data, determination of magnitude, location of epicenter, focal depth.	**[06 Hrs.]**
UNIT–3 : Seismicity of the world, history of earthquakes in India and abroad, case studies of effects of earthquakes, causes and sources of earthquake damage.	**[06 Hrs.]**
UNIT–4 : Non-engineered earthquake resistant structures, load bearing structures, masonry structures, seismic zoning of India (IS 1893:2002 Part I), seismic coefficients for different zones, definitions, irregularities in buildings, consequences of irregularities.	**[07 Hrs.]**
UNIT–5 : Strengthening, rehabilitation and retrofitting of earthquake damaged structures.	**[06 Hrs.]**
UNIT–6 : Earthquake disaster management, mitigation and social aspects of earthquakes, lessons from past earthquake: - study of damages caused due to past earthquake and remedial measures.	**[07 Hrs.]**

Text Books :

1. Agrawal & Shrikhande, „Design of Earthquake Resistant Structures", 3rdEdition, 2006, Prentice – Hall of India Pvt. Ltd.
2. Jai Krishna, Chandrasekaran & Brijesh Chandra, „ Elements of Earthquake Engineering", 2nd Edition, Standard Publishers Distributors, New Delhi
3. Roberto Villaverde, „Fundamental Concepts of Earthquake Engineering", 2009, CRC Press
4. Asadour H. Hadjian, „Basic Elements of Earthquake Engineering", 2015, Wiley

Reference Books:

1. C.V.R. Murty, Earthquake Tips, 2005, NICEE, IITK
2. www.nicee.org, „NICEE Guidelines for Earthquake Resistant Non-Engineered Construction', 2004, National information center of Earthquake engineering Indian Institute of Technology Kanpur Kanpur 208016, India
3. Robin K. McGuire, Seismic Hazard and Risk Analysis, 2004, Earthquake Engineering Research Institute; First edition.

VI Semester
CV2382 - OE-IV : Introduction To Finite Element Method

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. General steps of FEM. 2. Derivation for shape functions. 3. Parametric formulation in FEM. 4. Storage techniques and numerical integration.	Students will be able to 1. Explain the concepts of FEM. 2. Illustrate elemental equations using the concepts of FEM. 3. Analyze engineering problems using FEM. 4. Apply numerical integration using FEM.
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10, 12	

UNIT–1 : Introduction: Development, Historical background, Applications, Advantages and Disadvantages of FEM, General steps of FEM, direct equilibrium approach, Variational approach , weighted residual approach, local and global FEM, application to simple problems.	**[07 Hrs.]**
UNIT–2 : Shape functions: Introduction, requirement of Ideal displacement functions, Derivation of shape functions using Cartesian Coordinates, Lagrange and Serendipity elements.	**[06 Hrs.]**
UNIT–3 : Application of FEM to 1D problems : Derivation of element property matrix and influence vector, application, Application to bar, truss, steady state heat conduction, steady state flow through porous medium problems.	**[06 Hrs.]**
Unit–4 : Application Of Fem To 2d Problems: Equilibrium Equations, Triangular And Rectangular Element Formulation Using Cartesian Coordinates, Application To Two-Dimensional Stress Analysis.	**[07 Hrs.]**
UNIT–5 : Natural coordinates, Isoparametric elements, Application to 1D and 2D Problems.	**[07 Hrs.]**
UNIT–6 : Numerical integration, Modeling, storage and solution techniques.	**[06 Hrs.]**

Text Books :

1. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
2. Godbole P. N, Introduction to Finite Element Method, I. K. International Publishing House Pvt. Ltd., New Delhi, 2013
3. Desai Y. M., Eldho T. I. and Shah A. H., Finite Element Method s and Application to Engineerimg, Pearson , 2011.

Reference Books :

1. Krishnamoorthy C S, "Finite Element Analysis – Theory and Programming", Tata McGraw Hill Publishing Co., New Delhi, 1994.
2. Cook R D, Malkus D S, Plesha M E and Witt R J, "Concepts and Applications of Finite Element Analysis", John Weily& sons inc, New York, Fourth Edition, 2003.
3. Rajasekaran S, "Finite Element Analysis in Engineering Design". S Chand & Co., 2003.

VI Semester
CV2383 - OE-IV : Air Pollution and Solid Waste Management

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Air pollution episodes, air pollutants, their sources & effects. 2. Meteorological parameters, air sampling & measurement of pollutants. 3. Air pollution controlling technologies, air pollution due to automobiles & general Idea of noise pollution 4. Solid waste management by processing, treatment, disposal & reuse of solid waste.	Students will be able to 1. Classify the type, sources & effect of air pollutants. 2. Explain the parameters affecting air pollution and various methods of measurement. 3. Illustrate various air pollution control equipments & pollution caused due to automobile exhaust and basics of noise pollution. 4. Interpret the concepts of solid waste management, treatment and disposal methods.
Mapped Program Outcomes : 1, 3, 5, 7, 8, 9, 10	

UNIT–1 : Introduction to air pollution: Air pollution episodes, Atmosphere and its zones, classification and sources of air pollutants, effects of air pollutants on man, plants animal & materials.	**[06 Hrs.]**
UNIT–2 : Meteorological Aspects: Atmospheric stability, plume behaviour, Ambient air sampling and stack sampling, collection of particulates and gaseous pollutants, methods of estimation.	**[07 Hrs.]**
UNIT–3 : Air pollution control methods and equipment: Principle of control methods for particulates and gaseous pollutants, gravity settlers, electrostatic precipitators, bag filters cyclones, wet scrubbers, automobile exhaust: Pollution due to diesel and petrol engines, exhaust treatment and abatement, noise Pollution: Sources, ill effects, control measures.	**[06 Hrs.]**
UNIT–4 : Introduction to solid waste management, sources, quantification and characterization, classification and components, sampling and analysis Method of collection.	**[07 Hrs.]**
UNIT–5 : Equipment used for collection and transportation, transfer stations, solid waste processing and management.	**[06 Hrs.]**
UNIT–6 : Treatment and disposal methods: composting, sanitary landfills, Incineration – concept, components and applications, leachate management.	**[07 Hrs.]**

Text Books :

1. M.N. Rao & H.V.N. Rao, 1988, Air Pollution, Tata McGraw Hill Publishing Co. Ltd.
2. C.S. RAO, 2007, Environmental Pollution Control Engineering, New Age International, Wiley Estern Ltd. New Delhi.
3. Stern A. C., 1973, Air pollution, Academic Press.
4. A.D. Bhide & Sunderesan B.B., 1983, Solid Waste Management in Developing countries, INSDOC, New Delhi.
5. Tohobanoglous, 1993, Intgrated Solid Waste Management Engineering Principle and Management Issues, McGraw-Hill publication Ltd.
6. K. V. S. G. Murlikrishna, 1995, Air Pollution, Kaushal & Company.

Reference Books :

1. P. Aarne Vesilind, William Worrell & Debra Reinhart, 2002, Solid Waste Engineering, Cengage Learning India pvt. Ltd.
2. Dr. Y Anjaneyulu, 2002, Air Pollution and Control Technologies, Allied Publisher pvt. Ltd. Waste Management: A Reference Handbook. Contributors: Jacqueline Vaughn - Author. Publisher: ABC-Clio.

VI Semester
CV2384 - OE-IV : Environmental & Social Impact Assessment

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Evolution of EIA. 2. Methods of impact assessment and assessment of impact of air and noise environment. 3. Assessment of impact on cultural and socioeconomic environment. 4. EIA notification.	Students will be able to 1. Explain the EIA process, analyse major environmental issues for development projects. 2. Examine model tasks within an EIA cycle. 3. Construct portions of environmental documents through administrative and legal requirements. 4. Illustrate the standards of professional practice about EIA.
Mapped Program Outcomes : 1, 2, 6, 7, 8, 9, 10	

UNIT–1 : **Evolution of EIA:** Concepts, Nature & Type of impacts, Need of EIA, Participation in EIA, New concepts- Life cycle assessment.	**[07 Hrs.]**
UNIT–2 : **Methods for impact assessment:** Screening, Scoping, Base line studies, Check list, Mitigation, Matrices, Interaction of network methodologies.	**[06 Hrs.]**
UNIT–3 : **Assessment of impact for air and noise environment:** Basic information of air quality, identification of type and quantity of air pollutant, impact prediction and assessment.	**[07 Hrs.]**
UNIT–4 : **Assessment of impact for water and soil environment:** Basic information of water Quality, identification of impact, prediction of impact and assessment, mitigations.	**[06 Hrs.]**
UNIT–5 : **Assessment of impact on cultural and socioeconomic environment:** Public participation in EIA, Cumulative environmental effects Monitoring and auditing: after the decision.	**[07 Hrs.]**
UNIT–6 : **EIA notification by Ministry of Environment and Forest (Govt. of India):** Provisions in the EIA notification, Categorization of Industries for seeking environmental clearance from concerned authorities, Environmental management plan post environmental monitoring. Case studies in EIA.	**[06 Hrs.]**

Text Book :

1. Anand Bal, An Introduction to Environmental Management, Himalaya Publishing House.
2. Canter L.W. 1977. Environmental Impact Assessment. McGraw Hill, Inc. Printed in the United States of America.
3. Peter Watten (Eds.) – "Environmental Impact Assessment Theory and Practice", Unwin Hyman, London (1988).

Reference Books:

1. John G. Rau and David C Hooten (Ed)., "Environmental Impact Analysis Handbook", McGraw-Hill Book Company, 1990.
2. "Environmental Assessment Source book", Vol. I, II & III. The World Bank, Washington, D.C., 1991.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II", Blackwell Science, 1999.
4. Bass, Herson and K. Bogdon, 2001, The NEPA Book: A step-by-step guide on how to comply with the National Environmental Policy Act, Solano Press.
5. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.

VI Semester
CV2385 - OE-IV : Disaster Management

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. The nature & types of disaster, 2. Role of different government &social agencies in disaster management 3. Risk &cost assessment of disaster management 4. Disaster management cycle.	Students will be able to 1. Distinguish the nature & types of disaster. 2. Report its preparedness, role of different government &social agencies. 3. Predict the extent of risk and cost assessment. 4. Conclude provisions, management of disaster, post disaster condition & its management
Mapped Program Outcomes : 1, 2, 6, 11	

UNIT–1 : **Understanding Natural Disasters**: Natural disasters, which have been categorized as hydrological, wind-related, geo-physical, hydro-geological and climatic, discuss the causes and impacts, along with past illustrations and geographical distribution. Flood, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic Eruptions, Heat and Cold Waves, Climate Change: Global Warming, Sea Level Rise, Ozone Depletion.	**[08 Hrs.]**
UNIT–2 : **Man-Made Disasters:** Nuclear Disasters, Chemical Disasters, Biological Disasters, Building Fire, Coal Fire, Forest Fire, Oil Fire, Air Pollution, Water Pollution, Deforestation, Industrial Pollution, Road Accidents, Rail Accidents, Air Accidents, Sea Accidents.	**[05 Hrs.]**
UNIT–3 : **Risk & Cost Assessment:** Geographical conditions, Population, Living habits, Threats, Extent of damages to the lives, agricultural area, industrial units, Awareness & Safety Program. Relief arrangement & essential components, Shelters, Rescue & search tools &equipment, transport facilities. Cost assessment of each unit and funding.	**[06 Hrs.]**
UNIT–4 : **Disaster Preparedness:** Concept and Nature, Planning, Disaster Preparedness for People with Special Needs/Vulnerable Groups, Disaster Preparedness with Relevance to Housing, Infrastructure and Livestock, Community Based Disaster Preparedness Plan, Role of Information, Education, Communication, and Training, Disaster Preparedness: Role Play by Government and Social Groups. Information Technology: Role in Disaster Preparedness with Special Reference to Geographical Information System, Use and Application of Emerging Technologies in Disaster Preparedness.	**[07 Hrs.]**
UNIT–5 : **Disaster Response:** Disaster Response Plan, Communication, Participation, and Activation of Emergency Preparedness Plan, Logistics Management, Needs and Damage Assessment, Psychological Response, Trauma and Stress Management. Rumour and Panic Management, Minimum Standards of Relief, Managing Relief, Funding Relief, Recovery.	**[06 Hrs.]**
UNIT–6 : **Reconstruction and Rehabilitation:** Damage Assessment, Management and Development Information Structural, Parameters of Vulnerability, Development of Physical and Economic Infrastructure, Creation of Long-term Job Opportunities and Livelihood Options, Funding Arrangements for Reconstruction, Nature of Damage to Houses and Infrastructure due to Disasters, Disaster Resistant House Construction, Role of Housing / Building Authorities, Education and Awareness Role of Information Dissemination, Participative Rehabilitation Process: Some Case Studies Long-term Recovery.	**[07 Hrs.]**

VI Semester
CV2385 - OE-IV : Disaster Management

Text Books:

1. Satish Modh: Introduction to Disaster Management, Macmillan, 2009
2. Amit Awasthy: Disaster Management: Warning Response and Community Relocation, Global India Publications, 2009
3. Jyoti Purohit :Disaster Management in India: Structure and Challenges, 2013
4. Prakash Singh: Disaster Response in India, www.MilitaryBookshop.Companyuk, 2011

Reference Books:

1. D.B.N. Murthy: Disaster Management: Text and Case Studies, Deep and Deep Publications, 2007
2. National Policy on Disaster Management, NDMA, New Delhi, 2009.
3. A Global Report - Reducing Disaster Risk, A Challenge for Development; UNDP Publication, 2004.
4. Disaster Management Act. (2005), Ministry of Home Affairs, Government of India, New Delhi, 2005.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

7th & 8th Semester

Civil Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CV-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	CV2401	Estimating & Costing	**T**	3	0	0	3	3	30	20	50	3
2	7	PC	CV2402	**Lab:-** Estimating &Costing	**P**	0	0	2	2	1		60	40	
3	7	PC	CV2403	Wastewater Engineering	**T**	3	0	0	3	3	30	20	50	3
4	7	PC	CV2404	Hydrology and Water Resources Engineering	**T**	3	0	0	3	3	30	20	50	3
5	7	PE-III		Professional Elective -III	**T**	3	0	0	3	3	30	20	50	3
6	7	PE-IV		Professional Elective -IV	**T**	3	0	0	3	3	30	20	50	3
7	7	PE-V		Professional Elective -V	**T**	3	0	0	3	3	30	20	50	3
8	7	STR	CV2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	CV2410	Campus Recruitment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**18**	**0**	**6**	**24**	**23**				

Professional Elective - III

1	7	PE-III	CV2411	PE-III : Prestressed Concrete
2	7	PE-III	CV2412	PE-III : Advanced RCC
3	7	PE-III	CV2413	PE-III : Numerical Methods and Computational Techniques
4	7	PE-III	CV2414	PE-III : Environmental Impact Assessment
5	7	PE-III	CV2415	PE-III : Energy Conversion and Management
6	7	PE-III	CV2416	PE-III : Geotechnical Investigation & Ground Improvement Techniques
7	7	PE-III	CV2417	PE-III : Earth and Earth Retaining Structures
8	7	PE-III	CV2418	PE-III : Urban Transportation Planning
9	7	PE-III	CV2419	PE-III : Advanced Hydraulics

Professional Elective - IV

1	7	PE-IV	CV2421	PE-IV : Natural Resources Management
2	7	PE-IV	CV2422	PE-IV : Finite Element Method
3	7	PE-IV	CV2423	PE-IV : Introduction to Structural Dynamics
4	7	PE-IV	CV2424	PE-IV : Wastewater Treatment
5	7	PE-IV	CV2425	PE-IV : Environmental Legislation and Management System
6	7	PE-IV	CV2426	PE-IV : Advanced Foundation Engineering
7	7	PE-IV	CV2427	PE-IV : Geosynthetics
8	7	PE-IV	CV2428	PE-IV : Advanced Transportation Engineering
9	7	PE-IV	CV2429	PE-IV : Watershed Management
10	7	PE-IV	CV2430	PE-IV : Advanced Fluid Mechanics and Hydraulic Machines

Professional Elective - V

1	7	PE-V	CV2431	PE-V : Maintenance and Rehabilitation Engineering
2	7	PE-V	CV2432	PE-V : Project Planning and Management
3	7	PE-V	CV2433	PE-V : Modern Surveying Technique
4	7	PE-V	CV2434	PE-V : Advanced Steel Design
5	7	PE-V	CV2435	PE-V : Design of Bridge Structures
6	7	PE-V	CV2436	PE-V : Industrial Waste Water Treatment and Reuse
7	7	PE-V	CV2437	PE-V : Finite Element methods in Geotechnical Engineering
8	7	PE-V	CV2438	PE-V : Pavement Design
9	7	PE-V	CV2439	PE-V : Water Power Engineering
10	7	PE-V	CV2440	PE-V : Structural Engineering Practices

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

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SoE No. CV-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Civil Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	CV2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	CV2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
					TOTAL	**0**	**0**	**12**	**12**	**10**				
					GRAND TOTAL	**88**	**0**	**42**	**130**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

VII Semester
CV2401 - Estimating and Costing

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. The importance of subject and definition involved in the estimation of various structures. 2. The writing and developing detailed specification of items and quantities of various materials in different items. The concept of valuation, methods of valuation and rent fixation. 3. The estimates of buildings (Load bearing and framed structure), road, hill road and canal. 4. The procedure of submitting the tenders and types of contracts.	Students will be able to 1. Explain the definitions involved in estimates of structures. 2. Illustrate the specifications andquantities of materials in different items to prepare the estimate. 3. Calculate the valuation and rent of civil engineering structures. 4. Estimate the quantity and costing of building, road, hill road and canal. 5. Explain the tenders and carry out the construction of civil engineering structures.
Mapped Program Outcomes : 1, 2, 8, 9, 10, 12 **PSO** : iii	

UNIT–1 : **General**: Importance of the subject, purpose of quantity estimates, mode and unit of measurement as per I.S.1200, methods and stages of estimates, items of a work and their description, approximate estimation of Civil engineering works. **Proposal and Development of Project:** Project Management Consultant & their role, various important terminologies required like work charged establishment, muster roll, contingencies, percentage charges, measurement book, overheads etc**.**	**[06 Hrs.]**
UNIT–2 : **Specifications:** Purpose and principles of specifications, types of specifications, writing and developing detailed specifications of important items. **Cost Build up:** Purpose and principles, importance of Schedule of rates (CSR) in cost estimates, factors affecting analysis of rates, information from National Building Organization, task work, factors affecting task work, market rates, escalation.	**[06 Hrs.]**
UNIT–3 : **Quantity and cost estimates:** Methods of detailed estimates, forms used for detailed estimates, working out the quantities of various materials required for construction of different Civil Engineering works like building.	**[07 Hrs.]**
UNIT–4 : **Earthwork of Roads, Hill Roads & canals:** Definition, Different methods of earthwork, Cross & Longitudinal sections, Fully filling, fully cutting & partly filling & partly cutting, volume of Earthwork in filling & Cutting, Mass Curve.	**[07 Hrs.]**
UNIT–5 : **Arranging Works:** Pretender and contract planning, tender notice, acceptance of tender, Tender documents, various schedules in the tender document, essentials of contract, types of contracts, conditions of contract measurement and payment to contractor, arbitration.	**[07 Hrs.]**
UNIT–6 : **Valuation:** Purpose of valuation, factors affecting value of property price and cost, market value, potential value, sentimental value, scrap value etc. real estate, net and gross return, free hold and leasehold, sinking fund, depreciation, capitalized value, methods of valuation, differed annuity, valuation tables and rent fixation.	**[06 Hrs.]**

VII Semester
CV2401 - Estimating and Costing

Text books:

1. Estimating, Costing, Specification & valuation in Civil Engineering, Chakraborti M. UBS Publication, Calcutta, 2010

Reference books:

1. Estimating & Costing, Chandola S.P. &Vazirani V.N, Khanna Publishers 2-B, Nath market, Naisarak, Delhi, 2010
2. Estimating & Costing in civil Engineering, Dutta B.N, UBS Publishers distributors ltd., 5 Ansari road, New Delhi, February 1999
3. Estimating, Costing and valuation, Rangwala S.C, Charotar Publishing house, opposite Amul diary, court road, Anand, 2011

VII Semester
CV2402 - LAB : Estimating and Costing

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Understand IS 1200, Tender documents and conditions of contracts. 2. Understand specifications and rate analysis in details. 3. Estimate of buildings and earthwork of roads. 4. Estimate of woodwork for doors, windows and reinforcement in RCC Beam and Slabs.	Students will be able to 1. Illustrate the specifications and quantities of materials in different items to prepare the estimate. 2. Estimate the quantities in buildings and roads. 3. Estimate the quantities of doors, windows, and steel in RCC beams and slabs. 4. Explain the tender documents and conditions of contracts.
Mapped Program Outcomes : 1, 2, 8, 9, 10, 12, **PSO** : iii	

PRACTICALS (Any 8 of the following practicals will be perform)

1. Study of IS-1200
2. Detailed specification of five major items
3. Rate analysis of five major items.
4. Detailed estimate of Earth work of road for 1km length
5. Detailed estimate of Load bearing structures –
   i. Two room plan
   ii. Four room plan
6. Detailed estimate of RCC frame structures –
   i. One room plan
   ii. Three room plan
7. Detailed estimate of wood work for Doors and Windows.
8. A complete set of Tender documents
9. Set of major Conditions of contracts
10. .Calculation of reinforcement in RCC with bar bending Schedule.
11. Expert Lecture on "Role of Quantity Surveyor"

Reference Books :

1. Estimating, Costing, Specification & valuation in Civil Engineering, Chakraborti M. UBS Publication, Calcutta, 2010.
2. Estimating, Costing and valuation, Rangwala S.C, Charotar Publishing house, opposite Amul diary, court road, Anand, 2011.
3. Estimating & costing in civil Engineering, Dutta B.N, UBS Publishers distributors ltd., 5 Ansari road, New Delhi, February 1999.

VII Semester
CV2403 - Wastewater Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Methods of collection & conveyance of sewage. 2. Sewer appurtenances and construction of sewer. 3. Treatment methods for municipal, industrial & rural wastewater. 4. Different causes of air pollution and its control methods.	Students will be able to 1. Explain the collection and conveyance of sewage. 2. Construct sewerage system including house drainage system. 3. Analyze the wastewater characteristics, treatment units and design of primary treatment units. 4. Examine the air pollution effects and methods of control.
Mapped Program Outcomes : 1, 2, 3, 4, 7, 8, 9, 10	

UNIT–1 : Systems of sanitation: Conservancy and water carriage system. Patterns of sewage collection systems, Quantity of storm water and sanitary wastewater. Hydraulic Design of sewers - capacity, size, grade. Egg shape sewers.	**[07 Hrs.]**
UNIT–2 : Sewer Appurtenances – manholes, street inlets, storm water overflows, inverted siphons. Construction and Maintenance of sewers, equipment for maintenance, safety equipment. Sewage pumping. House drainage systems, sanitary fitting and appliances, traps – function, types, anti-syphon age, inspection chambers.	**[06 Hrs.]**
UNIT–3 : Characteristics of wastewater, Flow sheet of conventional sewage treatment plant. Preliminary and Primary treatment: Screens, Grit chambers, Primary settling tank. Design of bar screens, grit chambers and primary settling tanks.	**[07 Hrs.]**
UNIT–4 : Secondary Treatment: Activated sludge process, Trickling filter – Types, Working. Sludge digestion, Sludge drying beds. Methods of disposal.	**[06 Hrs.]**
UNIT–5 : Rural sanitation: Introduction, collection and disposal, Pit Privy, Aqua Privy, Bio-gas Plant, Eco-Sanitation, Septic tank including soak pit and Imhoff tanks. Industrial wastewater treatment processes.	**[06 Hrs.]**
UNIT–6 : Air Pollution: Sources, Types, Monitoring and Control. Meteorological Parameters and Plume behavior. Effects and causes of air pollution, Techniques of air pollution control.	**[07 Hrs.]**

Text Books :

1. Punmia B. C., Wastewater Engineering, 2nd Edition, Laxmi Publication, New Delhi
2. Birdie G.S., Birdie J.S., Water Supply and Sanitary Engineering, 4th Edition, Dhanpat Rai Publication, New Delhi.
3. S.K. Garg, Environmental Engineering-Vol-II, Sewage Disposal and Air Pollution Engg., Khanna Publications.
4. M.N. Rao, H.V.N. Rao, Air Pollution, Tata MacGraw Hill Publication.
5. P. N. Modi, Sewage Treatment & Disposal & Wastewater Engineering Vol. II, Standard Book House, 2019

Reference Books :

1. Metcalf, Eddy, Wastewater Engineering Treatment & Reuse, 4th Edition, Metcalf & Eddy Inc.

VII Semester
CV2404 - Hydrology & Water Resources Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Hydrological cycle, measurement of runoff and hydrographs. 2. Crop water requirements. 3. Reservoir planning and design of canal network and flood analysis. 4. Diversion headwork, earthen dam and gravity dam.	Students will be able to 1. Determine the surface water runoff and ordinates of hydrographs. 2. Compute water requirement for various crop pattern. 3. Explain parameters and procedures adopted in reservoir planning and analysis of flood occurrence. 4. Analyze of Gravity Dam, earthen dam and design of water conveyance canal system.
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10	

UNIT–1 : **Introduction :** Engineering hydrology, hydrological cycle. **Runoff :** Runoff, sources and component, classification of streams, factors affecting runoff, Estimation Methods. Measurement of discharge of a stream by Area-slope and Area-velocity methods. **Hydrograph :** Flood hydrographs and its components, Base flow & Base flow separation, S-Curve technique, unit hydrograph.	**[07 Hrs.]**
UNIT–2 : **General :** Irrigation, necessity, importance, benefits of irrigation, types. **Water requirement for crops :** Crop seasons and major crops of India, crop rotation, soils and their irrigation requirement, field capacity, wilting point, available moisture in soils for crops / plants, depth & frequency of irrigation, GCA, CCA, kor period, kor water depth, duty – delta relation, base period.	**[06 Hrs.]**
UNIT–3 : **Reservoir Planning :** Selection of site for reservoirs, engineering surveys, geological and Hydrological investigations, fixing of LWL, FTL/FRL, HFL, TBL, dead storage, live storage, different storage zones in reservoirs, reservoir sedimentation and its removal. **Statistical Methods:** Statistics in hydrological analysis, probability and probability distribution. **Floods:** Causes and effects, Factors affecting peak flows and its estimation, frequency analysis.	**[07 Hrs.]**
UNIT–4 : **Water Logging :** Causes, effect, Preventive measure of water logging. **Canal Irrigation :** types of canal system, stable canal, unstable canal, grading, lined, canal network **Canals In Alluvial Soils :** Kennedy"s silt theory–Design procedure, silt supporting capacity, drawbacks, Lacey"s silt theory–definition of initial final and permanent regime channels, Lacey"s Regime equations, channel design procedure, limitations. **Lined Canals :** design procedure, types of lining, relative merits and demerits of canal lining, economics of canal lining.	**[06 Hrs.]**
UNIT–5 : **Introduction to Dams :** Classification of dams, factors governing selection of type of dams **Diversion Head Works :** Component parts of diversion head-works – fish ladder, divide wall, silt excluder and silt ejector. **Earthen Dams :** Types of earthen dams, modes of failure and its remedial measures.	**[06 Hrs.]**
UNIT–6 : **Gravity Dam :** Definition: forces acting on gravity dam, stability requirements, theoretical & practical profile of gravity dam, low &high dam. Spillway, general profile of gravity dam.	**[07 Hrs.]**

VII Semester
CV2404 - Hydrology & Water Resources Engineering

Text Books :

1. Ojha, C.S.P., Berndtsson, R., and Bhunya, P., Engineering Hydrology, Oxford University Press
2. Raghunath H.M., Hydrology, New Age International Publishers.
3. Reddy R., Hydrology, Tata McGraw-Hill New Delhi.
4. S.R. Sahastrabudhe, Irrigation Engineering and Hydraulic Structures, (1996), S.K. Kataria Publications New Delhi.
5. G.L. Asawa, Irrigation and Water Resources Engineering, 2005, New Age International Publishers, New Delhi.
6. Santosh Kumar Garg, Irrigation Engineering and Hydraulic Structures, 1998, Khanna Publisher New Delhi.
7. B.C. Punmia, Irrigation Engineering and Water power Engineering, 1993, Laxmi Publications, New Delhi.

Reference Books:

1. Linsley, R.K., Kohler, M.A. and Paulhas, Hydrology for Engineers, Tata McGraw-Hill Publishing Company Limited.
2. Todd, D.K., Ground Water Hydrology, John Wiley & Sons.
3. Subramnaya, K., Engineering Hydrology, Tata McGraw-Hill Publishing Company Limited.
4. Sharma R.K., Sharma T.K., Hydrology & Water Resources Engineering, Dhanpat Rai Publications.
5. R.S. Varshney, S.C. Gupta, R.L. Gupta, Theory and Design of Irrigation Structures, Vol – II, 1979, Nem Chand & Bros. Publications Roorkee.
6. N.N. Basak, Irrigation Engineering, 1999, Tata McGraw-Hill Publications New Delhi.
7. S.K. Sharma, Principles and Practice of Irrigation Engineering, 1988, S. Chand Publications New Delhi.
8. Arora K. R., Irrigation, Water Power & Water Resources Engineering, Standard Publishers Distributors.
9. Ghanshyam Das, Hydrology and Soil Conservation Engineering: Including Watershed Management, PHI Publication, 2009.

VII Semester
CV2411 - PE-III : Prestressed Concrete

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Concepts of prestressed concrete. 2. IS codes related to prestressed concrete. 3. Analysis and design of the basic structural members in Prestressed concrete. 4. Limit state of serviceability to prestressed concrete members.	Students will be able to 1. Explain the concepts of Prestressed concrete. 2. Apply the knowledge of IS codes related to Prestressed concrete. 3. Analyze and design the basic structural members in Prestressed concrete. 4. Examine the limit state of serviceability to Prestressed concrete members.
Mapped Program Outcomes : 1, 2, 3, 5, 8, 9, 10, 12 **PSO** : i	

UNIT–1 : Introduction to prestressed concrete, types of prestressing, Advantages and limitations of Prestressing, systems and devices, materials, losses in prestress, IS1343 –2012 codal provisions.	**[06 Hrs.]**
UNIT–2 : Analysis of Prestress, Resultant Stresses at Section, Concept of Load Balancing, Cracking Moment, Kern Point, Pressure Line. Design of Members - Design of Sections for Axial Tension, Design of Sections for Flexure.	**[07 Hrs.]**
UNIT–3 : Analysis for Shear - Stress in an Uncracked Beam, Types of Cracks, Components of Shear Resistance, Modes ofFailure, Effect of Prestressing Force, Design for Shear - Limit State of Collapse for Shear, Design of Transverse Reinforcement, Detailing Requirements.	**[06 Hrs.]**
UNIT–4 : Deflection due to Gravity Loads, Prestressing Force, Total Deflection, Codal provision for Limits of Deflection. Transmission of Prestress in Pre-tensioned and Post-tensioned Members.	**[07 Hrs.]**
UNIT–5: Analysis and Design of prestressed concrete slabs – one way and two way.	**[07 Hrs.]**
UNIT–6: Statically Indeterminate Structures – Analysis and design of Continuous Beam, Principle of Linear Transformation, Concordant Tendon Profile.	**[06 Hrs.]**

Text Books:

1. N. Krishana Raju, Prestressed Concrete, Tata McGraw Hill Publishing Company Limited, New Delhi.6thedition, 2012
2. N. Rajagopalan, Prestressed Concrete, Alpha Science International, 2nd edition 2005
3. Dayaratnam P, Prestressed Concrete, Oxford & IBH, 5th edition 2014
4. Praveen Nagarajan, Prestressed Concrete Design, ZKindersley Pvt. Ltd, New Delhi, 2013.
5. K.U. Muthu, Prestressed Concrete, PHI Learning Pvt. Ltd, Delhi, 2016.

Reference Books:

1. Lin T.Y., Design of Prestressed Concrete structures, John Wiley &Sons, 3rd edition,1904
2. Edward G. Nawy, Prestressed Concrete, Pearson Education Limited, 5th edition 2005.

VII Semester
CV2412 - PE-III : Advanced R.C.C.

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. IS codes and IRC codes required for design of advanced concrete structures. 2. Concept of different IRC loading and design of bridge and culverts 3. Design methods of multistoried building frame, water tank, retaining wall. 4. RCC detailing of structures.	Students will be able to 1. Explain the provisions of relevant IS codes and IRC codes required for design of advanced concrete structures. 2. Analyze problems on building frames subjected to vertical load & horizontal load. 3. Analyze advanced concrete structures such as multistoried buildings, retaining wall, bridge, water tank, flat slab. 4. Illustrate RCC detailing of structures.
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10 **PSO** : i	

UNIT-1 : Design of building frames subjected to vertical load up to two bay and up to four story, including Design of foundation by Using Limit state	**[07 Hrs.]**
Unit-2 : Analysis and design of building frame subjected to lateral forces by portal frame method and cantilever method.	**[06 Hrs.]**
UNIT–3 : Design of flat slab by various methods.	**[06 Hrs.]**
UNIT–4 : Design of circular and rectangular water tanks resting on ground. Design of circular elevated water tank. (Intz type only).	**[07 Hrs.]**
UNIT-5 : Introduction to for IRC loadings. Design of bridge deck slab for culvert and bridge.	**[07 Hrs.]**
UNIT – 6 : Design of cantilever Retaining walls and counter fort Retaining wall.	**[06 Hrs.]**

Text Books :

1. Bhavikatti S. S., Advanced R. C. C. Design Volume-II, New age international publisher, New Delhi, Ist edition – 2006.
2. Krishna Raju N, Advanced R. C. C. Design, CSB Publisher and Distributor, New Delhi, 2nd edition-2005

Reference Books :

1. Johnson and Victor, "Essentials of Bridge Engineering" Oxford and IBH publisher, 1980.
2. Jain O.P. and Jai Krishna, Plain and Reinforced concrete structures–Volume –II, Nemchand and brothers, 1987
3. Chen, W.F. and Duan, L. "Bridge engineering Handbook"

VII Semester
CV2413- PE-III: Numerical Methods and Computational Techniques

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Algebraic, transcendental and linear algebraic equations 2. Eigen values, Initial & two point boundary value problem 3. Numerical Integration and Development of Computer Program. 4. Direct Integration Methods	Students will be able to 1. Explain the basic elements underlying development and use of numerical methods in engineering applications. 2. Compute numerical solution of various types of problems such as Roots of equations, Systems of linear simultaneous equations, Numerical Differentiation and integration, Eigen value problems etc. 3. Analyze algorithms to solve problems using modern computational tools. 4. Evaluate the direct integration method and compare it with basic method.
Mapped Program Outcomes : 1, 2, 4, 8, 9, 10	

UNIT-1 : **Solution of algebraic and transcendental equation:** Regula Falsi Method, Newton-Raphson method, Development of Computer Program.	**[06 Hrs.]**
Unit-2 : **Solution of linear algebraic equations:** Gauss elimination, Cholesky method, Given"s method, Householder"s method.	**[07 Hrs.]**
UNIT–3 : **Eigen values problems**: Direct, Jacobi, Rutishauser"s LR method, QR method.	**[07 Hrs.]**
UNIT–4 : **Initial & two point boundary value problem**: Euler"s, Runge - Kutta, Milne's Methods, Development of Computer Program.	**[07 Hrs.]**
UNIT-5 : **Numerical Integration:** Trapezoidal Method, Simpson"s Method, Gauss Quadrature, Development of Computer Program.	**[06 Hrs.]**
UNIT – 6 : **Direct Integration Methods:** Central difference method, Houbolt method, Newmark"s method, Wilson - θ method.	**[07 Hrs.]**

Text Books :

1. Balachandra Rao S., Santha C.K. Numerical Methods with programs in BASIC, FORTRAN and Pascal, University Press (India) Limited, Hyderabad 1992.
2. Bathe K. J., Wilson E. L., Numerical Methods in Finite Element Analysis, Prentice-Hall of India Private Limited, New Delhi, 1987.

Reference Books :

1. Kandasamy P. Thilagavathy K, Gunavathi K.; Numerical Methods, S. Chand & Company Ltd, New Delhi, Edition-I, 1997.
2. Chapra S.C. and Canale,R.P., " Numerical Methods for Engineers with Programming and Software Applications"- 3 Ed., Tata McGraw Hill, New Delhi, 2009.
3. Salvadori M., "Numerical Mehtods"- PHI learning Pvt., ltd., New Delhi, 1987.
4. Jain, Iyanger& Jain "Numerical Methods for Scientific Engineering computation"- Wiley Eastern Ltd., 1985.
5. Gupta S. K.; Numerical Methods for Engineers, New Age International Limited Publishers, New Delhi, 1997

VII Semester
CV2414 - PE-III : Environmental Impact Assessment

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. The concepts of EIA and related terminologies. 2. The various methodologies of EIA; 3. Basic procedures for assessment of resources. 4. Case studies of EIA.	Students will be able to 1. Illustrate the process of EIA. 2. Explain the various methodologies used for EIA. 3. Explain the procedures for EIA projects. 4. Illustrate the various case studies of EIA.
Mapped Program Outcomes : 6, 7, 8, 9, 10, 12	

UNIT–1 : **Evolution of EIA:** Concepts, Nature & Type of impacts, Need of EIA, Participation in EIA, New Concepts - Life cycle assessment.	**[07 Hrs.]**
UNIT–2 : **Methods for impact assessment:** Screening, Scoping, Base line studies, Check list, Mitigation, Matrices, Interaction of network methodologies.	**[06 Hrs.]**
UNIT–3 : **Prediction and assessment of impact for air and noise environment:** Basic information of air quality, Identification of type and quantity of air pollutant, existing air quality and air quality standards, impact prediction and assessment, mitigation.	**[07 Hrs.]**
UNIT–4 : **Prediction and assessment of impact for water and soil environment:** Basic information of water quality (Surface water and ground water), water quality standards, identification of impact, prediction of impact and assessment, mitigations.	**[06 Hrs.]**
UNIT–5 : **Prediction and assessment of impact on cultural and socioeconomic environment:** Basic information on cultural resources, rules and regulations for cultural resources, Basic information of socioeconomic environment, description of existing socioeconomic environment, prediction and assessment of impact, mitigation, resettlement and rehabilitation.	**[07 Hrs.]**
UNIT–6 : **EIA notification by Ministry of Environment and Forest (Govt. of India):** Provisions in the EIA notification, Categorization of Industries for seeking environmental clearance from concerned authorities, Environmental management plan, post environmental monitoring. Case studies in EIA.	**[06 Hrs.]**

Text Books :

1. Anand Bal, An Introduction to Environmental Management, Himalaya Publishing House.
2. Canter L.W. 1977. Environmental Impact Assessment. McGraw Hill, Inc. Printed in the United States of America.
3. Peter Watten (Eds.) – "Environmental Impact Assessment Theory and Practice", Unwin Hyman, London (1988).

Reference Books :

1. John G. Rau and David C Hooten (Ed)., "Environmental Impact Analysis Handbook", McGraw-Hill Book Company, 1990.
2. "Environmental Assessment Source book", Vol. I, II & III. The World Bank, Washington, D.C., 1991.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II", Blackwell Science, 1999.
4. Bass, Herson and K. Bogdon, 2001, The NEPA Book: A step-by-step guide on how to comply with the National Environmental Policy Act, Solano Press.
5. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.

VII Semester
CV2415 - PE-III : Energy Conversion & Management

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Conventional and non-conventional energy sources and its scenario 2. Energy management and the importance of energy conservation. 3. Energy conversion technologies and techniques of energy analysis. 4. Elements of Energy management systems.	Students will be able to 1. Explain different sustainable energy sources 2. Analyze energy management and importance of energy conversion. 3. Explain different energy conversion method. 4. Select modern technologies of Waste to Energy conversion
Mapped Program Outcomes : 1, 6, 7, 8, 9, 10, 12	

UNIT–1 : Significance of Energy Conversion and Environment, Overview of Global and Indian Energy Scenario; Environmental Impacts of Energy Conversion, Principles of Waste Minimization and Energy Recovery.	**[07 Hrs.]**
UNIT–2 : Renewable and Non-Renewable Energy Sources; Estimation of Potential of Energy Recovery from various Sources, Energy economics.	**[06 Hrs.]**
UNIT–3 : Energy Conversion Methods: Thermal, hydro, nuclear, solar, wind, tidal etc. their principles and application.	**[07 Hrs.]**
UNIT–4 : Waste to Energy options: physical, thermochemical and bio chemical processes, Combustion, Gasification, pyrolysis; Fuels Derived anaerobic digestion, Biogas Technology, Future Technologies for Waste to Energy Systems.	**[06 Hrs.]**
UNIT–5 : Introduction to Microbial Fuel cell, Gas generations and collection in landfills, Measurements and Control; Energy and Resources Conservation Strategies and Policies.	**[07 Hrs.]**
UNIT–6 : Intelligent Green Building, Green Rating Systems Alternative Construction Materials& methods Testing and Verification.	**[06 Hrs.]**

Text Books :

1. D. O. Hall, G. W. Barnard and P. A. Moss, Biomass for Energy in the Developing Countries, Current Roles, Potentials, Problems, Prospects, Pergamon Press Ltd, 1st edition.
2. W. C. Turner, Energy Management Handbook Wiley New york 1st edition.
3. P. Meier, Energy System Analysis for Developing countries, Sringer Verlag 1st edition.
4. Dorthy J De Renzo, Energy from Bioconversion of Waste materials, Noyes data Corporation USA 1st edition.

Reference Books :

1. G.D. Rai, Non-Conventional Energy Source, Standard Publishers Distributors.
2. Fowler J. M. Energy and the Environment McGraw Hill New York 2nd edition.
3. B.H. Khan, Non-Conventional Energy Resources, 2nd Edition, McGraw Hill Companies.

VII Semester
CV2416 - PE-III : Geotechnical Investigation & Ground Improvement Techniques

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Important methods of soil exploration and interpretation of the results. 2. Methods of ground improvement. 3. Use of geosynthetics materials. 4. Diaphragm wall	Students will be able to 1. Explain various methods of soil exploration and Field investigations. 2. Apply various methods of ground improvement. 3. Implement geosynthetic materials and Diaphragm wall in construction
Mapped Program Outcomes : 1,2,3,4,8,9,10 **PSO** : ii	

UNIT–1 : **Importance and objectives of Geotechnical exploration**: Planning of geotechnical exploration program: Methods of boring, location, number of boreholes, depth of boring. Sub-surface Investigation Report: Salient features and boring logs; Types of soil samplers& their suitability, precautions in sampling, preservation & shipment of samplers. Seismic refraction method, electrical resistivity method, qualitative and quantitative interpretation of test results.	**[07 Hrs.]**
UNIT–2 : **Field investigations:** Standard Penetration Test, static cone and dynamic cone penetration tests, interpretation of test results for obtaining design soil parameters for cohesive and cohesion less soils, Plate load test– purpose, procedure, interpretation for bearing capacity and settlement of foundation. Field vane shear test, design value of un-drained shear strength of clays, correction factor, pressure meter tests.	**[06 Hrs.]**
UNIT–3 : **Introduction to ground improvement techniques** - Need for ground improvement, various ground improvement techniques, economic considerations and suitability. Grouting: Materials and methods of grouting Stone Columns.	**[06 Hrs.]**
UNIT–4 : **Reinforced soil and Geo-synthetics:** Basic theory of reinforced soil, concept of reinforced soil wall and reinforced slope, geo-synthetic types: applications in Civil Engineering.	**[07 Hrs.]**
UNIT–5 : **Ground Anchor and Soil Nailing:** Concept, Design features, types, construction procedure, Functions, Applications, Advantages. Limitations of soil nailing system and ground anchors.	**[07 Hrs.]**
UNIT–6 : **Diaphragm wall:** Construction sequence, cement slurry wall, Design features, Functions, applications, Case study on Diaphragm wall. Deep soil mixing.	**[06 Hrs.]**

Text Books :

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books :

1. Design Aids in Soil Mechanics and Foundation Engineering, 1988, Kaniraj R., McGraw Hill New Delhi.
2. Analysis and Design of Foundations and Retaining Structures, 1979, Shamsher Prakash, Gopoal Ranjan and Swami Sharan, Sarita Prakashan.
3. Theory and Practice of Foundation Design, 2004, Som N.N. & Das S.C., Prentice Hall and co New Delhi.
4. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.

VII Semester
CV2417 - PE-III : Earth Pressure & Earth Retaining Structures

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Various earth pressure theories 2. Earth retaining structures 3. Design of some earth retaining structures	Students will be able to 1. Explain various earth pressure theories 2. Evaluate earth pressure on various retaining structures 3. Analyze and design of earth retaining structures
Mapped Program Outcomes : 1, 2, 3, 4, 8, 9, 10 **PSO :** ii	

UNIT–1 : Earth pressure, introduction, earth pressure as a stability problem, concept of strain dependence of developed stresses, active, at rest and passive conditions, plastic equilibrium, EP computation for practical cases.	**[07 Hrs.]**
UNIT–2 : Various theories related with E.P. Distillation, Rankine, Coulomb and Hansen theoretical derivation and graphical construction with different geometric and boundary conditions.	**[06 Hrs.]**
UNIT–3 : Retaining wall - types, material, method of construction, nature of forces acting. Comparison of different earth pressure theories and application in retaining wall. Stability analysis and design aspects, application of theory of elasticity in analysis of earth pressure distribution.	**[07 Hrs.]**
UNIT–4 : Eart -structure - Definition, Features of an earth dam, stability analysis of slope, total-vs.- effective stress analysis, limit equilibrium method of slices based on circular failure surfaces, introduction to analysis based on general failure surfaces, introduction to analysis based on general failure surfaces. Stability of earth dams during different stages-during and at end of construction, steady seepage, sudden draw down, estimation of pore water pressure-use of stability charts.	**[06 Hrs.]**
UNIT–5 : Bulkhead: Classification of Bulkhead, Cantilever sheet pile wall in cohesionless and cohesive soil, cofferdam.	**[07 Hrs.]**
UNIT–6 : Design of gravity retaining wall: Preliminary design Detailed design.	**[06 Hrs.]**

Text Books :

1. Earth Pressure and Earth Retaining Structures, 2013, Chris R.I. ClaytonRick I. Woods Andrew J. Bond Jarbas Milititsky., Third edition, CRC press (Taylors & Francis Group).
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication

Reference Books :

1. Tropical soils in engineering practice by S. A. Ola, Balkema publications, Holland Principles of Foundation Engineering: Das B.M., PWS publishing co., (1999)
2. Principles of Geotechnical Engineering, 7th Edition. Braja M. Das. Executive Director, Global Publishing Program: Chris Carson.

VII Semester
CV2418 - PE-III : Urban Transportation Planning

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Basics of the transportation planning process. 2. Various methods of forecasting and discuss environmental impacts caused by traffic. 3. Importance and factors governing trip generation and various methods of trip distribution. 4. Various traffic regulations, enforcements and traffic management approaches.	Students will be able to 1. Explain basics of the transportation planning process. 2. Illustrate various methods of forecasting and discuss environmental impacts caused by traffic. 3. Explain factors governing trip generation and various methods of trip distribution. 4. Explain various traffic regulations, enforcements and traffic management approaches.
Mapped Program Outcomes : 1, 2, 7, 8, 9, 10	

UNIT–1 : **Importance of urban transport planning** **Transport Planning Process:** Scope, Independence of the land use and traffic, system approach to transport planning, stages, survey and analysis, forecast analysis and future condition of plan synthesis, evolution, programme adoption and implementation, continuing study, citizen participation, difficulties in transport planning process.	**[07 Hrs.]**
UNIT–2 : **Traffic forecasting:** Necessity, Limitations, Types of traffic, Methods of forecasting, Period of forecasting. **Traffic and environment:** Introduction, Detrimental effects on environment, Noise, Air pollution, vibration, Visual intrusion and degrading aesthetics, Severance and land consumption.	**[06 Hrs.]**
UNIT–3 : **Trip Generation:** introduction and definition, trip purpose, factors governing trip generation and attraction rates. **Trip Distribution**: Introduction, Methods: Uniform factor method, Average factor method. Farther method, Furness Method, Criticism of Growth factor method etc.	**[06 Hrs.]**
UNIT–4 : **Model Split:** General consideration, factors affecting, Model split in transport planning process, recent development. Mode choice analysis. Introduction to Various modes of urban transportation.	**[07 Hrs.]**
UNIT–5 : **Regulation of traffic:** Basic principles of regulation, scope of traffic regulation, traffic laws, regulation of speed, vehicles, driver & traffic, parking & enforcement regulations, motor vehicle act.	**[06 Hrs.]**
UNIT–6 : **Nature of traffic problems in cities:** Growth of town & traffic, present difficulties in urban traffic condition, measures, Application of ITS in urban traffic management, VMS, Signal coordination. **Urban Street Light systems:** Need, laws of illumination, decrement by artificial lightening, appearance of lighted pavement, types of surface, distribution of light, mounting height, spacing, lantern arrangement, types of lamps, quantity of illumination.	**[07 Hrs.]**

Text Books :

1. Traffic Engineering and Transport Planning, Kadiyali, L.R, Khanna Publishers
2. Principles & Practice of Highway Engineering, Chakroborty P Das, Khanna Publisher, 2000
3. Highway Engineering, Rangawala B.S, Charotar Publishing House, 2011

Reference Books :

1. IRC Handbook and MOST Specifications, Indian Road Congress
2. Fundamentals of Transportation and traffic Operations. Pergamon, Elsevier science Inc
3. Institute of Transportation Engineers, „Manual of Transportation Engineering Studies", Prentice Hall

		June 2020	1.00	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
CV2419 - PE-III : Advanced Hydraulics

COURSE OBJECTIVE	COURSE OUTCOMES
Students will be introduced to 1. Uniform flow, critical flow and transition in channel. 2. GVF, flow profiles in channel, profile length by various methods. 3. Hydraulic similitude and model investigation 4. Unsteady flow and rigid water column theory for pipe flow.	Students will be able to 1. Calculate various flow parameters in open channel. 2. Analyze the practical flow profiles and profile length in open channel. 3. Apply model theory to know in advance the performance of prototype. 4. Compute time flow establishment for unsteady flow and water hammer pressure in pipe flow
Mapped Program Outcomes : 1, 2, 3, 5, 8, 9, 10	

UNIT–1 : Types of channel, classification of channel, criteria for Critical flow, specific energy & specific energy curve, velocity distribution, wide rectangular channel, conveyance of channel, section factor, Hydraulic exponent M & N.	**[05 Hrs.]**
UNIT–2 : Dynamic equation of GVF in terms of normal depth & critical depth, conveyance K & section factor Z, hydraulic exponent M & N, channel transitions for subcritical and supercritical flow: hump in channel, reduction in channel width, chocking conditions in channel.	**[06 Hrs.]**
UNIT–3 : Gradually varied flow, channel slope, back water curve, drawdown curve. Characteristic of GVF profiles, breakin grade, composite GVF profiles, Various gradually varied flow profiles in channel, standard practical profiles, sluice gates and their effects on GVF profile.	**[06 Hrs.]**
UNIT–4 : Computation of gradually varied flow length in channel, direct step method, Bresse"s method, Chow"s method.	**[08 Hrs.]**
UNIT–5 : Hydraulic similitude and model investigation : Dimensionless numbers and their significance, Model investigation, model laws, similitude-types of similarities i.e. Geometric, Kinematics and Dynamic, Force ratio, types of model, merits and limitations of distorted and undistorted model, scale effect in models.	**[07 Hrs.]**
UNIT–6 : Unsteady flow in a pipe, Bernoulli"s Equation of unsteady flow in a pipeline for incompressible fluid flow, Time flow establishment, rigid water column theory of water hammer, computation of water hammer pressures.	**[07 Hrs.]**

Text Books:

1. VenTe Chow, Open channel hydraulics, International Student Edition. McGraw Hill,
2. Ranga Raju K.G. Tata McGraw Hill. K.G., Flow through open channels, 1998, Tata McGraw Hill Publications.
3. Subramanya K., Flow in open channels, 2009, Tata McGraw Hill Publication
4. Modi& Seth, Fluid mechanics and Machineries, Standard Book House, Delhi.

Reference Books:

1. Hanif Choudhary, Applied Hydraulic Transients, 3rd edition, Springer New York, Heidel Berg Dordrecht, London.

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
CV2421 - PE-IV : Natural Resources Management

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Natural resources, challenges, opportunities & prospects for sustainable development. 2. Act & Policies for Natural Resources Management. 3. Adaptation of programs for conservation of resources. 4. Modern development & its effect on environment.	Students will be able to 1. Explain problems arising in implementation of Natural Resources Management. 2. Apply laws, policies & practice implementation for private and public resources owners and users. 3. Explain the role of Natural Resources Management in sustainable development. 4. Evaluate factors contributing to natural resources insecurity and degradation.
Mapped Program Outcomes : 1, 6, 7, 8, 9, 10, 12	

UNIT–1 : **Introduction to Natural Resource Bases:** Concept of resource, classification of natural resources, Factors influencing resource availability, distribution and uses. Forest resources, Land resources, Food resources, Mineral Resources Marine Resources.	**[07 Hrs.]**
UNIT–2 : **Overview of policies & Governance of Natural Resources:** Environmental Protection Act, Wildlife Protection Act, National Conservation Policy, National Action Plan on Climate Change, Forest Protection Act, Air & Water pollution & prevention Act.	**[06 Hrs.]**
UNIT–3 : **Renewable and Non Renewable Energy** Sources of energy generation, Rural energy, Biomass to energy, fuel wood use, Biochemical conversion, Anaerobic digestion and biogas production, Thermo-chemical conversions, gasification, Ethanol, Bio-diesel.	**[07 Hrs.]**
UNIT–4 : **Programs for NRM** Rural development programs, Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Human Development Index (HDI), Environmental Clearance Program, Environmental Management Plan.	**[06 Hrs.]**
UNIT–5 : **Sustainable Natural Resources Management and Development:** Industrialization, Infrastructure development, globalization, urbanization and privatization, sustainability of modern developments Applications and case studies.	**[07 Hrs.]**
UNIT–6 : **Environmental issues in urbanizing world:** Climate change and carbon trading, watershed management, wetland management, Urban Forestry, Biodiversity, migration & Rehabilitations, Urban poverty and livelihood.	**[06 Hrs.]**

Text Books :

1. Tom Tietenberg and lynne lewis, 2013, Environmental and natural resource economics, Pearson education incorporation, publishing as Addison-wesley.
2. Knight, Richard L., editor, et al. 1995. A New Century for Natural Resources Management. Island Press.

Reference Books :

1. Francois Ramade 1984. Ecology of Natural Resources. John Wiley & Sons Ltd.
2. Singh, Rajvir. 2000. Watershed Planning and Management
3. Harris, J.M. 2006. Environmental and Natural Resource Economics: A Contemporary Approach, 2nd edition.

		June 2020	1.00	Applicable for AY 2020-21 Onwards
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VII Semester
CV2422 - PE-IV : Finite Element Method

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Variational principle and Rayleigh Ritz Method used in finite element method. 2. Shape functions and its use in Finite Element Formulation 3. Natural coordinates and Isoparametric elements used finite element method. 4. Mathematical modelling techniques and solution steps by using software.	Students will be able to 1. Explain principles of finite element method. 2. Apply principles of FEM for derivation of element equations 3. Analyze civil engineering problems by finite element method. 4. Illustrate mathematical modeling and solution techniques in FEM
Mapped Program Outcomes : 1, 2, 5, 9, 10	

UNIT–1 : Introduction: Development and Applications, Advantages and Disadvantages of FEM, General steps of FEM, Direct equilibrium approach, Variational approach, application of Raleigh - Ritz method to simple bar and beam problems.	**[07 Hrs.]**
UNIT–2 : Shape functions: Introduction, Lagrange and Hermitian shape functions, Derivation of shape functions using Cartesian Coordinates, Requirement of Ideal displacement functions.	**[06 Hrs.]**
UNIT–3 : Formation of stiffness matrices and load vectors, Application of FEM to bar, and beam Problems.	**[06 Hrs.]**
UNIT–4 : Application of FEM to 2D problems: Equilibrium equations, Triangular and Rectangular element formulation using Cartesian Coordinates, Application to two-dimensional stress analysis.	**[07 Hrs.]**
UNIT–5 : Natural coordinates, Isoparametric elements, Application to 1D and 2D Problems.	**[07 Hrs.]**
UNIT–6 : Numerical integration, Modeling and storage techniques, Introduction to standard FEM software.	**[06 Hrs.]**

Text Books :

1. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
2. Godbole P. N., Introduction to Finite Element Method, I.K. International Publishing House Pvt. Ltd., New Delhi, 2013
3. Desai Y. M., Eldho T. I. and Shah A. H., Finite Element Method s and Application to Engineerimg, Pearson, 2011.

Reference Books :

1. Krishnamoorthy C S, "Finite Element Analysis – Theory and Programming", Tata McGraw Hill Publishing Co., New Delhi, 1994.
2. Rajasekaran S, "Finite Element Analysis in Engineering Design". S Chand & Co., 2003.

VII Semester
CV2423 - PE-IV : Introduction To Structural Dynamics

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Discrete single-degree and multiple-degree vibratory systems and calculate the free and forced response of these systems. 2. Inerprete the mode shapes and frequencies for the free response of continuous vibratory systems. 3. Make modeling continuous vibratory systems – vibration of strings, axial and torsional vibration of bars and beams	Students will be able to 1. Analyze knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems 2. Solve engineering problems having motions varying with time. 3. Analyze a vibratory structure, in order to achieve specified requirements. 4. Relate the importance of understanding how structural vibrations may affect safety and reliability of engineering systems.
Mapped Program Outcomes : 1, 2, 3, 4	

UNIT–1 : Introduction to structural dynamics, types of prescribed loadings, formulation of equations of motion Single-Degree-of-Freedom (SDOF) System:, d" Alembert"s principle, torsional vibration undamped systems, free vibrations, general solution, numerical examples.	**[06 Hrs.]**
UNIT–2 : SDOF system: damped free vibrations, damping coefficient, experimental determination of fundamental frequency and damping coefficient, general solution, numerical examples.	**[07 Hrs.]**
UNIT–3 : SDOF system: forced vibrations, equation of motion, harmonic load, periodic load, resonance, numerical examples.	**[06 Hrs.]**
UNIT–4 : SDOF system: General load, impulse load, Duhamel integration, vibration isolation, force transmissibility and base motion numerical examples.	**[07 Hrs.]**
UNIT–5 : Two and three DOF systems: equations of motion, natural frequencies, introduction to mode superposition, numerical examples.	**[07 Hrs.]**
UNIT–6 : Introduction to earthquake engineering, response spectra, response of SDOF systems to earthquake excitation, numerical examples	**[06 Hrs.]**

Text Books:

1. J.M. Biggs, Introduction to structural Dynamics, McGraw-Hill, NY, 1964.
2. M. Paz and W. Leigh, Structural Dynamics - Theory and Computations, 5th Edition,2004
3. R.W. Clough and J. Penzien, Dynamics of Structures, McGraw-Hill, Singapore, 2003.

Reference Books:

1. R.R. Craig, Structural Dynamics – An Introduction to Computer Methods, J. Wiley & Sons, 1981.
2. L. Meirovitch, Elements of Vibration Analysis, 2nd edition, McGraw-Hill, Singapore, 1986.
3. A.K.Chopra, Dynamics of Structures–Theory and Applications to Earthquake Engineering, Prentice Hall.2009.
4. J.L. Humar, Dynamics of structures, McGraw Hill, 1993

VII Semester
CV2424 - PE-IV : Wastewater Treatment

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Characteristics & disposal methods for wastewater. 2. Principles of working and design of various waste water treatment units and processes. 3. Need & processes of Advance wastewater treatment. 4. Characteristics and treatment of wastewater from various industries.	Students will be able to 1. Apply suitable method for safe disposal of wastewater. 2. Design various treatment units for waste water 3. Explain advanced processes for treatment of waste water 4. Select suitable treatment of waste water from various industries.
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10	

UNIT–1 : Holistic approach to Wastewater management, Effluent & Stream standards, wastewater characteristics and their significance, disposal methods for wastewater on land and in water and its impact, self-purification of streams	**[06 Hrs.]**
UNIT–2 : Preliminary and primary treatment processes and units: Screens, grit chamber and primary settling tank- Principles, types & designs.	**[07 Hrs.]**
UNIT–3 : Secondary treatment processes & units: Concepts in biological treatment, bacterial growth, Activated sludge process, Trickling filter- Principles, types. Simple design problems / exercise.	**[07 Hrs.]**
UNIT–4 : Other biological treatment units: Aerated lagoons, Stabilization Ponds, Up flow Sludge Blanket Reactors, Sludge Digester.	**[06 Hrs.]**
UNIT–5 : Need of advanced treatment, removal of trace organics, micro screening and control of nutrients, nitrification and de- nitrification, removal of phosphorus.	**[07 Hrs.]**
UNIT–6 : Treatment alternatives for Industrial waste, volume reduction, strength reduction, equalization tank, neutralization tank, Specific industrial wastewater treatment for paper and pulp industry, sugar industry, distillery industry, dairy industry, textile industry.	**[06 Hrs.]**

Text Books :

1. B.C. Punmia, 2010, Wastewater engineering, Laxmi Publications (P) Ltd., New Delhi.
2. P. N. Modi, 2008, Sewage Treatment & Disposal and Waste Water Engineering, Standard Book House.
3. S. K. Garg, 2010, Environmental Engineering (Volume-2), Khanna Publication.
4. M. N. Rao, 2007, Waste water treatment, oxford and IBH publishing.
5. Patwardhan, 2008, Industrial wastewater Treatment, PHI learning Pvt. Ltd.
6. G.L. Karia and R. A. Christian, 2006, Wastewater Treatment, PHI learning Pvt. Ltd.

Reference Books :

1. Metcalf and Eddy, 2006, Wastewater Treatment Disposal and reuse, Tata McGraw Hill publishing company Ltd.

VII Semester
CV2425 - PE-IV : Environmental Legislation & Management System

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Concept of environmental policies, principles, agreements. 2. Provisions in various environmental acts. 3. Fundamentals of environmental management and ISO 14000 series. 4. Legal judgements in several cases	Students will be able to 1. Explain legal aspects for environment protection. 2. Analyze legal provisions in various environmental acts. 3. Illustrate environmental management plans, principles and standards 4. Explain powers of government, board & court judgment
Mapped Program Outcomes : 6, 7, 8, 9, 10, 12	

UNIT–1 : Introduction : Indian Constitution and Environmental Protection– National Environmental policies– Environmental agreements and Protocols – Montreal Protocol, Kyoto agreement, Rio declaration.	**[06 Hrs.]**
UNIT–2 : Water Act 1974 : Power & functions of regulatory agencies - Provision relating to prevention and control, Legal sampling procedures, State Water Laboratory Penalties for violation of consent conditions.	**[07 Hrs.]**
UNIT–3 : Air Act 1981 : Power & functions of regulatory agencies Provision relating to prevention and control, Legal sampling procedures, State Air Laboratory Authority – Penalties for violation of consent conditions..	**[07 Hrs.]**
UNIT–4 : Environment (Protection) Act 1986: Genesis of the Act – delegation of powers – Role of Central Government - Municipal Solid Waste Management - Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier, authorization – Biomedical waste rules – responsibilities of generators and role of Pollution Control Boards.	**[06 Hrs.]**
UNIT–5 : Fundamentals of Environmental Management and ISO 14000 series : Background and development of ISO 14000 series. Environmental management Plans, principles and elements. The ISO 14001-Environmental management systems standard. Environmental law in India: Environmental policy and laws.	**[07 Hrs.]**
UNIT–6 : Other Topics: Relevant Provisions of Indian Forest Act, Public Liability Insurance Act, National tribunal - Supreme Court Judgments in Landmark cases.	**[06 Hrs.]**

Text Books :

1. CPCB, "Pollution Control acts, Rules and Notifications issued there under "Pollution Control Series – PCL/2/1992, Central Pollution Control Board, Delhi, 1997.
2. Shyam Divan and Armin Roseneranz "Environmental law and policy in India "Oxford University Press, New Delhi, 2001.
3. Greger I. Megregor, "Environmental law and enforcement", Lewis Publishers, London1994.
4. Constitution of India [Referred articles from part-III, part-IV and part-IV A]
5. Pares Distn. Environmental Laws in India (Deep, Lated edn.)
6. Handbook of environmental management and technology: Gwendolyn Holmes, Ben Ramnarine Singh, Louis Theodore.
7. The ISO 14000 Handbook: Joseph Cascio.
8. ISO 14004: Environmental management systems: General guidelines on principles, systems and supporting techniques (ISO 14004:1996 (E)).
9. ISO 14001: Environmental management systems: Specification with guidance for use (ISO 14001:1996b(E)) (International organization for standardization-Switzerland)

VII Semester
CV2426 - PE-IV : Advanced Foundation Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Various bearing capacity theories of shallow foundation 2. Foundation Settlement 3. Geotechnical design of shallow and deep foundations. 4. Machine foundation and Well foundation.	Students will be able to 1. Apply various bearing capacity theories of shallow foundation 2. Calculate foundation settlement 3. Apply geotechnical design of shallow and deep foundations. 4. Explain machine foundation and well foundation.
Mapped Program Outcomes : 1, 2, 3, 4, 8, 9, 10, **PSO**-ii	

UNIT–1 : **Bearing Capacity of Foundations**: Terzaghi"s, Meyerhoff, Hansens bearing capacity theories, Bearing capacity based on SPT, SPT Correlations, Design N Values, eccentric and inclined loads,	**[07 Hrs.]**
UNIT–2 : **Foundation Settlements**: The Settlement Problem, Stresses in Soil Mass Due to Footing Pressure, Immediate Settlement Computations, Alternative Methods of Computing Elastic Settlements, Consolidation or final settlement.	**[06 Hrs.]**
UNIT–3 : **Combined Footing:** Geotechnical Design of rectangular footing, trapezoidal footing, strap footing	**[07 Hrs.]**
UNIT–4 : **Vertically Loaded Pile** Ultimate Bearing Capacity in Cohesionless Soils, Ultimate Bearing Capacity of Piles in Granular Soils Based on SPT Value, Settlement of pile groups in sand, settlement of pile groups in cohesive soils	**[06 Hrs.]**
UNIT–5 : **Introduction to Machine Foundation:** Introduction, Types of machine foundation, Basic definitions, Degree of freedom of block foundation, General criteria for design of Machine foundation, free & forced vibrations, Determination of natural frequency, foundations for impact loads and vibration isolation.	**[07 Hrs.]**
UNIT–6 : **Introduction to Well foundation:** Different shapes of wells, forces acting on the well foundation, Individual components of well foundation, Uses, constructional features, sinking of wells, tilt and shift, their rectification, depth of well and grip length.	**[06 Hrs.]**

Text Books:

1. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering, 2003, VNS Murthy, CRC Press.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication.

Reference Books :

1. IS-8009: Part I (1976). Reaffirmed 1993. Code of practice for calculation of settlement of foundation subjected to symmetrical vertical loads. Part I-Shallow Foundations, 1993, Bureau of Indian standard.
2. Principles of Foundation Engineering: Das B.M., PWS publishing co., (1999)
3. Foundation Analysis & Design: Bowles J.E., McGraw Hill, (1996)
4. Shallow Foundation: Das B.M., CRC Press, (2009).

VII Semester
CV2427 - PE-IV : Geosynthetics

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Different geosynthetics materials and their applications 2. Various properties of geosynthetics materials. 3. Design of various structures using geosynthetic	Students will be able to 1. Compare geosynthetic materials and their applications 2. Explain Various properties of geosynthetics materials. 3. Apply design of various structures using geosynthetics
Mapped Program Outcomes : 1, 2, 3, 4, 8, **PSO-**ii	

UNIT–1 : **Introduction** Overview of geosynthetics, development of geosynthetics, products, functions and applications, advantages and beneficial effects.	**[07 Hrs.]**
UNIT–2 : **Geotextile** Properties and test methods, Functions and Applications, Designing for reinforcement, separation, filtration, drainage and stabilization, Design of reinforced earth wall	**[06 Hrs.]**
UNIT–3 : **Geogrid,** Properties and test methods, Functions and Applications, Design for bearing capacity.	**[07 Hrs.]**
UNIT–4 : **Geomembrane,** Properties and test methods, Functions and Applications, Design of landfill liner using geomembrane.	**[06 Hrs.]**
UNIT–5 : **Geonet :** Properties and test methods, Functions and Applications, Design for drainage.	**[07 Hrs.]**
UNIT–6 : Geocomposites, Geocell, Geofoam, Gabion wall, Introduction, Advantages and Applications.	**[06 Hrs.]**

Text Books :

1. Ground Improvement Techniques by P. Purushothama Raj, Lakshmi Publications Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors.
2. Soil Mechanics & Foundation Engineering, 2009, Arora K.R., Standard Publisher Distributors
3. Soil Mechanics & Foundations, 2009, Punmia B. C., Laxmi publication

Reference Books :

1. R.M. Koerner, Designing with Geosynthetics (Vol. 1 & 2), Prentice Hall edition, New Jersey.
2. G.L. S. Babu, An Introduction to Soil Reinforcement & Geosynthetics, Orient Blackswan.
3. J.N. Mandal, Geosynthetics Engineering: In Theory and Practice, Research Publishing, Singapore.

VII Semester
CV2428 - PE-IV : Advanced Transportation Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Development of railway and its terminology. 2. Geometric design of railway track 3. Development of air transportation in India 4. Tunnel engineering	Students will be able to 1. Illustrate the importance of railway transportation and its terminologies 2. Analyze and design the geometric element of railway track 3. Explain terminologies of air transportation 4. Explain about tunnel engineering.
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10	

UNIT–1 : Transportation and its development, Alignment surveys, requirement, coning of wheels, stresses in railway track, high speed track, selection for rails, test on rail wear & defects, corrugation and creep of rails, rail joints.	**[07 Hrs.]**
UNIT–2 : **Geometric design of railway track** : gradients, speed, super elevation, cant deficiency, curves, length of transition curves, grade compensation. **Points and crossing :** Left and right hand turnouts, turnouts & crossovers.	**[06 Hrs.]**
UNIT–3 : **Station and Yards**: Types, functions, facilities &equipments. **Railway Signaling and interlocking:** classification and types of signals, control and movement of trains, track circulation, signaling & controlling.	**[07 Hrs.]**
UNIT–4 : **History of Air Transportation in India :** Comparison with other transportation modes, aircraft components and characteristics, airport site selection. **Airport obstructions :** Zoning laws, imaginary surfaces. **Runway And taxiway design :** Windrose diagram, cross wind component, runway orientation and configuration.	**[06 Hrs.]**
UNIT–5 : **Airport layout and classification** : Terminal area, aircraft parking and parking systems, unit terminal concept, aprons, hangers. **Visual Aids :** Airport marking and lighting for runways, taxiways and other areas. **Air traffic control :** Need, networks, control aids, instrumented landing systems, advances in air traffic control.	**[07 Hrs.]**
UNIT–6 : **Tunnels :** Alignment, surveys, cross section of highway & railway tunnels, tunneling methods in hard rock and soft grounds, tunnel lining, drainage, ventilation and lighting of tunnels, advances in tunneling techniques.	**[06 Hrs.]**

Text Books :

1. A Text Book of Railway Engineering, S.C. Saxena and S.P. Arora, 2005, Dhanpat Rai Sons New Delhi.
2. Airport Planning and Design, S.K. Khanna, 1999, Nem Chand and Brothers, Roorkee.
3. Tunnel Engineering S.C. Saxena, 2012, Dhanpat Rai publication.
4. Ports and Harbours by Oza

Reference Books :

1. Textbook on Transportation Engineering, S. P. CHANDOLA, 200, S. Chand Publishers, New Delhi
2. Planning and Design of Airports, Robert Horonjeff, Francis Mckelvey, William Sproule, Seth Young, Fifth Edition 2010, McGraw Hill Professionals.

VII Semester
CV2429 - PE-IV : Watershed Management

COURSE OBJECTIVE	COURSE OUTCOMES
Students will be introduced to 1. Watershed characteristics, and Principles of watershed management. 2. Soil erosion and relationship between soil and water. 3. Watershed management components and conservation practices. 4. Monitoring and Modeling in Watershed management..	Students will be able to 1. Explain the watershed characteristics and need of watershed management. 2. Classify soil and soil erosion and relate the relationship between soil and water. 3. Analyze Watershed management components and implement water conservation techniques. 4. Compare watershed Modeling techniques and monitoring tools.
Mapped Program Outcomes : 1, 5, 7, 8, 9, 10, 12	

UNIT–1 : Watershed: Watershed characteristics, causes of watershed deterioration, effects of watershed deterioration on community. Concepts of watershed management. Water resources regions in India. Principles of watershed management, Integrated Watershed Management Approach (IWMA), Objectives of IWMA, selection of watershed village, equity issues for watershed policies.	**[07 Hrs.]**
UNIT–2 : Surveys: Benchmark surveys for Integrated Watershed Management, Remote Sensing survey in Watershed Management and its applications. Land capability classification: objectives and factors affecting, Stakeholder participation: Modes of participation, Appraisals: Types, Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA), Principles and basic assumptions, fundamentals, tips, myths, benefits and tools of PRA techniques.	**[07 Hrs.]**
UNIT–3 : Soil Erosion : Factors affecting soil erosion, Types of soil erosion, Damages (losses) due to soil erosion, Estimation of losses using Universal Soil Loss Equation (USLE) and Revised Universal Soil Loss Equation (R-USLE) methods. Control measures for reducing soil erosion. Soil-water-air relationship and different types of soils, soil salinity and measures for reducing soil salinity. Water requirement of crops and methods of water application to crops.	**[06 Hrs.]**
UNIT–4 : Watershed components management: management of natural drainages in watershed using check dams, Gully stabilization and storage, River training works, Guide bank, Pitched island, Retards, Revetments, Gabion, Reservoir sedimentation, factors affecting and measurement. Hydrologic components of watershed: Precipitation, Infiltration, Evaporation, Evapotranspiration, Runoff, Groundwater.	**[07 Hrs.]**
UNIT–5 : Water conservation and Harvesting: Wasteland, causes and remedial measures, waterlogging: causes and effects, landslide: adverse effects and management. Land drainage management, urban storm water management. Management of arable land: Bench terracing, Conservation Bench terracing, ditches, land levelling, hydraulic measures, retaining wall, biological or vegetative measures. mulching, mixed cropping, alley cropping and tillage. Management of non arable land: contour trenching. Orchard terraces, stone Walls, Diversion Drain, Vegetative Control Measures, Half Moon Terraces, Geojute, Retaining Walls, Wattling, Crib Structures, Micro Watershed Treatment.	**[07 Hrs.]**

VII Semester
CV2429 - PE-IV : Watershed Management

UNIT–6 : Watershed Modelling: Data required, watershed models and its application, Rainfall-Runoff modelling, Curve Number Method, Models using GIS. Monitoring: Purpose and monitoring tools, Evaluation: Indicators used, stages of evaluation, impact analysis. Watershed committees for reviewing and reporting, Research requirements and post project management in watershed. Case studies on watershed management.	**[06 Hrs.]**

Text Books:

1. J. V. S Murthy, Watershed Management, New Age International Publishers, 1998.
2. Suresh Rao, Soil and Water Conservation Practices, Standard Publishers, 2003.
3. V.V. N. Murthy, Land and Water Management, Kalyani Publishers, 1994.

Reference Books:

1. Ghanshyam Das, Hydrology &soil Conservation Engineering, PHI Publication.

VII Semester
CV2430 - PE- IV: Advanced Fluid Mechanics and Hydraulic Machines

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Drag and lift of submerged body 2. Boundary layer theory of real fluid flow 3. Force exerted by jet on plate 4. Hydraulic machine and surge tank	Students will be able to 1. Examine the fundamental principles of fluid mechanics and related applications to submerged object 2. Analyze the real fluid flow in pipe 3. Determine forces acting on the plate 4. Design the surge tank and evaluate the performance of hydraulic machines
Mapped Program Outcomes : 1, 2, 3	

UNIT–I: FLOW AROUND SUBMERGED BODIES—DRAG AND LIFT: Introduction, Force Exerted by a Flowing Fluid on a Body, Expressions for Drag and Lift, Dimensional Analysis of Drag and Lift, Streamlined and Bluff Bodies, Drag on a Sphere,Terminal velocity of a body, Applications of stokes" law, Drag on a Cylinder, Circulation and Lift on a Circular Cylinder, Flow patterns and development of lift, Position of stagnation points Pressure at any point on the cylinder surface, Expression for lift on cylinder, Expression for lift coefficient for rotating cylinder, Magnus effect, Lift on an Airfoil.	**[06 Hrs.]**
UNIT–II : Boundary layer theory Introduction, Reynold"s experiment, Critical Reynolds number, Boundary layer definitions and characteristics, flow of viscous fluid in circular pipes,Velocity and shears tress distribution, maximum velocity, average velocity, Drop of pressure, Hagen–Poiseuille equation, Momentum equation for boundary layer by Vonkarman, Laminar boundary layer, turbulent boundary layer.	**[07 Hrs.]**
UNIT–III : Impact of Jet : Introduction, Force Exerted on a Stationary Flat Plate held Normal to jet, Inclined to jet, and Curved Plate. Force Exerted on Moving Flat Plate held Normal to Jet, Inclined to the direction of Jet, Curved Vane when the Plate is Moving in the Direction of Jet, Jet Striking a Moving Curved Vane Tangentially at One Tip and Leaving at the Other.	**[06Hrs.]**
UNIT–IV: Centrifugal Pump: Introduction, Classification of Pumps, Component Parts of a Centrifugal Pump, working of a Centrifugal Pump, Work done by the Impeller on Liquid, Heads of a Pump, Losses and Efficiencies of a Centrifugal Pump, Minimum Speed for Starting a Centrifugal Pump, Effect of Variation of Discharge on the Efficiency, Multi-stage Centrifugal Pumps, Specific Speed, Characteristics of Centrifugal Pumps, Cavitation in Centrifugal Pumps, Priming of a Centrifugal Pump.	**[07 Hrs.]**
UNIT–V : Reciprocating Pump: Introduction, Classification of Reciprocating Pumps Components and Working, Discharge, Work Done and Power Required to Drive Reciprocating Pump, Single-acting reciprocating pump, Double-acting reciprocating pump, Co-efficient of Discharge and Slip of Reciprocating Pump, Effect of Acceleration of Piston on Velocity and Pressure in the Suction and Delivery Pipes, Indicator Diagrams, Effect of acceleration, friction in suction and delivery pipes on indicator Diagram, Air Vessels.	**[06Hrs.]**
UNIT–VI : Surge Tank: Introduction, function, location, Types of Surge tank, stability analysis of surge tank, upsurge in tank with and without friction, time of oscillation, Thomas criteria, Design of simple surge tank.	**[07 Hrs.]**

VII Semester
CV2430 - PE- IV: Advanced Fluid Mechanics and Hydraulic Machines

Text Books:

1. Asawa, G.L, Fluid Flow in Pipes and Channels, CBS Publishers and Distributers.
2. Gupta, Vijay & Gupta, S.K., Fluid Mechanics, New Age International Publishers.
3. Modi & Seth, Fluid mechanics and Machineries, Standard Book House, Delhi.
4. Subramanya K., Theory and application of Fluid mechanics including Hydraulic machines, Tata McGraw-Hill publishing company ltd. New Delhi.
5. R.K. Rajput., A textbook of Fluid mechanics And Hydraulic machines, S. Chand & company ltd

Reference Books:

1. White, F.M, Fluid Mechanics, McGraw-Hill.
2. Ramamrutham S, Hydraulics fluid mechanics & Fluid machines, Dhanpat Rai publishing company (P) ltd. New Delhi.

VII Semester
CV2431 - PE-V : Maintenance & Rehabilitation Engineering

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Various maintenance works in civil engineering structures. 2. Methods & techniques apply for maintenance in structures 3. Planning & management of Maintenance& Rehabilitation work.	Students will be able to 1. Explain Maintenance& Rehabilitation techniques for improve condition of existing structures. 2. Analyze factors Affecting Frequency and Magnitude of Maintenance Work 3. Apply various smart materials used in rehabilitation of structures. 4. Explain different available repairing techniques with specialized materials
Mapped Program Outcomes : 1, 6, 7, 8, 9, 10, 12	

UNIT–1 : Introduction, Classification of Maintenance Work, specifications for maintenance works, Common Maintenance Problems, Techniques of maintenance, Special construction methods, new materials.	**[07 Hrs.]**
UNIT–2 : Factors Affecting Frequency and Magnitude of Maintenance Work, Effect of pollution on buildings. Inspection, Identification and diagnosis of common defects and failures with possible causes in buildings, Roads, bridges, railway tracks, canals and C.D. Works, tunnels and special structures like service reservoirs, water supply, sewerage, storm water drains.	**[06 Hrs.]**
UNIT–3 : Preventive Maintenance, Road stabilization techniques, Routine and service maintenance, recycling, bridges and Cross Drainage works repairs, Service & stability requirements.	**[07 Hrs.]**
UNIT–4 : Materials and Techniques for Maintenance, Failure of Buildings, case studies, diagnostic testing methods and equipments.	**[06 Hrs.]**
UNIT–5 : Maintenance Planning, Conservation and Recycling, Documentation, materials and methods for conservation work, case studies.	**[07 Hrs.]**
UNIT–6 : Maintenance Oriented Designs, Maintenance Management, operational assessment, Research in Maintenance, Field equipment and tools for investigation, repairs and monitoring non-destructive evaluation techniques.	**[06 Hrs.]**

Text Books :

1. Concrete Technology, 2009, Shetty M.S., S.Chand Publication, New Delhi.
2. Concrete for Construction - Facts and Practice, 1999, Raina V.K, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. SP: 25 -1984 - Hand Book on Causes and Prevention of Cracks in Buildings, 1999, Bureau of Indian Standards, New Delhi.
4. I.R.C./B.I.S./C.B.R.I. Publication.

Reference Books :

1. Concrete - Building Pathology, 2003, Macdonald S., Blackwell Science Limited, Oxford.
2. Common Building Defects, Diagnosis and Remedy, compiled by National Building agency, Construction press, London & New York.
3. CPWD hand book on Repairs and Rehabilitation of RCC buildings published by DG(Works), CPWD, Government of India (Nirman Bhawan), http://www.cpwd.gov.in/handbook.pdf
4. Concrete Repair, Rehabilitation and Retrofitting: M. Alexander, H. D. Beushausen, F.Dehn& P. Moyo, Taylor & Francis Publication

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
CV2432 - PE-V : Project Planning & Management

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Planning of project and execution of different construction projects. 2. Principles of Construction Scheduling & Network Analysis. 3. Development of projects by managing Quality & safety measures. 4. Legal aspect in project management & various laws.	Students will be able to 1. Apply the knowledge of planning & Execution of construction projects. 2. Explain Construction Scheduling & Network Analysis. 3. Explain the quality control aspect in planning & management with safety provisions. 4. Explain the legal aspects & various laws in construction projects.
Mapped Program Outcomes : 6, 7, 8, 9, 10, 11, 12	

UNIT–1 : **Introduction to Construction Planning and Management** Various function of construction management, Resources, stages, project planning & team work,Classification of Civil Engineering Drawings.	**[06 Hrs.]**
UNIT–2 : **Introduction to Contracts Specification & Scheduling** Types of Contracts, Contract documents, Specification, condition of contract, stages of planning. **Network Analysis:** The Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT), Bar Chart.	**[07 Hrs.]**
UNIT–3 : **Organising Construction** Introduction to Principles of Organisation, its types, Organisation for construction firm and other services.	**[07 Hrs.]**
UNIT–4 : **Introduction to** different type of construction equipment"s and their applications.	**[06 Hrs.]**
UNIT–5 : **Inspection and Quality Control** Need of Quality Control, Principles of Inspection, various stages, and various tests. **Safety Management** Importance of safety, introduction to various safety measures.	**[06 Hrs.]**
UNIT–6: **Introduction to** Legal Aspects in Project Planning and Management.	**[07 Hrs.]**

VII Semester
CV2432 - PE-V : Project Planning & Management

Text Books :

6. Construction Planning and Management – Purifoy
7. Construction Planning and Management – Dr U K Shrivastava, Galgotia Publ.
8. Project Planning & Management – B C Punmia
9. Laws related to buildings and engineering contracts in India- Gajaria G T, LexisNexis Butterworths India Publisher, 2000.
10. Punmia B.C. & Khandelwal K.K., Project Planning & Control with PERT&CPM, Laxmi Publications, New Delhi,1990.

Reference Books :

6. Construction Contracts- Jimmie Hinze McGraw Hill,
7. Contracts and the legal Environment for Engineers and Architects- Joseph T Bockrath, McGraw Hill,
8. Srinath L, CPM & PERT, Affiliated East-West Press Pvt. Ltd., New Delhi.
9. P.S. Gahlot & B.M. Dhir, Construction Planning and Management, New Age International.
10. Chaudhary Roy, Project Management, Tata McGraw Hill, New Delhi.

VII Semester
CV2433 - PE-V : Modern Surveying Technique

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. The students will be able to understand the advantages of electronic surveying over l surveying methods. 2. The student will be able to handle and to understand the working principle of Advanced Electronic Devices 3. The student will be able to understand and to apply knowledge of GPS, GIS and Remote Sensing technique / data for required purpose	Students will be able to 1. Explain the basic concept of GPS surveying 2. e the basic concept of GIS surveying 3. Classify the Remote sensing system 4. Illustrate the basic concept of Hydrography and Astronomical surveying
Mapped Program Outcomes : 1, 2, 5, 9, 10	

UNIT–1 : **GPS SURVEYING** Introduction to GPS, History, Satellite Navigations constellations today–GPS system, GLONASS system, Galileo System, GPS Errors Future of GPS.GPS surveying technique, Reference Systems and Coordinate systems, Datum transformations, software improvements.	**[06 Hrs.]**
UNIT–2 : GIS SURVEYING GIS Subway system, representation of data, Raster and vector data structure, advantages and Disadvantages vector data over raster data, data format conversion, Spatial and Non-spatial data, Components of GIS, working of GIS, Hardware-Computing, printing and scanning systems, Introduction to Software – Standard Packages like Arcview, ArcGIS, Autocad Map, Map Info.	**[07 Hrs.]**
UNIT–3 **PHYSICS OF REMOTE SENSING** Physics of Remote Sensing: Sources of Energy, Active and Passive Radiation, Ideal and real remote sensing, Electromagnetic Radiation, Transmission, Absorption, Thermal Emissions, Interaction with Atmosphere, IRS system, Advantages and application of remote sensing.	**[07 Hrs.]**
UNIT–4 : **MICROWAVE REMOTE SENSING** Microwave Remote Sensing: Active and Passive Systems, Advantages, Concept of radar Equation, Surface Scattering, Errors in Radar, Imaging-non imaging system. Applications: passive microwave, Land use – Land cover.	**[06 Hrs.]**
UNIT–5 : **Hydrography Introduction** : Tides, Shore line survey, River Survey Soundings, Sounding Equipment, method of locating soundings. **Underground surveying :** Correlation of underground and surface survey, transferring the level to underground and surface survey.	**[07 Hrs.]**
UNIT–6 : **Astronomy :** The Earth, Solar system, Elements of spherical trigonometry, Napler"s rule of circular parts, celestial sphere, astronomical terms.	**[06 Hrs.]**

VII Semester
CV2433 - PE-V : Modern Surveying Technique

Text Books :

1. Punmia B.C., Jain A.K., Jain A.K, Surveying, (Vol. 2 & Vol. 3), Laxmi Publication, New Delhi. 1, 15th Edition.
2. Kanetkar T.P. & Kulkarni S. V, Surveying & Levelling (Vol.2 & Vol. 3), Pune Vidhyarthi Gruha Prakashan, Pune.
3. Reddy M. A., Remote sensing & GIS, B. S. Publication, Hyderabad.
4. Dr. A.M. Chandra, Higher Surveying, New age international publishers , New Delhi

Reference Books :

1. Thomas M. L., Ralph W. K., Jonathan W., Remote Sensing and Image Interpretation, Chipman Wiley & Sons, 5th Edition (2010).

VII Semester
CV2434 - PE-V : Advanced Steel Design

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Eccentric and moment resistant connection. 2. Plate girder and its design 3. Roof trusses and analysis for industrial shed. 4. Bridges, bearings and design of foot bridge.	Students will be able to 1. Explain the type of structure and its design methodology. 2. Calculate different types of loading with respect to structural parameters. 3. Apply Indian Standard code provisions for designing advanced steel structure components 4. Analyze and design Steel built-up sections and truss members.
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10 **PSO :** i	

UNIT–1 : Eccentric connection : Introduction to bracket type 1 and bracket type 2 connection	**[06 Hrs.]**
UNIT–2 : Moment Resistant Connection: Seat connection, frame connection & Introduction to Moment resistant connection	**[07 Hrs.]**
UNIT–3 : Plate Girder: Element of Plate Girder, Types of Section, Design Aspect, Stability of Webs, Design of Welded Plate Girder.	**[06 Hrs.]**
UNIT–4 : Roof truss: Types of roof truss, different loading on truss, components of truss and analysis for industrial shed.	**[07 Hrs.]**
UNIT–5 : Introduction to Bridge and bearings: Types of Bridges, Types of bearings	**[06 Hrs.]**
UNIT–6 : Design of Footbridge: Introduction to foot bridge, Design of Footbridge	**[07 Hrs.]**

Text Books :

1. Design of steel structures, By S. Arya and J. L. Ajmani, New Chand & Bros. Roorkee, 1992
2. Fundamentals of Structural Steel Design, By M. L. Gambhir, McGraw Hill Education, 2013
3. Design of Steel Structures, By N. Subramanian, OXFORD University Press, First Edition, 2008

Reference Books :

1. Limit State Design of Steel Structures, By S. K. Duggal, McGraw Hill Education Private Limited, 2011
2. Design of Steel Structures, By P. Dayaratnam, S. Chand Publication, 2008

VII Semester
CV2435 - PE-V : Design Of Bridge Structures

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Evolution of bridges, their classification and components of bridges. 2. Various types of bridges, loading conditions and load combinations as per IRC. 3. Design consideration of various types of culverts, bridges and its substructure - superstructure components. 4. Basics of Suspension and Cable stayed bridges	Students will be able to 1. Illustrate various types of bridges, loading conditions and their components. 2. Distinguish and analyze superstructure and substructure as per design standards. 3. Compare the suitability of long span bridges.
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10	

UNIT–1 : **Introduction** - History of Bridges; Definition and Basic Forms, Components of a Bridge and its definitions. **Classification of Road Bridges**, related structures, span length; classification of road bridge, short history of bridge development.	**[06 Hrs.]**
UNIT–2 : **Standard Loading for Road Bridge Design as per codes**: Introduction of IRC codes. Dead load, Live load, Impact factor, Centrifugal force, Wind loads, Longitudinal forces, Buoyancy, Water Current Forces, Thermal Forces, Deformation and Horizontal Forces, Erection Stresses, Seismic Forces, Load combinations for different working state and limit state designs.	**[07 Hrs.]**
UNIT–3 : Introduction to various types of culverts, Slab Bridges, Beam and Slab Bridges, Plate Girder Bridges, Prestressed Concrete Bridges, Composite Bridges, Introduction to their design.	**[06 Hrs.]**
UNIT–4 : **Substructure:** Pier, Loads on Piers Abutment, Major types of abutments. **Bridge Foundations:** Open foundation, Pile foundation; Well foundation.	**[07 Hrs.]**
UNIT–5 : **Bearings and Deck Joints**: Bearings, Forces on Bearings, Types of Bearings, Basis for Selection of Bearings. Different types of bridge expansion joints.	**[07 Hrs.]**
UNIT–6 : **Suspension bridges**: Components of suspension bridge, Structural behavior, Advantages. **Cable Stayed Bridge**: General Features, Components of cable stayed bridges, Towers or Pylons, Types of cable stays.	**[06 Hrs.]**

VII Semester
CV2435 - PE-V : Design Of Bridge Structures

Text Books:

1. T.R. Jagadeesh, M.A. Jayaram, Design of Bridge Structure, PHI publication.
2. Krishnaraju „ Bridge Engineering, UPD Publishers, New Delhi, 2000.
3. Baider Bakht and Leslie, G. Jaeger,„ Bridge Analysis Simplied, Mcgraw Hill Book Co,1998.

Reference Books:

1. IRC 005, Standard Specifications and Code of Practice for Road Bridges, Section I (General Features of Design) (Seventh Revision), 1998.
2. IRC 006, Standard Specifications and Code of Practice for Road Bridges, Section II – Loads and Stresses (Fourth Revision), 2014.
3. IRC-21:2000; Standards specifications and code of practice for Road bridges.
4. IRC 078, Standard Specifications and Code of Practice for Road Bridges, Section VII – Foundations and Substructure (Revised Revision), 2014.
5. IRC 083-1, Standard Specifications and Code of Practice for Road Bridges, Section IX (Bearings), Part I (Metallic Bearings) (First Revision), 1999.
6. IRC 112, Code of Practice for Concrete Road Bridges, 2011.
7. Johnson Victor, „Bridge Engineering", Oxford IBH, New Delhi, 2000.
8. Raina, R.K, „Principles of Design of RCC Bridges, Tata McGraw Hill, 1999.Conrad P. Heins and Richard A. Lawrie, „Design of Modern Concrete Highway Bridges, John Wiley andSons, 1999.

VII Semester
CV2436 - PE-V : Industrial Wastewater Treatment and Reuse

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Various maintenance works in civil engineering structures. 2. Methods & techniques apply for maintenance in structures 3. Planning & management of Maintenance& Rehabilitation work	Students will be able to 1. Understand impact and environmental problems of industrial wastewater 2. Articulate the fundamentals of various treatment processes. 3. Review treatment methodologies for wastewaters of various industries 4. Analyse related data for design of various treatment units for Industrial wastewater treatment
Mapped Program Outcomes : 1, 3, 7	

UNIT–1 : Environmental impact due to industrial water pollution, problems associated with industrial wastewater, characterization of industrial wastewater. Sampling and analysis of wastewater, toxicity testing, statistical analysis of data, Indian standards for waste disposal	**[06 Hrs.]**
UNIT–2 : Common effluent treatment plant. Recycle and reuse of industrial waste, volume and strength reduction, concept of zero liquid discharge	**[07 Hrs.]**
UNIT–3 : Equalization and proportioning of wastewater, design of equalization tank. Neutralization of wastewater, Oil and grease removal, Floatation.	**[06 Hrs.]**
UNIT–4 : Stabilization pond, oxidation ponds,	**[07 Hrs.]**
UNIT–5 : Anaerobic treatment, UASB, attached growth processes.	**[06 Hrs.]**
UNIT–6 : Treatment of specific industrial wastes: textile, dairy, tanning, sugar, brewery and distillery, iron and steel, food industries.	**[07 Hrs.]**

Text Books :

1. Metcalf and Eddy, Wastewater Engineering, Treatment, Disposal and Reuse, Inc. Third Edition McGraw Hill 1991.
2. W.W. Eckenfelder, Industrial Pollution Control, McGraw Hill Int. Edition 1990.
3. W.J. Weber, Physicochemical Processes for Water Quality Control, John Wiley and Sons, 1972.
4. Nemerow, N.L. Theories and Practices of Industrial Waste Treatment. New York: Addison Wisely.
5. Bess Elivievre, E.B. The Treatment of Industrial Wastes, McGraw Hill Book co.
6. Culp R L et al, Handbook of Advanced Wastewater Treatment Van No Strand Reinhold Publ. N.Y.
7. Arceivala, S.J., (1998) "Wastewater Treatment for Pollution Control ", Tata McGraw Hill.

Reference Books :

1. Central pollution control board, India, comprehensive industry document series.
2. World Bank Group (1998) "Pollution Prevention and Abatement Handbook–Towards Cleaner Production", World Bank and UNEP, Washington D.C.

VII Semester
CV2437 - PE-V : Finite Element Methods In Geotechnical Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Principles of Elasticity and Plane stress, Plane strain and axi-symmetric analysis 2. Shape functions and its use in Finite Element Formulation 3. Techniques of nonlinear analysis, Constitutive modeling for soils 4. Application of finite element method and software to different geotechnical structure	Students will be able to 1. Explain the principles of finite element method. 2. Apply principles of FEM for derivation of element equations 3. Analyze various elements by finite element method. 4. Evaluate the different geotechnical structures using software
Mapped Program Outcomes : 1, 2, 5, 9, 10	

UNIT–1 : Concepts of FEM, Steps involved in Finite Element Analysis Procedure, Merits and Demerits. Principles of Elasticity: Stress equations, Strain-Displacement relationships in matrix form.	**[06 Hrs.]**
UNIT–2 : FEM Hisotry and its applications Discretization of continuum, types of elements, displacement models, convergence requirements, Equations of equilibrium and compatibility, Plane stress, Plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.	**[06 Hrs.]**
UNIT–3 : Using Generalized coordinates Computations of element properties shape function Strain displacement matrix and stiffness, bar elements beam elements, truss elements, constant strain triangle, linear strain triangle, Quadrilateral elements.	**[07 Hrs.]**
UNIT–4 : Using Natural coordinates Computations of element properties shape function Strain displacement matrix and stiffness matrix for bar elements beam elements, truss elements.	**[06 Hrs.]**
UNIT–5 : Introduction to nonlinear analysis Techniques of nonlinear analysis, Constitutive modeling for soils, Nonlinear- soil parameters.	**[07 Hrs.]**
UNIT–6 : Application finite method to different geotechnical structure. Use of different finite element software for geotechnical engineering, application, benefit.	**[06 Hrs.]**

Text Books :

1. Finite Element Method Desai & Able
2. A First Course in the Finite Element Method – D. L. Logan
3. Finite Element Method – Y. M. Desai, T. I. Eltho and A. H. Shah
4. Introduction to Finite Elements in Engineering - Chandrupatla, R.T. & Belegundu, A.D
5. Gere and Weaver, "Matrix Method of Structural Analysis", CBS Publication, 2004

Reference Books :

1. Gere and Weaver, "Matrix Method of Structural Analysis", CBS Publication, 2004
2. Finite element analysis in geotechnical engineering-vol1,David M. Potts and Lidija Zdravkovic

VII Semester
CV2438 - PE-V : Pavement Design

COURSE OBJECTIVES	COURSE OUTCOMES
Students will be introduced to 1. Classification of various types of pavement, different design parameters and specifications for flexible and rigid pavements. 2. Various specification and standard for highway and airfield constructions and pavement management system. 3. Analysis and design of flexible and rigid pavements. 4. Pavement condition evaluation and techniques for strengthening of the pavement.	Students will be able to 1. Explain various types of pavement, different design parameters and specifications for flexible and rigid pavements. 2. Analyze and design flexible and rigid pavements. 3. Explain various specification and standard for highway and airfield constructions and pavement management system. 4. Examine pavement condition and Explain techniques for strengthening of the pavement.
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10	

UNIT–1 : Introduction to Various types of pavement: Flexible, semi flexible and rigid pavements, composite pavement, Introduction to Ultrathin thin white topping & perpetual pavement. Design Parameters: Standard Axle load, wheel assemblies for road vehicles, Type and contact pressure, contact area imprints, Computations of ESWL.	**[06 Hrs.]**
UNIT–2 : Analysis of Flexible and Rigid Pavements: Stress, strain, deflection analysis for single, two, three and multi layered flexible pavement systems, stress and deflections for rigid pavements due to load and temperature.	**[07 Hrs.]**
UNIT–3 : IRC, MORTH, ICAO, IAAI specification and standard for highway and airfield constructions. Pavement management system.	**[06 Hrs.]**
UNIT–4 : Highway Pavement Design: Flexible : IRC-37, Brumister, AASHO method of design. Rigid: IRC 58, rigid pavement joints and reinforcement.	**[07 Hrs.]**
UNIT–5 : Airfield Pavement Design: Flexible : US Corps of Engineering, CBR and FAA. Rigid: PCA, FAA & LCN. Cost Estimates : Cost evaluation and comparative study.	**[06 Hrs.]**
UNIT–6 : Pavement Evaluation: International roughness Index (IRI), rut depth, profilometers, Bump integrator, Benkelman Beam Deflection study. Strengthening of Pavements: Introduction to flexible, composite and rigid overlay design for flexible and rigid pavement, repair, maintenance and rehabilitation of pavement.	**[07 Hrs.]**

VII Semester
CV2438 - PE-V : Pavement Design

Text Books :

1. Pavement Design by R. Srinivasa Kumar
2. Principles And Practices Of Highway Engineering: (Including Expressways And Airport Engineering) by L.R. Kadiyali), N.B. Lal
3. N.J. Garber and L. A. Hoel, Traffic and Highway Engineering, Thomson Learning, Inc., 2002.
4. E.J. Yoder and M. W. Witczak, Principles of Pavement Design, John Willey, Inc., 1975.
5. F.L. Roberts, P. S. Kandhal, E. R. Brown, DY Lee, and T. W. Kennedy, Hot

References Books :

1. Association of State Highway and Transportation Officials (AASHTO) Specifications and Guides, 2002. Y. H. Huang, Pavement Analysis and Design, Prentice Hall, 1993.
2. Mix Asphalt Materials, Mixture Design and Construction, 2ndEdition, NAPA Research and Education Foundation, 1996.
3. R. Horonjeff and F. X. Mckelvey, Planning and Design of Airports, McGraw Hill, Inc., 4thEdition, 1994.
4. The Asphalt Institute (AI) Superpave Series No. 2 (SP 2), Superpave Mix Design, 1996.
5. The AI Manual Series No. 2 (MS 2), Mix Design Methods for Asphalt Concrete and Other Hot Mix Types, 1996.
6. The AI Manual Series No. 4 (MS 4), The Asphalt Handbook, 1989 Edition.

VII Semester
CV2439 - PE-V : Water Power Engineering

COURSE OBJECTIVES	COURSE OUTCOMES
Student will be introduced to 1. Hydropower Engineering, power station, hydropower schemes and hydropower potential. 2. Intake structure and surge tank. 3. Hydraulic Machine Turbine. 4. Pump Storage Plants and Tidal Power Station	Students will be able to 1. Examine fundamentals of hydropower and hydropower potential. 2. Explain components of intake structure and surge tank. 3. Determine the flow parameters of turbines. 4. Explain the pump storage plant and its economics.
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10	

UNIT–1 : Introduction: Sources of energy, types of power station, choice of generation type, components of water Power project, types and general layouts of various hydropower schemes, General arrangements of a power station, powerhouse, sub-structure and super structure, underground power station–necessity, principal, types, development and economics.	**[07 Hrs.]**
UNIT–2 : Estimation of hydro power potential, basic water power equation, gross head, net head, nature of supply, Storage and pondage, Method of computing hydrographs, mass curves, flow duration curves. Nature of demand: Load curve, load duration curves, load factor, plant factor, plant use factor, firm power secondary power.	**[06 Hrs.]**
UNIT–3 : Intake structures: Types, level of intake, hydraulics of intake structures, trash rack, transition, intake gates. Conduits: Types, economic section, power canals, pen-stock types hydraulic design and economic diameter pipe supports, anchor blocks, tunnels – classification, location and hydraulic design, tunnel linings.	**[06 Hrs.]**
UNIT–4 : Surge Tank: Functions and behavior of the surge tanks, location, types of surge tanks, basic design criteria of simple surge tank, stability of surge tank, Thomas criteria for stability of surge tank, hydraulic design of simple surge tank. Numerical on surge tank.	**[06 Hrs.]**
UNIT–5 : Turbines: Classification of turbines, characteristics of different types, choice of type of turbine, turbine setting and cavitations, velocity inlet and outlet triangle, specific speed, Tail race: Functions, types, channel and tunnel, draft tubes-function and principal types.	**[07 Hrs.]**
UNIT–6 : Pumped storage plants, purpose and general layout of pumped storage schemes, main types, typical arrangements of the upper reservoirs, economics of pumped storage plants. Introduction to Tidal power stations.	**[07 Hrs.]**

Text Books:

1. Dandekar M. M. & Sharma K. N, Water Power Engineering, Vikas Publishing House Pvt. Ltd., New Delhi.
2. Sharma R.K. & Sharma T.K., Water Power Engineering, S. Chand Publication.
3. Streeter V. L. & Wylie E. B, Hydraulic Transient, McGraw Hill Book Company, New York.

Reference Books:

1. S.K. Garg, Irrigation Engineering & Hydraulic Structure (Volume-I & II), Khanna Publications.
2. Arora K. R., Irrigation, Water Power & Water Resources Engineering, Standard Publishers Distributors.
3. Chaudhary Hanif, Applied Hydraulic Transients, Van Nostrand Rein Hold Company, New York. Varshney, Water power engineering, Nemchand Publication.

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
CV2440 - PE-V : Structural Engineering Practices

COURSE OBJECTIVE	COURSE OUTCOMES
Students will be introduced to 1. Structural Engineering Practices and pre-requisites in initiating structural design 2. Various standards and specifications frequently referred by Structural Engineers and their use in practice 3. Architectural plans, structural analysis and design of structural elements, identification of points for discussion between an architect and structural designer. 4. Design the RCC building and prepare structural drawings.	Students will be able to 1. Articulate structural engineering practices and pre-requisites. 2. Apply relevant standards and software related to structural design. 3. Explain important construction processes related to structural members. 4. Analyze and design building components and prepare detailed structural drawings
Mapped Program Outcomes : 1, 2, 3, 8, 9, 10, 12 **PSO** : i	

UNIT–1 : Importance of various architectural building plans and sections for the structural design. Structural behavior, Design basis, Design Intent, Standards, Manuals, Methods, material testing, Material Properties, Mix design, Quality Control, Different Tests & checks carried out at site, cube tests, buckling, creep, Shrinkage, etc. Professional ethics	**[07 Hrs.]**
UNIT–2 : Preparation of the structural framing plan of the building, beam locations, column positions, column orientations, shear walls locations. Introduction of SP16, IS:1893, IS:13920	**[06 Hrs.]**
UNIT–3 : Importance, determination & calculation of different loads like Dead load, live load, wall load, seismic load, wind load, finish load, temperature load, vibratory load, etc. Various load combinations.	**[06 Hrs.]**
UNIT–4 : Three dimensional Modeling of the Structure, Boundary Conditions, Section Properties, Applications of Loading, Static & Dynamic Analysis of structure, Design of structure, Understanding & Interpretation of the results, Deformation control, Mode Shapes, Vibrations, Acceptance Criteria"s, Tolerances, , .	**[7 Hrs.]**
UNIT–5 : Foundations – Importance of soil exploration, Various types of Foundation, Selection of type of foundation. Construction Methods.	**[07 Hrs.]**
UNIT–6 : Reinforcement detailing of Structures as per SP24 and as per exposure conditions, Fire Rating, etc.	**[06 Hrs.]**

Text books:

1. P.C. Vergese, Limit State Design of Reinforced Concrete, Prentice Hall Publishers, 2nd edition, 2008
2. Shah and Karve, Reinforced Concrete Structures, Structures Publishers, Pune, 5th edition, 2015.
3. Sinha S.N, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Limited, New Delhi, 2007
4. Ashok K. Jain, Reinforced Concrete –Limit State Design, Nem chand and Brothers, 7th edition,2012

Reference books:

1. P.C. Varghese, Advanced Design of Structures, Prentice Hall Publishers,2009
2. Punmia B.C.,Jain A.K.,Jain A.K,Reinforced Concrete Structures (Vol-I),Laxmi Publications Pvt Ltd, New Delhi, 2007
3. N. Krishana Raju,Prestressed Concrete,Tata McGraw Hill Publishing Company Limited, New Delhi, 5th edition 2012

VII Semester
CV2409 - Mini Project

(Thrust Area : Geotechnical Engineering)

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Apply knowledge of mathematic ıd engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. Design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. Relate on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. Apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. Analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	1. Illustrate a sound technical knowledge of their project topic. 2. Write problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Express effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1, 2, 3, 4, 5, 9, 10, 11 **PSO :** ii.	

(Thrust Area : Structural Analysis and Construction Materials)

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Application of mathematics, science, and engineering in a global, economic, environmental, and societal context. 2. Design a model, a system or components and analyze and interpret the data. 3. Teamwork and independent functioning of professional and ethical responsibility and life-long learning. 4. Effective communication and use the techniques, skills, and modern engineering tools and contemporary issues necessary for engineering practices. 5. Analyze, design and cost estimates of civil engineering structures.	1. Illustrate a sound technical knowledge of their selected project topic. 2. Write problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Express effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 **PSO :** i, iii	

VII Semester
CV2409 - Mini Project

(Thrust Area : Transportation Engineering)

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. Design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. Relate on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. Apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. Analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	1. Illustrate a sound technical knowledge of their selected project topic. 2. Write problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Express effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	

(Thrust Area : Water Pollution and Water Resources Engineering)

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. Design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. Relate on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. Apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. Analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	1. Illustrate a sound technical knowledge of their selected project topic. 2. Write problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Express effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 **PSO :**i, ii, iii	

Project will be allotted to a group of students, (preferably not more than 06) as per their choice and previous scores. The project work will be carried out by the students as directed by their guides. Evaluation will be done by continuous assessment and will be based on involvement of the student in the work.

VII Semester
CV2410 - Campus Recruitment Training (CRT)

COURSE OBJECTIVE	COURSE OUTCOMES
Students will be introduced to 1. Problems on Mathematics, Profit and loss, ratio and proportion, simple and compound interest etc. 2. Coding decoding, cubes cutting, syllogisms, data interpretation etc. 3. Articles, Sentence correction, para jumbles, vocabulary, verbal reasoning 4. Logical development through program solving, python basics, Matrix, number system etc.	Students will be able to 1. Make detailed notes and reports. 2. Compute the problems on quants 3. Illustrate the problems on logical, technical and verbal 4. Apply the field knowledge to the practical applications.
Mapped Program Outcomes : 1, 2, 5, 8, 9, 10, 11	

Student would be required to undergo a practical training for two months during the summer vacation after 6th semester. They would submit a report about the same and also make the presentation for evaluation.

VIII Semester
CV2451 - Major Project

(Thrust Area : Geotechnical Engineering)

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. Design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. Relate on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. Apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. Analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	Students will be able to 1. Illustrate a sound technical knowledge of their selected project topic. 2. Write problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Express effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1, 2, 3, 4, 5, 9, 10, 11 **PSO :** ii.	

(Thrust Area : Structural Analysis and Construction Materials)

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Application of mathematics, science, and engineering in a global, economic, environmental, and societal context. 2. Design a model, a system or components and analyze and interpret the data. 3. Teamwork and independent functioning of professional and ethical responsibility and life-long learning. 4. Effective communication and use the techniques, skills, and modern engineering tools and contemporary issues necessary for engineering practices. 5. Analyze, design and cost estimates of civil engineering structures.	Students will be able to 1. Illustrate a sound technical knowledge of their selected project topic. 2. Write problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Express effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 **PSO :** i, iii	

VIII Semester
CV2451 - Major Project

(Thrust Area : Transportation Engineering)

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. Design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. Relate on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. Apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. Analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	Students will be able to 1. Illustrate a sound technical knowledge of their selected project topic. 2. Write problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Express effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	

(Thrust Area : Water Pollution and Water Resources Engineering)

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. Design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. Relate on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. Apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. Analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	Students will be able to 1. Illustrate a sound technical knowledge of their selected project topic. 2. Write problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Express effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 **PSO :**i, ii, iii	

The group of students will continue to work for the project allotted previously and will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

VIII Semester
CV2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. To plan extracurricular events in order to foster a competitive spirit, teamwork, leadership, diligence, punctuality, and a sense of belonging among students. 2. Foster the development of creative ability, self-confidence, and a sense of accomplishment. 3. Designing procedures that consider environmental, social, political, ethical, and health and safety considerations.	Students will be able to 1. Develop leadership through the engagement of collaboration, and then put it into action to complete the task 2. Employ with a diverse range of individuals. 3. Operate to the advancement of society and the identification of health-related problems 4. Produce independently as well as member of a team in order to achieve established goals
Mapped Program Outcomes : 6, 7, 8, 9, 10, 11, 12	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology
SoE & Syllabus 2020
3rd to 8th Semester
Mechanical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. ME-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						47				
				Third Semester										
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3
2	3	PC	ME2201	Material Science & Metallurgy	T	3	0	0	3	3	30	20	50	3
3	3	PC	ME2202	**Lab:-** Material Science & Metallurgy	P	0	0	2	2	1		60	40	
4	3	PC	ME2203	Machining Process	T	3	0	0	3	3	30	20	50	3
5	3	PC	ME2204	**Lab:-** Machining Process	P	0	0	2	2	1		60	40	
6	3	PC	ME2205	Mechanics of Material	T	4	0	0	4	4	30	20	50	3
7	3	PC	ME2206	**Lab:-** Mechanics of Material	P	0	0	2	2	1		60	40	
8	3	PC	ME2207	Kinematics of Machines	T	3	0	0	3	3	30	20	50	3
9	3	PC	ME2208	Fluid Mechanics	T	4	0	0	4	4	30	20	50	3
10	3	PC	ME2209	**Lab:-** Fluid Mechanics	P	0	0	2	2	1		60	40	
				TOTAL		**20**	**0**	**8**	**28**	**24**				
				Fourth Semster										
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	20	50	3
2	4	PC	ME2251	Design of Machine Elements	T	3	0	0	3	3	30	20	50	3
3	4	PC	ME2252	Engineering Thermodynamics	T	3	0	0	3	3	30	20	50	3
4	4	PC	ME2253	**Lab:-** Machine Drawing	P	0	0	2	2	1		60	40	
5	4	PC	ME2254	Manufacturing Process-II	T	3	0	0	3	3	30	20	50	3
6	4	PC	ME2255	**Lab:-** Manufacturing Process-II	P	0	0	2	2	1		60	40	
7	4	PC	ME2256	Mechanical measurement & Metrology	T	4	0	0	4	4	30	20	50	3
8	4	PC	ME2257	**Lab:-** Mechanical measurement & Metrology	P	0	0	2	2	1		60	40	
				TOTAL		**16**	**0**	**6**	**22**	**19**				
				Audit Courses										
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	A	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05
Chairperson	Dean (Acad. Matters)	Date of Release	Version

Applicable for AY 2022-23 Onwards

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SoE No. ME-202.1

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(Revised Scheme of Examination w.e.f. 2022-23 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	20	50	3
2	5	PC	ME2301	Heat Transfer	**T**	3	0	0	3	3	30	20	50	3
3	5	PC	ME2302	**Lab:-** Heat Transfer	**P**	0	0	2	2	1		60	40	
4	5	PC	ME2303	Dynamics of Machines	**T**	3	0	0	4	3	30	20	50	3
5	5	PC	ME2304	**Lab:-** Dynamics of Machines	**P**	0	0	2	2	1		60	40	
6	5	PC	ME2305	Production Management	**T**	3	0	0	3	3	30	20	50	3
7	5	OE-I		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3
8	5	OE-II		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3
9	5	STR	ME2310	**Industry Visit and its report**	**P**	0	0	0	0	1		100		
					TOTAL	**18**	**0**	**4**	**23**	**21**				

Open Electives -I

1	5	OE-I	ME2331	OE I : Operations Research Techniques
2	5	OE-I	ME2332	OE I : Automobile Engineering
4	5	OE-I	ME2334	OE I : Control System Engineering
5	5	OE-I	ME2335	OE I: Robotics and Subtractive Manufacturing

Open Electives -II

1	5	OE-II	ME2341	OE II : Total Quality Management
2	5	OE-II	ME2342	OE II : Reliability Engineering
3	5	OE-II	ME2343	OE II : Power Generation Engineering
4	5	OE-II	ME2344	OE II : Project Evaluation & Management

Audit Courses											
1	5	HS	AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0	

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TA = for Practical : MSPA will be 15 marks each**

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Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

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Nagar Yuwak Shikshan Sanstha's

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SoE No. ME-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	3
2	6	PC	ME2351	Fluid Machines	**T**	3	0	0	3	3	30	20	50	3
3	6	PC	ME2352	**Lab:-** Fluid Machines	**P**	0	0	2	2	1		60	40	
4	6	PC	ME2353	Computer Aided Design (CAD LAB)	**P**	0	0	2	2	1		60	40	
5	6	PC	ME2354	Design of Mechanical Drives	**T**	3	0	0	3	3	30	20	50	3
6	6	PE-I		Professional Elective I	**T**	3	0	0	3	3	30	20	50	3
7	6	PE-I		**Lab:- Professional Elective I**	**P**	0	0	2	2	1		60	40	
8	6	OE-III		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3
9	6	OE-IV		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3
				TOTAL		**18**	**0**	**6**	**24**	**21**				

*** Refure list Open Elective- I & II**

**** Refure list Open Elective- III & IV**

Audit Courses														
1	6	HS	AU2129	YCCE Communication Aptitude Preparation (YCAP6.2)for ME, EE,ETC	**A**	3	0	0	3	0				

List of Professional Electives-I

1	**6**	PE-I	ME2361	PE I : Finite Element Methods
	6	PE-I	ME2362	PE I : Lab:- Finite Element Methods
2	**6**	PE-I	ME2363	PE I : Computer Graphics
	6	PE-I	ME2364	PE I : Lab:- Computer Graphics
3	**6**	PE-I	ME2365	PE I : I.C. Engines
	6	PE-I	ME2366	PE I : Lab:- I.C. Engines
4	**6**	PE-I	ME2367	PE I : Refrigeration & Cryogenics
	6	PE-I	ME2368	PE I : Lab:- Refrigeration & Cryogenics
5	**6**	PE-I	ME2369	PE I : Computer Integrated Manufacturing
	6	PE-I	ME2370	PE I : Lab:- Computer Integrated Manufacturing
6	**6**	PE-I	ME2371	PE I : Mechatronics
	6	PE-I	ME2372	PE I : Lab:- Mechatronics
7	**6**	PE-I	ME2373	PE I: Data Structure and Algorithm
	6	PE-I	ME2374	PE I : Lab:Data Structure and Algorithm
8	**6**	PE-I	ME2375	PE I: Management Information System
	6	PE-I	ME2376	PE I : Lab: Management Information System
9	**6**	PE-I	ME2377	PE I :Industrial Fluid Power
	6	PE-I	ME2378	PE I : Lab:- Industrial Fluid Power
10	**6**	PE-I	ME2379	PE I: Thermal Engineering Systems
	6	PE-I	ME2380	PE I : Lab:Thermal Engineering Systems
11	6	PE-I	ME2387	PE I : Advance Welding Techniques
	6	PE-I	ME2388	PE I : Lab: Advance Welding Techniques
12	6	PE-I	ME2389	PE I : Control Systems Engineering
	6	PE-I	ME2390	PE I : Lab: Control Systems Engineering

Coursera Electives				
1	6	PE-I	ME2385	PE I : Supply Chain Management
	6	PE-I	ME2386	PE I : Lab:- Supply Chain Management
2	7	PE-IV	ME2450	PE IV: Aerial Robotics and Mobility

Open Electives -III

1	6	OE-III	ME2381	OE III : Operations Research Techniques
2	6	OE-III	ME2382	OE III : Automobile Engineering
3	6	OE-III	ME2383	OE III : Control System Engineering
4	6	OE-III	ME2384	OE-III : Robotics and Subtractive Manufacturing
Open Electives -IV				
5	6	OE-IV	ME2391	OE IV : Total Quality Management
6	6	OE-IV	ME2392	OE IV : Reliability Engineering
7	6	OE-IV	ME2393	OE IV : Power Generation Engineering
8	6	OE-IV	ME2394	OE IV : Project Evaluation & Management

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TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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SoE No. ME-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	ME2401	Automation In Production	**T**	3	0	0	3	3	30	20	50	3
2	7	PC	ME2402	**Lab:-** Automation In Production	**P**	0	0	2	2	1		60	40	
3	7	PE		Professional Elective II	**T**	3	0	0	3	3	30	20	50	3
4	7	PE		Professional Elective III	**T**	3	0	0	3	3	30	20	50	3
5	7	PE		**Lab:-** Professional Elective III	**P**	0	0	2	2	1		60	40	
6	7	PE		Professional Elective IV	**T**	3	0	0	3	3	30	20	50	3
7	7	PE		Professional Elective V	**T**	3	0	0	3	3	30	20	50	3
8	7	STR	ME2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	ME2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -II

1	7	PE-II	ME2411	PE II : Tool Design
2	7	PE-II	ME2412	PE II : Additive Manufacturing
3	7	PE-II	ME2413	PE II : Fuel Cell Technology
4	7	PE-II	ME2414	PE II : Refrigeration and Air Conditioning
5	7	PE-II	ME2415	PE II : Material Handling Systems
6	7	PE-II	ME2416	PE II : Reliability Engineering
7	7	PE-II	ME2417	PE II : Advanced Manufacturing Techniques
8	7	PE-II	ME2418	PE II : Optimization Techniques

Professional Electives -III

9	7	PE-III	ME2421	PE III : Vibration
10	7	PE-III	ME2422	PE III : Lab:- Vibration
11	7	PE-III	ME2423	PE III : Comuter Aidded Design and Manufacturing
12	7	PE-III	ME2424	PE III : Lab:- Comuter Aidded Design and Manufacturing
13	7	PE-III	ME2425	PE III : Vehicle Engineering
14	7	PE-III	ME2426	PE III : Lab:- Vehicle Engineering
15	7	PE-III	ME2427	PE III : Solar Energy and It'S Utilisation
16	7	PE-III	ME2428	PE III : Lab:- Solar Energy and It'S Utilisation
17	7	PE-III	ME2429	PE III : CNC & Robotics
18	7	PE-III	ME2430	PE III : Lab:- CNC & Robotics
19	7	PE-III	ME2433	PE III :Pipe Design Engineering
20	7	PE-III	ME2434	PE III : Lab:- Pipe Design Engineering
21	7	PE-III	ME2435	PE III : Earth Moving Equipments
22	7	PE-III	ME2436	PE III : Lab:- Earth Moving Equipments

Professional Electives -IV

23	7	PE-IV	ME2441	PE IV : Sysnthesis of Mechanism
24	7	PE-IV	ME2442	PE IV : Design for Manufacturing & Assembly
25	7	PE-IV	ME2443	PE IV : Renewable Energy System
26	7	PE-IV	ME2444	PE IV : Engineering of Plastics
27	7	PE-IV	ME2445	PE IV : Finance & Cost Management
28	7	PE-IV	ME2446	PE IV : Artificial Intelligence
29	7	PE-IV	ME2447	PE IV : Maintenance Management
30	7	PE-IV	ME2448	PE IV : Total Quality Management
31	7	PE-IV	ME2449	PE IV : Project Evaluation & Management

Professional Electives -V

32	7	PE-V	ME2461	PE V : Stress Analysis
33	7	PE-V	ME2462	PE V : Product Design and Development
34	7	PE-V	ME2463	PE V : Power Plant Engineering
35	7	PE-V	ME2464	PE V : Value Engineering
36	7	PE-V	ME2465	PE V : Design of Experiments and Taguchi Methods
37	7	PE-V	ME2466	PE V : Industrial Safety
38	7	PE-V	ME2467	PE V : Control System Engineering
39	7	PE-V	ME2468	PE V : Tribology
40	7	PE-V	ME2469	PE V : Turbines

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TA = for Practical : MSPA will be 15 marks each**

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Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

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SoE No. ME-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Mechanical Engineering

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						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	ME2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	ME2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**87**	**0**	**44**	**132**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

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Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

3rd Semester

Mechanical Engineering

III Semester
GE2201 - Engineering Mathematics III

Objectives	Outcomes
1. Able to find numerical solution of various mathematical equations 2. Give knowledge of Laplace transform, Z transform, Fourier transform 3. Define the periodic functions in the form of Fourier series 4. Solve partial differential equations	The student will be able to: 1. Estimate the Calculus of Numerical Function. 2. Determine transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations. 3. Discuss the nature of periodic function and express it in terms of series. 4. Use appropriate method/s to solve partial differential equations.

Unit I: Finite Differences
Difference table; Operators E and Δ, Central differences, Factorials notation, Numerical differentiation and integration, Difference equations with constant coefficients. **(6 hours)**

Unit II: Laplace Transform
Laplace Transforms: Laplace transforms and their simple properties, Unit step function, inverse of Laplace transform, convolution theorem, Applications of Laplace transform to solve ordinary differential equations .**(7 hours)**

Unit III: Z-transform
Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant co-efficient. **(6 hours)**

Unit IV: Fourier Series
Periodic Functions and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions **(7 hours)**

Unit V: Partial Differential Equation
Partial Differential Equations of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve first and second order partial differential equations. **(7 hours)**

Unit VI : Fourier Transform : Definition: Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem**.** **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John Wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John Wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan
5	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	Laxmi Prakashan

III Semester
ME2201 - Material Science and Metallurgy

Objective	Course Outcome
1. To impart Knowledge for analysing different Microstructure and Crystalline nature of metals.	1. Student will be able to distinguish microstructure and analyse the effect of Crystalline nature of metals
2. To impart knowledge of Iron-Iron carbide equilibrium diagram and microstructure, general properties and heat treatment practices of commercial steels and Cast Iron.	2. Student will be able to construct Iron-Iron carbide equilibrium diagram and analyse microstructure, general properties and heat treatment practices of commercial steels and Cast Iron.
3. To impart knowledge of various heat treatment processes.	3. Student will be able to analyse and implement suitable heat treatment processes
4. To impart basic knowledge of powder Metallurgy for Powder metallurgical components	4. Student will be able to perceive the basics of powder Metallurgy for powder metallurgical components.

UNIT-1:[5 hrs]

Introduction to materials, classification of materials. Properties and applications of materials. Crystalline nature of metals, specially microscopic and macroscopic examinations of metals. Alloys and solid solutions, types and their formations, modified Gibbs's phase rule, Lever rule for phase mixtures and their application in system. **[CO1]**

UNIT-2:[8 hrs]

Study of equilibrium diagrams and invariant reactions. Iron-Iron carbide equilibrium diagram, critical temperatures. Microstructure of slowly cooled steels. Estimation of carbon from microstructures; structure property relationship. Classification and applications of steels. Effect of alloying elements. **[CO 1,2]**

UNIT-3:[8 hrs]

Classification and application of plain carbon steels. Examples of alloy steel such as Hadfield Manganese Steel, ball Bearing Steels, etc.Tool Steels – Classification, composition, application and commercial heat treatment practice for HSS, Secondary hardening. Stainless Steels - Classification, composition, application and general heat treatment practice for Stainless Steels. **[CO 1,2,3]**

UNIT-4:[8 hrs]

Heat treatment and its importance. Annealing, Normalizing, Hardening, Quench Cracks, Hardenability test.
TTT diagram and its construction and related Heat Treatment Processes such as Austempering, Martempering, Patenting etc.
Retention of Austenite, Effects and elimination of retained austenite, Tempering.Case / Surface hardening treatments such as Carburising, Nitriding, Cyaniding, Carbonitriding, Flame and Induction hardening. **[CO 1,2,3]**

III Semester
ME2201 - Material Science and Metallurgy

UNIT-5:[8 hrs]

Cast Iron – Classification, White cast Iron, Gray Cast Iron, Nodular Cast Iron, Malleable Cast Iron, Chilled and alloy Cast Iron. (Production route, Composition, Microstructure and applications) Effects of various parameters on structure and properties of Cast Iron, Alloy cast Iron such as Ni-resist, Ni-hard.
Non-Ferrous Alloys – Study of non-ferrous alloys such as brasses (Cu-Zn diagram), Bronzes (Cu-Sn diagram), Aluminum Alloys (e.g. Al-Si & Al-Cu diagram), Bearing materials. [**CO 1,2,3]**

UNIT-6:[8 hrs]

Powder Metallurgy: Powder manufacture and Conditioning, Production of Sintered Structural Components, Self lubricating bearing, Cemented Carbides, Ceramics, Sintered Carbide cutting tools. **[CO 1,2]**

Reference books:

1	Introduction to Engineering Metallurgy	21st revised edition, 2007	Dr. B K Agrawal	Tata McgraHill
2	Introduction to Physical Metallurgy	29st revised edition, 2009	Sidney H.Avner	McGraw-Hill,1964
3	Engineering Physical Metallurgy and Heat Treatment	21st revised edition, 1988	Yu Lakhtin	Mir publishers, Moscow, Russia
4	Metallurgy for Engineers	4th Revised edition 1987	E C Rollason	E. Arnold,

III Semester
ME2202 - Lab. : Material Science and Metallurgy

Objective	Course Outcome
(1) To provide general information of material science and metallurgy to the engineering students. The student is required to understand important relationship between structure of metals and its properties.	(1)Students will be able to create specimen for metallographic examination . (2))Students will be able to analyze the microstructure and investigate various properties of ferrous and non-ferrous Materials (3) Students will be able to test different Engineering Materials

List of Practical

A set of 10 Experiments from following list to be performed.

A set of 10 Experiments from following list to be performed.

1) Study of Metallurgical Microscope. **[CO 1,2]**
2) Preparation of Specimen for metallographic examinations. **[CO 1,2]**
3) Study and drawing of microstructures of Steels. **[CO 1,2]**
4) Study and drawing of microstructures of Cast Iron.. **[CO 1,2]**
5) Study and drawing of microstructures of Non Ferrous Metals.. **[CO 1,2]**
6) Study of the effect of annealing and normalizing on properties of steels. **[CO 1,2,3]**
7) Determination of hardenability of steels by Jominy End Quench test.. **[CO 1,2,3]**
8) Tensile test on Mild Steel and Aluminum test specimen.. **[CO 1,2,3]**
9) Measurement of hardness of ferrous and non-ferrous materials with the help of Brinell hardness tester. **[CO 1,2,3]**
10) Measurement of hardness of ferrous and non-ferrous materials with the help of Vicker hardness tester. **[CO 1,2,3]**
11) Measurement of hardness of ferrous and non-ferrous materials with the help of Rockwell hardness tester. **[CO 1,2,3]**
12) Study the heat treatment of high speed steels. . **[CO 1,2,3]**
13) Study the heat treatment of stainless steel.. **[CO 1,2,3]**
14) Study of effect of alloying elements on properties of steels. **[CO 1,2,3]**
15) Study of macroscopic examinations. . **[CO 1,2,3]**
16) Study of mechanisms of quenching. . **[CO 1,2,3]**
17) Study of Pack carburizing of steel samples. . **[CO 1,2,3]**

III Semester
ME2203 - Machining Processes

Objective	Course Outcome
1. To understand the basic tool geometry of cutting tool and basic machining parameters. 2. To analyse the various machining processes. 3. To identify and explain basic components and function of different machine tools. 4. To understand the application and limitations of various machining processes with regard to shape formation and surface quality.	After completion of this course, Students will be able to 1. Distinguish among various cutting tool materials and tool geometries. 2. Examine the different processes and machine tools for cylindrical surface machining. 3. Differentiate various machining processes and conditions for flat surface machining using SPCT. **4.** Justify machining processes for flat surfaces marching using MPCT.

Unit I

Mechanics of Machining And Machinability: Introduction to machining, geometry of SPCT. Mechanism of chip formation, Orthogonal and Oblique cutting, Use of chip breaker in machining, Merchant Circle (Analytical treatment expected), thermal aspects of machining, cutting temperature measurement during machining, Cutting Fluids, Machinability, Estimation of Tool life, Tool materials. [CO 1]

Unit II

Lathe: Kinematic systems and operations of lathes, attachments for various operations, machine specifications, basis for selection of cutting speed, feed and depth of cut, time estimation for turning operations such as facing, step turning, taper turning, threading, knurling. Capstan and Turret Lathe and special purpose Machines: Construction, Operation and selection of Machining Parameters, Machining Centers, Tool Heads and indexers. [CO 2]

Unit III

Shaper: Introduction, type, specification, description of machines, hydraulic drives in shapers, cutting parameters, attachments for shaper, work holding devices, shaper operations.

Planer: Introduction, specifications, description, type of planner, Mechanism for planner: Driving mechanism, feeding mechanism, planner cutting tools, cutting parameters

Slotter: Introduction, specifications, description, type of drives for slotter, types of slotting. [CO I,3]

Unit IV

Milling: Kinematic systems and operations of milling machines, attachments for Milling. Cutting parameters, Types of milling cutters, Tool geometry & their specifications. Indexing- simple, compound and differential. Screw threads and Gear Manufacturing Methods.. [CO 1,4]

Unit V

Grinding operations, grinding wheel, specifications & selection, cylindrical &centre less grinding operation, surface grinding, tool & cutter grinding, time estimation for grinding operations.

Super finishing process: Honing, Lapping, super finishing, polishing, buffing, metal spraying, galvanizing and electroplating. Process parameters and attainable grades of surface finish, surface roughness measurement. [CO 1,4]

III Semester
ME2203 - Machining Processes

Unit VI

Drilling: Introduction, tools for drilling, classification of drills, twist drills, drill size and specifications, carbide tipped drills, type of drilling machines, Drilling machines operations, time estimation for drilling.
Reaming: Introduction, description of reamers, type of reaming operations.
Boring: Introduction, types of boring machine, horizontal boring machine, vertical boring machine, jig boring machine, micro boring, boring operations.
Broaching: Introduction, type of broaches, and nomenclature of broaches, type of broaching machines. [CO I1,4]

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Workshop Technology - Part I,	Chapman W.A.J	Fifth edition	CBS Publishers
2	Manufacturing Technology (Metal Cutting & Machine Tools)	P N Rao	2nd Edition (2009)	The McGraw-Hill Companies
3	Manufacturing Science	Ghosh & Malik	2nd Edition (2010)	East West
4	Workshop Technology (Volume-II)	Hajra Choudhary	2nd Edition (2012)	The McGraw-Hill Companies

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Manufacturing Engineering & Technology	S Kalpakjian & SR Schmid	1st Edition (2009)	Pearson Education Canada
2	Technology of machine Tools	Krar & Oswald	1st Edition (1984)	Gregg Division, McGraw-Hill
3	Manufacturing Processes	M Begman	1st Edition (1974)	Ballinger Pub. Co
4	Processes & Materials of Manufacture	R Lindberg	1st Edition (1990)	Allyn and Bacon Technology & Engineering
5	Production Technology	s. Karunakaran	1st Edition (2008)	HMT
6	Workshop Technology (Volume I & II)	Bawa	2nd Edition (2009)	The McGraw-Hill Companies

III Semester
ME2204 - Lab. : Machining Processes

Objective	Course Outcome
1. Understand the basic tool geometry of cutting tool and Identify basic components and function of different machine tools. 2. Understand the application and limitations of various machining processes with regard to shape formation and surface quality.	fter completion of this course, Students will be able to 1. Distinguish among various cutting tool materials and tool geometries. 2. Examine the different processes and machine tools for cylindrical surface machining. 3. Differentiate various machining processes and conditions for flat surface machining using SPCT. 4. Justify machining processes for flat surfaces marching using MPCT.

LIST OF PRACTICALS:

S No	Name of Experiment
1	Demonstration of single point cutting tools, their nomenclature, geometry materials and applications. CO 1
2	Demonstration of multi point cutting tools, their nomenclature, geometry materials and applications. CO 1
3	Demonstration of working of Lathe Machine and study of its mechanism. CO 2
4	Demonstration of working of Shaper Machine and study of its mechanism CO 3
5	Demonstration of working of Milling machine and study of its mechanism. CO 4
6	Demonstration of working of Drilling machine and study of its mechanism. CO 4
7	Practical on lathe for turning , facing , step turning , taper turning and threading. CO 2
8	Practical on Shaper with exposure to auto feed. CO 3
9	Practical on milling machine for slot cutting. CO 4
10	Practical on Drilling machine for drilling. CO 4
11	Demonstration of boring operations. CO 2
12	Study of Grinding machine and super finishing processes. CO 4
13	Introduction to NC and CNC machines. CO 4

III Semester
ME2205 - Mechanics of Material

Objective	Course Outcome
1) The student should be able to acquire elementary knowledge of stress, strains and material properties. 2) To impart the knowledge on shear force and bending moment calculations for beams. 3) To impart the knowledge about bending and shear stress and its importance. 4) To impart basic knowledge on strain energy calculations due to various types of loads and to estimate the load carrying capacity of columns. 5) To impart basic knowledge to calculate deflection of beams. 6) To impart knowledge on the principal stresses and planes in three dimensional stress systems.	After completion of this course, Students will be able to 1) Describe the basic concepts of stress, strain and their variations under different types of loading 2) Apply the basic concepts involved in mechanics of materials, bending moment, shear force, stresses in beams to solve complex problems 3) Analyze strain, impact loading and crippling load 4) Evaluate the torsional shear stress in shaft and solve the problem on Slope and deflection in beams under different loading and support conditions.

Unit 1 **[8 hrs]**

Concept of simple stresses and strains: Introduction, Stress, strain, types of stresses, stress - strain diagram for brittle & ductile material, elastic limit, Hooks law, modulus of elasticity, modulus of rigidity, factor of safety, analysis of tapered rod, analysis of composite section, thermal stress and strain, thermal stresses with heat flow in cylinders and plates, Hertz's contact stresses. Longitudinal strain & stress, lateral stresses and strains, Poisson's ratio, volumetric stresses and strain with uni-axial, bi-axial & tri-axial loading, bulk modulus, relation between Young's modulus and modulus of rigidity, Poisson's ratio and bulk modulus. **[CO-1]**

Unit 2 **[8 hrs]**

Shear force and bending moments in Beam: Types of beam (cantilever beam, simply supported beam, overhung beam etc.), Types of loads (Concentrated and UDL), shear force and bending moment diagrams for different types of beams subjected to different types of loads, sign conventions for bending moment and shear force, shear force and bending moment diagrams for beams subjected to couple, Relation between load, shear force and bending moment. **[CO-2]**

Unit 3 **[6 hrs]**

Stresses in beams: Pure bending, theory of simple bending with assumptions & expressions for bending stress, derivation of bending equation, bending stresses in symmetrical sections, section modulus for various shapes of beam sections.
Shear stresses in beams: - Concept, derivation of shear stress distribution formula, shear stress distribution diagram for common symmetrical sections, maximum and average shear stress. **[CO-2]**

Unit 4 **[7 hrs]**

Strain energy and impact: Concept of strain energy, derivation and use of expressions for deformation of axially loaded members under gradual sudden and impact loads. Strain energy stored in bending & torsion. Castingliano's theorem.

III Semester
ME2205 - Mechanics of Material

Column & Struts: Failure of long & short column, slenderness ratio, Euler's column theory, End conditions for column. Expression for crippling load for various end conditions of column. Effective length of column, limitations of Euler's formula, Rankine formula, Johnson's parabolic formula. **[CO-3]**

Unit 5 **[8 hrs]**

Torsion of circular shafts: Derivation of torsion equation. Torsional shear stress induced in the shaft, when it is subjected to torque. Torque transmitted by solid & hollow circular shaft. Derivation of maximum, minimum principal stresses and maximum shear stress induced in shaft when it is subjected to bending moment, torque & axial load. **Deflection of beams:** Derivation of differential equation of elastic curve, Deflection & slope of cantilever, simply supported, overhung beams subjected to concentrated loads, UDL, Relation between slope, deflection & radius curvature McCauley's method, area moment method to determine deflection of beam.**[CO-4]**

Unit 6 **[8 hrs]**

Combined Stresses: Definition of principal planes & principal stresses, analytical method of determining stresses on oblique section when member is subjected to direct stresses in one plane in mutually perpendicular two planes, when member is subjected to shear stress and direct stresses in two mutually perpendicular planes, Mohr's circle for representation of stresses. Derivation of maximum and minimum principal stresses & maximum shear stresses when the member is subjected to different types of stresses simultaneously (i.e. combined stress) **[CO-1]**

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Strength of Materials	Ramamrutham S.	16th Edition (2010)	DhanpatRai Publishing
2	Strength of Materials	Beer and Johnston	4th Edition (2009)	McGraw-Hill
	Strength of Materials	P.Purushothama and V.Ramasamy	1st Edition 2012	Pearson

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Strength of Materials	Timoshenko and Young	Seventh Edition1984	CSB Publisher
2	Strength of Materials	Singer F. L	4th (February 1987)	Harper and Row Publications
3	Introductionto Mechanics of Materials	Popov E.P	2nd (June 1998)	Prentice Hall Publication

III Semester
ME2206 - Lab. : Mechanics of Material

Objective	Course Outcome
• The student should be able to acquire elementary knowledge ofstress,strainsandmaterialproperties. • To impart the knowledge on shear force and bending moment calculations for beams. • To impart the knowledge about bending and shear stress and its importance. • To impart basic knowledge on strain energy calculations due to various types of loads and to estimate the load carrying capacity of columns. • To impart basic knowledge to calculate deflection of beams. • To impart knowledge on the principal stresses and planes in three dimensional stress systems.	fter completion of this course, Students will be able to 1) Describe the basic concepts of stress, strain and their variations under different types of loading 2) Apply the basic concepts involved in mechanics of materials, bending moment, shear force, stresses in beams to solve complex problems 3) Analyze strain, impact loading and crippling load 4) Evaluate the torsional shear stress in shaft and solve the problem on Slope and deflection in beams under different loading and support conditions.

List of Practical

A set of 8 Experiments from following list to be performed.

1. Study and demonstration of Universal Testing Machine & its attachments. **[CO-1]**
2. Tension Test on mild steel on Universal Testing Machine. **[CO-1]**
3. Compression test on Aluminum on Universal Testing Machine.**[CO-1]**
4. To perform flexture test.**[CO-1,2]**
5. Izod&Charpy - Impact tests of a standard specimen. .**[CO-3]**
6. Torsion Test on Mild steel bar. **[CO-4]**
7. To study the spring testing machine and perform the compression test on open coil helical spring. **[CO-3]**
8. To study the Rockwell hardness testing machine & perform the hardness test.**[CO-1]**
9. Assignments: Drawing sheet on shear force & bending Moment diagrams for a given loading (At least four problems.) **[CO-2]**
10. Estimation of principal stresses and maximum shear strain for a given combined loading by analytical & Mohr's circle method. (At least two problems).**[CO-4]**
11. Experiment on fatigue analysis. **[CO-4]**

III Semester
ME2207 - Kinematics of Machinery

Objective	Course Outcome
• To provide a study of understanding the concept of kinematics in Mechanisms and machines to students of mechanical engineering though the theoretical principles involved have immediate application to practical problems • To provides the foundation for the study of displacements, velocities, accelerations and static and dynamic forces. Required for the proper design of mechanical linkages, cams and geared systems.	1) Students should be able to understand the mechanical system, mechanism its components, relative between them. 2) Students should be able to determine the relative velocity & Acceleration of a kinematic link of a given mechanism and various forces coming on links in static condition. 3) Students should be able to identify the motion as per the application & draw the profile of a cam followers mechanism. 4) Students should be able to understand various types of Gears used in Machine terminologies and concepts of velocity ratios in gear trains.

Unit 1 **[8 hrs]**

Basic concept of mechanism, link, kinematics pairs, kinematics chain, mechanism, machine, simple & compound chain, Degree of freedom, estimation of degree of freedom of mechanism by Grubber's criterion and other methods. Harding's notations, classification of four bar chain [class-I & Class-II], inversion of four-bar-chain, Kutchbach theory of multiple drives, **[CO 1]**

Unit 2 **[7 hrs]**

Quantitative kinematics analysis of mechanism: - Displacement, Velocity and Acceleration analysis of planer mechanism by graphical method as well as analytical method [complex number method/matrix method], Instantaneous center method, Kennedy's theorem. **[CO 2]**

Unit 3 **[8 hrs]**

Concepts of cam mechanism, comparison of cam mechanism with linkages. Types of cams and followers and applications. Synthesis of cam for different types of follower motion like constant velocity, parabolic, SHM, cycloid etc.
Analysis of follower motion for cams with specified contours like eccentric cam, tangent cam and circular arc cam with concave and convex curvature. Pressure angle in cam, parameters affecting cam performance. **[CO 3]**

Unit 4 **[7 hrs]**

Concept of motion transmission by toothed wheels, comparison with cams and linkages, various tooth profiles, their advantages and limitations, gear tooth terminologies, concept of conjugate action, law of conjugate action, kinematics of in volute gear tooth pairs during the contact duration, highlighting locus of the point of contact, arc of contact, numbers of pairs of teeth in contact, path of approach and path of recess, interference, undercutting for in volute profile teeth. **[CO 4]**

Unit 5 **[8 hrs]**

Kinematics of helical, bevel, spiral, worm gears, rack and pinion gears, kinematics analysis, and torque analysis of simple epicyclical and double epicyclical gear trains. **[CO 4]**

Unit 6 **[7 hrs]**

Static force analysis: Free body diagram, condition of equilibrium. Analysis of all links of given linkage, cam, gear mechanism and their combinations without friction. **[CO 2]**

III Semester
ME2207 - Kinematics of Machinery

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Theory of mechanisms & machines	Shigley J. E	4TH Edition 2014	Tata McGraw-Hill
2	Theory of Mechanism and Machine	Khurmi & Gupta	Second Edition 2005	S. Chand
3	Mechanism and Machine Theory	Rao J.S & DukkiPati R.V.	4th Edition 2014	New Age International (P) Limited
4	Theory of Machine	Rattan S.S	4th Edition 2014	Tata McGraw-Hill
5	Theory of Machine	V. P. Singh	6th Edition 2014	Dhanpat Rai & Co.

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Theory of machines	Thomas Bevan	Third Edition	Pearson Education India
2	Theory of Machines	Sandor & Erdman	Fourth Edition	Tata McGraw-Hill

III Semester
ME2208 - Fluid Mechanics

Objective	Course Outcome
Develop an understanding of fluid statics, kinematics and dynamics in Mechanical. Learn to apply Bernoulli's Equation and momentum equation to Fluid flow systems. Study various flow measuring devices. Understand the concept of viscosity as applied in real flows. Learn to use equations in combination with experimental data to determine losses in flow systems.	(1) The student will be able to EVALUATE various fluid properties and ANALYZE hydrostatic forces acting on submerged flat bodies [**PO: 1,3,5,12,13**] (2) The students will be able to CLASSIFY AND ANALYZE the various flow pattern, AND WILL BE ABLE TO EVALUATE velocity and acceleration using fluid kinematics. [**PO: 1,3,5,12,13**] (3)The students will be able to analyze and SOLVE ideal flow and real flow problems by applying Bernoulli's equations and momentum equations. The students will also be able to DESCRIBE AND ANALYZE the fluid flow over bodies . [**PO: 1,3,5,12,13**] (4) The students will be able to ALAYZE THE flow, through pipes. The students will be able to EVALUATE HEAD LOSSES, DISCHARGE, POWER LOST ETC FOR THE FLOW THROUGH PIPES WITH AND WITHOUT FITTINGS [**PO: 1,3,5,12,13**]

Unit1 **[8 hrs]**

Introduction to Fluid Mechanics: Definition of Fluid, Properties of fluids, Newton's law of viscosity, Pascal's law, Basic equation of fluid static, Pressure variations in compressible & incompressible fluids, Fluid pressure & its measurement (Manometers & Bourdon's pressure gauge), Hydrostatics: Forces on submerged plane surfaces **[CO:1]**

Unit2 **[7 hrs]**

Kinematics Of Fluid Flow: Types of flow, Stream line, Path line, Streak line, Stream tube, Continuity equation, One and Two dimensional flow, Velocity and Acceleration at a point, Circulation and Vorticity, Stream function and Velocity potential. **[CO:2]**

Unit3 **[8 hrs]**

Dynamics Of Fluid Flow: Integral Momentum Equation, One-dimensional method for flow analysis, Impact of jet on stationary and moving Flat and curved vanes, Theory of Rotodynamic machines. **[CO:3]**

Unit4 **[7 hrs]**

Derivation of Bernoulli's equation for incompressible flow & its applications for various ideal and practical systems, Venturimeter, Orifice Meter and Pitot tube **[CO:3]**

III Semester
ME2208 - Fluid Mechanics

Unit5 **[8 hrs]**

Viscous Flow: Newton's law of viscosity and its applications, Introduction to laminar and turbulent flow through pipes, Reynolds number and its significance, Boundary layer concept, Wall shear and boundary layer thickness, Kinetic energy correction factor, Momentum energy correction factor, Drag and Lift on immersed bodies. . **[CO:3]**

Unit 6 **[7 hrs]**

Flow Through Pipes: Equations for pipe flow, Friction charts and their uses, Losses in pipes and fittings, Hydraulic gradient lines and total energy lines, Pipes in series and parallel. Siphon, Water hammer phenomenon, Economics of pipe systems. Power Transmission Through Pipeline: Condition for maximum power transmission through a given pipeline (single pipe), Relationship of nozzle diameter to pipe diameter for maximum power transmission. **[CO:4]**

Reference Books:

S. No.	Title	Authors	Publisher
1	Fluid Mechanics: Fundamentals and Applications	Yunus A. Cengel and John M. Cimbala	McGraw-Hill
2	Engineering Fluid Mechanics	K. L. Kumar	S. Chand & Company Ltd.
3	Basic Fluid Mechanics	C.P. Kothandaraman & R. Rudramoorthy	New Age Publication
4	Fluid Mechanics	J.F.Douglas, J.M.Gasiorek & J.A. Swaffield	ELBS Publication
5	Fluid Mechanics	A.K.Mohanty	Prentice Hall Publication
6	Fluid Mechanics & Fluid Power Engineering	D. S. Kumar	S. K. Kataria Publication
7	Fluid Mechanics	A.K.Jain	Khanna Publishers

III Semester
ME2209 - Lab. : Fluid Mechanics

Objective	Course Outcome
Develop an understanding of fluid statics, kinematics and dynamics in Mechanical. Learn to apply Bernoulli's Equation and momentum equation to Fluid flow systems. Study various flow measuring devices. Understand the concept of viscosity as applied in real flows. Learn to use equations in combination with experimental data to determine losses in flow systems.	(1) The student will be able to EVALUATE various fluid properties and ANALYZE hydrostatic forces acting on submerged flat bodies [**PO: 1,3,5,12,13**] (2) The students will be able to CLASSIFY AND ANALYZE the various flow pattern, AND WILL BE ABLE TO EVALUATE velocity and acceleration using fluid kinematics.[**PO: 1,3,5,12,13**] (3)The students will be able to analyze and SOLVE ideal flow and real flow problems by applying Bernoulli's equations and momentum equations. The students will also be able to DESCRIBE AND ANALYZE the fluid flow over bodies . [**PO: 1,3,5,12,13**] (4) The students will be able to ALAYZE THE flow, through pipes. The students will be able to EVALUATE HEAD LOSSES, DISCHARGE, POWER LOST ETC FOR THE FLOW THROUGH PIPES WITH AND WITHOUT FITTINGS [**PO: 1,3,5,12,13**]

LIST OF PRACTICALS

1) Study of Pressure Measuring Devices **[CO:1]**
2) To determine hydrostatic Force on vertical Surface**[CO:1]**
3) To determine hydrostatic Force on horizontal Surface**[CO:1]**
4) Verification of Bernoulli's Equation**[CO:3]**
5) To Determine Coefficient of Discharge of Venturimeter**[CO:3]**
6) To Determine Coefficient of Discharge of Open Orifice **[CO:3]**
7) To Determine Coefficient of Discharge of Orifice for compressible fluids**[CO:3]**
8) To Determine Coefficient of Discharge of Triangular notch**[CO:3]**
9) To Determine Coefficient of Discharge of Rectangular Notch**[CO:3]**
10) To Determine friction factor of fluid flowing through pipe**[CO:4]**
11) Performance on pipes in series**[CO:4]**
12) Performance on pipes in parallel**[CO:4]**
13) To Determine Minor losses and Coefficients of Minor Losses**[CO:4]**
14) To Determine Force exerted by Jet**[CO:3]**
15) Study of fluid flow over immersed bodies **[CO:3]**
16) Any other practical based on Fluid Mechanics syllabus**[CO:1,3,4]**

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology
SoE & Syllabus 2020
4th Semester
Mechanical Engineering

IV Semester
GE2204 - Advanced Mathematical Techniques

Objective	Outcomes Students will be able to
• To introduce various Numerical Methods to solve algebraic and differential equations • To understand the concept of Probability distribution • To introduce the concept of Fuzzy Set theory and functions • To make aware of different optimization techniques	• Utilize numerical techniques to obtain approximate solutions of mathematical equations • Measure the Statistical parameters for random variables • Explain the basic concept of fuzzy sets, Relations and fuzzy logic. • Design and determine the solution of linear programming problems

Unit I:
Numerical Methods for Algebraic And Transcendental Equations: Errors in numerical calculation, Errors in series approximation, Rounding of error solutions of algebraic and transcendental equations, Iteration method, Bisection method, False position method, Newton Raphson method and their convergence
Numerical Methods System of Algebraic Equations: Solution of System of linear equations, Gauss- Seidel method, Crouts method**.** **(7 hours)**

Unit II:
Numerical Methods for Differential Equations: Numerical solution of ordinary differential equation by Taylor's series method, Picard's method, Runge's second and third order method, Runge-Kutta 4^{th} order method, Euler's method, Euler's modified method, Milne's Predictor and Corrector method. **(6 hours)**

Unit III:
Random Variables and Probability Distribution: Discrete and continuous random variables, probability density function of one and two variables, Probability distribution function of one and two variables, Joint distributions and conditional distributions. **(6 hours)**

UNIT IV:
Mathematical Expectation: Definition of mathematical expectation, functions of one and two random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis. **(7 hours)**

UNIT V:
Fuzzy Sets And Fuzzy Logic: Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations. **(7 hours)**

Unit VI:
OPTIMIZATION TECHNIQUES: Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method. **(6 hours)**

IV Semester
GE2204 - Advanced Mathematical Techniques

Text Books:

SN	Title	Edition	Authors	Publisher
1	Computer based Numerical and Statistical Techniques	Paperback Firstedition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	Fourth Edition (2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	Year-2009.First Edition	C.Mohan and Kasum Deep	New Age International Publication

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers
6	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	LaxmiPrakashan

IV Semester
ME2251 - Design of Machine Elements

Objective	Course Outcome
This subject occupies a predominant position in the curriculum of Mechanical Engineering. It consists of application of scientific principles, technical information & creative thinking for the development of a new or improved machine or mechanical system, to perform desired function with maximum efficiency.	Student will be able to 1) Apply the knowledge of design principal in machine components. 2) Design and analyze various joints i.e., Welded joints, Bolted joints and Riveted joints. 3) Learn the design principals of power screw, springs, clutches and brakes. 4) Apply principal of design of pressure vessel and power transmission shafts.

Unit1 **[8 hrs]**

Definition of design, types of design, design process, need, defining the problem, feasibility, design alternatives, final design selection, preliminary and final plant drawings.
Theories of failure, Design for Fatigue & manufacturing considerations in design, basis of good design, failure of machine parts, Mechanical properties, Design considerations and selection of materials. **[CO – 1]**

Unit2 **[7 hrs]**

Design of Joints:
Welded joint: design of single transverse, double transverse, parallel fillet, combination fillet butt joint, Eccentrically loaded welded joints.
Bolted joint: Design of bolted fasteners, bolt of uniform strength, bolted joints under eccentric loading.
Design of riveted joints. **[CO – 2]**

Unit3 **[7 hrs]**

Power screw and Leaf spring: Design of power screw
Design of Helical and Leaf Springs. **[CO – 3]**

Unit4 **[7 hrs]**

Brakes and clutches: Kinematics of Friction Drives such as Brakes, Clutches Design of Friction Clutch, Single Plate, Multiple Plate, Cone, Centrifugal Clutch, Design of Brake, Shoe Brake, Band Brake,, Internal Expanding brake. **[CO – 3]**

Unit5 **[7 hrs]**

Pressure Vessel: Classification of Thick and Thin Cylindrical Pressure Vessel, Stresses in Thin and Thick Cylindrical Pressure Vessels when it is subjected to internal pressure, Expression for Circumferential and Longitudinal stresses, Design of pressure vessel, Heads and Cover Plate. **[CO – 4]**

Unit 6 **[8 hrs]**

Design of Shafts: Design of transmission Shafts on the Basis of Strength and rigidity, ASME Code for shaft Design, Design of Stepped shaft Axle splined Shaft, Keys. **[CO – 4]**

IV Semester
ME2251 - Design of Machine Elements

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Mechanical Engg. Design	Shigley J. E	7 th Edition. 2000	McGraw-Hill,
2	Design of Machine Element	Shiwalkar B. D	3rd Edition 2008	Denett & Co.
3	Design of machine elements	Bhandari V.B.	5th Edition	Design of machine elements
4	Machine Design	U. C. Jindal	2010	Dovling Kinderslay

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Mechanical Design of Machine	Maleev hartman	5th Edition.	Cbs Publishers & Distributors
2	Design Data Book	Shiwalkar B. D	7th Edition	PSG Tech, Coimbatore, India

IV Semester
ME2252 - Engineering Thermodynamics

Objective	Course Outcome
To develop the understanding of thermodynamic principles/laws for ideal gas/pure substance and to use it for evaluation of the energy interaction with the thermodynamic systems undergoing process.	***On completion of this course, the student will be able to:*** 1) **Apply**the First and zeroth law of thermodynamics for the **analysis** of thermodynamic systems to **evaluate** energy interactionin various processes. a. (Analyzing, Applying, Evaluate) b. (Programme Outcome: PO-1, PO-3, PO-5, PO-12, PO-13) 2) **Evaluate** the performance of cyclic devices, change in the entropy and availability in various processes **applying** the laws of thermodynamics. a. (Evaluating, Applying) b. (Programme Outcome: PO-1, PO-3, PO-5, PO-12, PO-13) 3) **Evaluate** various thermodynamic parameters in various *processes with phase change***using** phase change diagrams, relations and steam tables/ charts**applying** Law of thermodynamics. a. (Evaluating, Analyzing, Applying) b. (Programme Outcome: PO-1, PO-3, PO-5, PO-12, PO-13) 4) **Analyze** the performance of various Thermodynamic cycles **applying** Law of thermodynamics for **evaluation** of energy interaction. a. (Evaluating, Analyzing, Applying) b. (Programme Outcome: PO-1, PO-3, PO-5, PO-12, PO-13)

UNIT I:
Introduction To Thermodynamics:

Basic concepts of Thermodynamics, Continuum and macroscopic approach; thermodynamic system, Concept of energy and various forms of energy; internal energy, enthalpy; specific heats;, thermodynamic properties and equilibrium; state of a system, state postulate, state diagrams, paths / processes and cycles on state diagrams . The Ideal Gas equation of state.
The concepts of heat and work interactions. Evaluation of different modes of work.
Zeroth Law of Thermodynamics, concept of temperature [CO 1]

UNIT II
First Law of Thermodynamicsapplied to the various processes in Closed Systems, Various Steady flow systems, Steady-Flow Engineering Devices and Unsteady Flow process such as: charging and discharging of gas cylinder. [CO 1]

IV Semester
ME2252 - Engineering Thermodynamics

UNIT III
Second Law of Thermodynamics :
Limitations of the Zeroth and First law of thermodynamics,
concepts of Thermal energy reservoirs, heat engines and heat pumps/refrigerators,
Kelvin-Planck and Clausius statements and their equivalence; reversible and irreversible processes;
Carnot cycle and Carnot principles/theorems; thermodynamic temperature scale; [CO 2]

UNIT IV
Entropy:
Clausius inequality and concept of entropy; microscopic interpretation of entropy, the principle of increase of entropy, T-s diagrams, Change in entropy for processes in Closed and Steady flow systems.
Introduction to concept of Availability. [CO 2]

UNIT V
Properties of Pure Substances (Steam) :
Thermodynamic properties of pure substances in solid, liquid and vapor phases; P-v-T behavior of simple compressible substances, phase rule, thermodynamic property tables (Steam Tables) and charts.
Calculations of work and heat interactions in non- flow and steady flow processes.
Determination of dryness fraction using various calorimeters. [CO 3]

UNIT VI:
Thermodynamic Cycles
Vapor Power Cycles: Carnot vapor cycle, Rankine cycle: ideal and the reheat, the analysis of vapor power cycle.
Air-standard cycles:air standard assumptions,basic considerations and the analysis of power cycles: Otto cycle, Diesel engine cycle, and Brayton cycle.
Refrigeration Cycle: Introduction to Vapor-compression Refrigeration Cycle [CO 4]

Text books:				
1	Engineering Thermodynamics	6th edition 2017	P. K. NAG	Tata McGraw-Hill
2	Thermodynamics- An Engineering approach	7TH Edition (2017)	Yunus A. Cengel, Michael A. Boles	McGraw-Hill
3	Thermodynamics & Heat Engines vol-I & II	8TH Edition (2017)	R.YADAV	Central Publishing House,.
Reference books				
1	Fundamentals of Classical Thermodynamics	1st edition 2007	GordenJ.VanWylen Richard E.Sonntag	John Wiley
2	Basic Engineering Thermodynamics	3rd edition 2009	5 Reiner Joel	Longman

IV Semester
ME2253 - Lab : Machine Drawing

Objective	Course Outcome
To familiarize the students with- 1) To gain knowledge of different types of line and its application, conventional representation of various machining and mechanical details as per IS 2) To visualize an object and convert it into a drawing. 3) To become conversant with 2D and 3D.	The student will able to 1) Apply standards practices and conventions in machine drawing. 2) Draw a Orthographic and Isometric drawing 3) Preparing and visualizing detailed drawing of various machine components. 4) Create a 2D and 3D using CAD software with due manufacturing consideration.

Unit1 **[8 hrs]**

Drawing Standards for following- Drawing Sheets, Name Blocks, Lines, Dimensioning of Tolerances, Standard features, Machining Symbols, Welding Symbols, Heat Treatment, manufacturing Instructions, Allowances, and Materials. [CO 1]

Unit2 **[6 hrs]**

Orthographic Projection of Elements, section, dimensioning, Dimensioning of tolerances, Orthographic Projections, Sectional Views, Missing Views, conventional representation of machine elements. [CO 2]

Unit3 **[6 hrs]**

Preparation of drawing of machine Elements such as - threads, Bolts, Nuts, Washers, Rivets, Welds, Keys and Keyways, splines, Couplings, shaft. [CO 1,2]

Unit4 **[8 hrs]**

Assembly and Dismantling Principles : Fits and Tolerances (Standards, Types Application and Selection) , Tolerance Charting, Surfaces Finishing Requirement for Assembly, Geometry suitable for Assembly, Assembly / Dismantling Tools, Bearing Assemblies, Assemblies by Fastening. [CO 3]

Unit5 **[9 hrs]**

Study of some Standard Assemblies.
Assembly Drawings: Principles, Techniques and standards for Preparing Component Drawings, Subassembly Drawing, Full Assembly Drawing, Exploded Views.
Assembly drawings of :- Lathe machine tail stock and tool post , radial engine sub assembly, plummer block, steam stop valve or safety valve, etc. [CO 3,4]

Unit 6 **[8 hrs]**

Production Drawing : Name Plates, Part List, Revisions Etc., Essential Parts/ Formats Required for Production Drawings, Process Sheet, blue print reading. [CO 4]

4th SEMESTER

IV Semester
ME2253 - Lab : Machine Drawing

LIST OF PRACTICALS

1. Drawing of some Standard Components. (Two Sheets). [CO 1]
2. Drawings of two Standard Assemblies with Components. (Two Sheets). [CO 2]
3. Computer printout of a small Assembly with Components. [CO 4]
4. Pencil Drawing / Computer printout of a Large Assembly with components Drawings, subassembly drawings and assembly drawings using all standard formats. [CO 4]
5. Computer Printout of Production Drawing and process Sheets for One Component having maximum five Operations. Pencil Drawing should be in full imperial sheet folded to quarter Imperial size, Computer printouts should be on a plotter in A3 size. All drawings should be submitted in one folder. [CO 4]
6. To parts and assembly drawing using suitable CAD software. [CO 3,4]

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Machine Drawing	Bhatt N.D	38th Edition 2010	CharotarPulishe
2	Machine Drawing	SiddheshwarShastri	6th Edition 2009	Kanhaiah. Tata Mcgraw Hill
3	Machine Drawing	Parkinson	4th Edition 2011	Sir Isaac Pitman & Sons Limited
4	Machine Drawing	Venkat Reddy, Narayan and Kanhaiya	2nd Edition	B.S. publication
5	Fundamentals of Engineering Drawing	Warren J. Luzadder	11th Edition 2017	Parson
6	Machine Drawing	K. L. Narayana & Kannaiah	3rd Edition 2012	New Age Publications
7	Machine Drawing	P. S. Gill	BD Katariya & sons	

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Relevant IS Codes		Edition	TATA McGraw hill

IV Semester
ME2254 - Manufacturing Processes-II

Objective	Course Outcome
Subject is the essential framework of manufacturing processes and is composed of the scientific and practical inter relationship among the processing, structure, properties and performance of all conventional methods of manufacturing techniques	After completion of this course, 1) The student will be able to illustrate the basics of moulding process and compare various casting processes 2) The student will be able to analyze various Forming and sheet metal working processes. 3) The student will be able to Elaborate and classify different welding processes. 4) The student will be able to discuss and analyze unconventional machining processes.

Unit 1 **[8 hrs]**

Casting Process: Introduction, Pattern making: Types, materials used, Pattern making allowances, color codes. Core making: - Types, core material & its properties. Molding: Types of sand moulds, molding sand composition, molding sand properties, molding machines. Gating design – Elements of gating systems, pouring time, riser design Choke area (Analytical treatment). **[CO-1]**

Unit 2 **[5 hrs]**

Foundry mechanism: Special casting processes such as investment Casting, Centrifugal Casting, Shell Molding, CO Molding, Slush Casting, Die Casting, Cleaning, inspection & casting defects. **[CO-1]**

Unit 3 **[5 hrs]**

Mechanics of forming processes (including analytical treatment). Rolling (Determination of variables in Rolling), Forging (Hammer/Press), Extrusion & Wire Drawing. Melting furnaces – Types, Electric furnace, Induction furnace,Cupola-construction & operation. **[CO-2]**

Unit 4 **[7 hrs]**

Sheet metal working:- Introduction, Terminology, Types of Presses and operations, Classification of dies, Introduction to design parameters, Analytical treatment—Blanking dies (calculation of cutting force), Bending dies (calculation of blank length, bending force) , Drawing dies (design of blank size, calculation of drawing force, blank holder force) **[CO-2]**

Unit 5 **[9 hrs]**

Joining processes: Introduction to Welding, Soldering, Brazing Processes. Types of Welding, Arc Welding & Gas Welding Processes, Defects & Inspection of Welding Joints, Electrodes, Weldability of Metals, Welding equipments of Fixtures. Advance Welding Methods: Introduction to TIG, MIG, spot welding, Plasma Arc welding, Electron Beam, and Electron Laser Beam welding. **[CO-3]**

IV Semester
ME2254 - Manufacturing Processes-II

Unit 6 **[7 hrs]**

Nonconventional Machining Processes: Characteristics, Operation, applications, Limitation and selection of process parameters of the following processes, Abrasive Jet Machining, Ultrasonic Machining, Water Jet Machining, EDM, and ECM. **[CO-4]**

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Manufacturing Technology (Foundry Forming & Welding)	P N Rao	4 th Edition (2013)	The McGraw-Hill Companies
2	Manufacturing Science	Ghosh & Malik	2nd Edition (2010)	
3	Workshop Technology (Volume-I)	HajraChoudhary	2nd Edition (2009)	The McGraw-Hill Companies
4	Manufacturing Engineering & Technology	S Kalpakjian& SR Schmid	1st Edition (2018)	Pearson Education Canada
5	Manufacturing Technology	Adithan, Gupta	5 TH Edition (2012)	
6	Modern Machining Processes	Pandey, Shah	1st Edition (2008)	The McGraw-Hill Companies

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Workshop Technology: Vol. I - III	WAJ Chapman	2ndEdition	St. Martin's Press
2	Manufacturing Processes	M Begman	1st Edition	Ballinger Pub. Co
3	Processes & Materials of Manufacture	R Lindberg	1st Edition	Allyn and BaconTechnology & Engineering
4	Workshop Technology (Volume I & II)	Bawa	2nd Edition	The McGraw-Hill Companies
5	Workshop Technology Vol. I & II	B.S. Raghuvanshi	1st Edition	Dhanpat Rai & Sons

IV Semester
ME2255 - Lab. : Manufacturing Processes-II

Objective	Course Outcome
Practical is the essential framework of manufacturing processes and is composed of the scientific and practical inter relationship among the processing, structure, properties and performance of all conventional methods of manufacturing techniques.	**(1)** The student will be able to illustrate the basics of moulding practices and various casting process . **(2)** The student will be able to illustrate CUPOLA and other furnaces. **(3)** The student will be able to Elaborate and classify different welding processes. **(4)** The student will be able to discuss various SMW processes

List of Practical:-

A set of 10 Experiments from following list to be performed.

- Preamble about Foundry practices used in industries.[CO 1]
- Preparation of mould sand. [CO 1]

- Study of Various moulding processes. [CO 1]
- Study of various types of melting furnaces and cupola in detail. [CO 2]
- Study of different types of wooden pattern[CO 1]
- Grain fineness test of moulding sand. [CO 1]
- Demonstration of mould making along with Study of foundry tools. [CO 1]
- Preparation of mould making. [CO 1]

- Preparation of casting job along with Study of casting processes. [CO 1]
- Preparation of wooden pattern in pattern making shop. [CO 1]
- Job making involving various operations such as MIG ,TIG welding processes etc. [CO 3]
- Preparation of job on punching press. [CO 4]
- Report of foundry visit [CO 1]

A Visit: A visit to a foundry shop for more understanding of the casting practices**.** [CO 4]

IV Semester
ME2256 - Mechanical Measurement and Metrology

Objective	Course Outcome
To make the student aware of various Fundamental principles applicable to instruments used for measuring various mechanical parameters. To expose the students about limits, fits, tolerances & implement them to achieve the goal of interchangeable manufacturing. To impart the fundament quality control concepts & their implementation in manufacturing industry.	The Students will be able to – (1) Demonstrate the basic knowledge of measuring instruments and evaluate various characteristics(Static & Dynamic) (2) Select proper measuring instrument & use it for measuring various mechanical paramenters. (3) Demonstrate the basic knowledge of limits, fits, tolerance & design of limit gauges, tolerance charts. (4) Various quality control concepts & implement them to control quality of manufacturing processes.

UNIT 1
Purpose, Structure, and elements of a general measurement system. Static characteristics of measurement system, measurement error, Type of inputs, methods of corrections. Dynamic characteristics of measurements system, Mathematical modeling, transfer function, order of system, Standard input signals. Response of Zero, First and second order instruments.(no analytical treatment) [CO 1]

UNIT 2
Standards of measurements, interchangeability, simple gauging instruments for linear and angular measurements, form measurement, surface finish measurement, comparators, measurement of straightness and flatness, measurement thread , interferometers, calibration of equipment, CMM. [CO 2]

UNIT 3
Tolerance analysis of limit and fits, Design of limit gauges(analytical treatment), types of fits, shaft basis system ,hole basis system, selective assembly ,allowances, process planning sheet, preparation of tolerance chart (analytical treatment). [CO 3]

UNIT 4
Study of instruments for measurements of linear & angular displacement, speed, acceleration, force, torque, power and Strain.. [CO 2]

UNIT 5
Study of instruments for measurement of temperature, level, pressure and flow. [CO 2]

UNIT 6
Acceptance sampling techniques, O.C. Curve, sampling plans, (analytical treatment), inspection types and objective. Quality control and control charts. [CO 4]

IV Semester
ME2256 - Mechanical Measurement and Metrology

Text Books:

S. No.	Title	Authors	Edition	Publisher
1	Measurement Systems	Beckwith and Buck	6th edition 2014	Pearson Education India,
2	Mechanical Measurements Applications and Design	Doebelin	6 Edition 2014	McGraw-Hill.
3	Text book of Engineering Metrology	R. K. jain	20th Edition 2014	Khanna Publicatiion Delhi
4	Production Engineering	P. C. Sharma	2009	S. Chand Co.
5	Mechanical measurement & Instrumentation	Er. R. K. Rajput	2nd Edition 2017	SK Katariya & sons
6	Mechanical measurement & Instrumentation	A. K. Sawhney	12th Edition 2010	Dhanpatrai & Co

Reference Books:

S. No.	Title	Authors	Edition	Publisher
1	Engineering Metrology `	I.C. Gupta	15th Edition 2003	Dhanpatrai & Co
2	SQC	E L. Grant	3rd Edition 19988	McGraw-Hill.
3	SQC	Mahajan	2015	Dhanpatrai & Co

IV Semester
ME2257 - Lab.: Mechanical Measurement and Metrology

Objective	Course Outcome
To make the student aware of various Fundamental principles applicable to instruments used for measuring various mechanical parameters. To expose the students about limits, fits, tolerances & implement them to achieve the goal of interchangeable manufacturing. To impart the fundament quality control concepts & their implementation in manufacturing industry.	The Students will be able to – (1) Demonstrate the basic knowledge of measuring instruments and evaluate various characteristics(Static & Dynamic) (2) Select proper measuring instrument & use it for measuring various mechanical paramenters. (3) Demonstrate the basic knowledge of limits, fits, tolerance & design of limit gauges, tolerance charts. (4) Various quality control concepts & implement them to control quality of manufacturing processes.

List of Practical:-

A set of 10 Experiments from following list to be performed.

1. Measurement of strain by using a basic strain gauge and hence verify the stress induced.[CO 1,2]
2. Speed Measurement by using Stroboscope. [CO 1,2]
3. Speed Measurement by using Magnetic Pick Up [CO 1,2]
4. Speed Measurement by using Photo-electric Pick Up [CO 1,2]
5. Measurement of flow by using Rota meter. [CO 1,2]
6. Displacement measurement by inductive transducer. [CO 1,2]
7. Calibration of Thermocouple. [CO 1,2]
8. Calibration of RTD. [CO 1,2]
9. Calibration of LVDT [CO 1,2]
10. Determination of negative temperature coefficient and calibration of a thermistor. [CO 1,2]
11. Measurement of force & weight by using a load cell. [CO 1,2]
12. Liquid Level Measurement by using Capacitive Transducer system. [CO 1,2]
13. Measurement of Air velocity using Hot wire anemometer. [CO 1,2]
14. Measurement of Air velocity using turbine type anemometer[CO 1]
15. Scope of metrology lab and study of all metrological instruments. [CO 1]
16. Study of slip gauges and its uses. [CO 1,2]
17. To find half taper angle of a w/p using sine bar[CO 1,2]
18. To find various parameters of screw thread using TMM. [CO 1,2]

IV Semester
ME2257 - Lab.: Mechanical Measurement and Metrology

19. To find effective diameter of a threaded plug by two wire method using floating carriage machine. [CO 1,2]
20. Study of flatness of surface using monochromatic light with the help of fringe pattern. [CO 1,2]
21. To measure the surface roughness of a given w/p using Stylus probe. [CO 1,2]
22. To study the profile of given w/p using optical profile projector. [CO 1,2]
23. Design of limit gauge. [CO 3]
24. Preparation of process planning sheet and tolerance chart. [CO 3]
25. Problems on acceptance sampling. [CO 4]

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

5th Semester

Mechanical Engineering

V Semester
GE2311 - FUNDAMENTALS OF MANAGEMENT

Objective	Outcomes Students will be able to
To introduce the fundamentals and legal provision of Management	Explain the Legal provision and Functions of Management.
To introduce the Human Resource and Financial practice of organization	Analyze the role of Human Resource and Financial Management in the organization.
To Introduce the Project Management	Analyze the project life cycles.
To provide knowledge of Marketing Activities of Management	Identify tools and techniques for the marketing of goods and services.

Unit – 1 - Principle of Management

Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership

UNIT-2: Legal Aspects of Management

The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company

UNIT-3: Human Resource Management

Human Resource Management-Meaning and Scope, Principles of HRD, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Grievance Redressal Procedure .

UNIT-4: Project Management

Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Tools and Techniques of Project Management, Network techniques - Introduction and Use of CPM &PERT for planning, SWOT Analysis, Project Risk Analysis, Project Control.

UNIT-5: Marketing Management

Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

V Semester
GE2311 - FUNDAMENTALS OF MANAGEMENT

UNIT-6: Financial Management

Definition & Functions of Finance department, Sources of finance, Types of capital, Profit maximization vs. Wealth maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

Text book and Reference

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

V Semester

ME2301 - HEAT TRANSFER

Objective	Course Outcome
The student should be able to 1) The contents of syllabus intend to understand basic principles and physical phenomenon of Thermal Energy transfer and to understand heat transfer applications and formulate the problem. 2) To apply experimental tools for analysis of heat transfer applications in engineering. 3) To receive results from experimental and the mathematical tools and interpret the results to provide solutions for improvement. 4) In all to generate interest in learning to develop intuitive understanding in Heat Transfer.**[a,e,k,l,m]**	**On completion of this course, the student will be able to** 1) Analyze and solve the problems of unidirectional steady state heat conduction systems. 2) Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient. 3) Design & analyze the heat exchangers with LMTD & ϵ-NTU methods 4) Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Analyze and solve the problems of unidirectional steady state heat conduction and lumped heat capacitance systems.	3	3	3	2	3	1	2	1	1	1	2	2	3	3
CO2	Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient.	3	3	3	2	3	1	2	1	1	1	2	2	3	3
CO3	Design & analyze the heat exchangers with LMTD & ϵ-NTU methods.	3	3	3	2	3	1	2	1	1	1	2	2	3	3
CO4	Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships.	3	3	3	2	3	1	2	1	1	1	2	2	3	3

V Semester

ME2301 - HEAT TRANSFER

Unit No.	Contents	Max. Hrs.
1	**Introduction:** Modes of Heat Transfer, Basic Laws of Heat Transfer and Conservation of Energy requirement. Derivation of **general Heat conduction equation** in Cartesian, Cylindrical and Spherical Co-ordinates, Thermal conductivity and Thermal diffusivity. **One dimensional steady state conduction equation** for the plane wall, Cylinder and Sphere, Thermal resistance of composite structures, Contact resistance, and overall heat transfer coefficient.	6
2	**Conduction with uniform internal heat generation**: within plane wall, solid Cylinder and solid sphere, **Extended Surfaces** with uniform cross section area, temperature distribution and their heat transfer rate, Fin efficiency and effectiveness,	5
3	**Forced Convection:** Physical signification of related non-dimensional parameters, Newton's law of cooling, Concept of velocity and thermal boundary layer, Local and average heat transfer coefficient, **Using Empirical co-relation** (from heat transfer data book) for heat transfer during external and internal flow in laminar and turbulent regime for UHF and UWT condition, for determination of heat transfer coefficient.	5
4	**Natural Convection:** Grashoff number, Rayleigh number, Hydrodynamic and Thermal Boundary Layer. **Using Empirical co-relation** (from heat transfer data book) for heat transfer during external flow in laminar and turbulent regime for UHF and UWT condition (over plates & cylinders in Horizonal and vertical position, and over sphere). **Heat transfer with phase change (Theory only):** Pool boiling phenomenon, curve and regimes of pool boiling, Film and drop wise condensation, Film wise condensation on vertical surface (plate & cylinder), horizontal tube & bank of tubes, effect of superheated and non-condensable gasses on condensation heat transfer.	5
5	**Heat Exchanger:** Classification of heat exchangers, overall heat transfer coefficient, fouling factor, temperature distribution **Heat Exchanger Analysis** for parallel & Counter flow heat exchangers using LMTD Approach and Effectiveness -NTU approach	6
6	**Radiation** **Basic Radiation Concepts:** Fundamentals, Basic ideas, spectrum, basic definitions, radiative properties of opaque surfaces, Spectral and directional variations, emissive power, radiosity, intensity of radiation and solid angle, Band Emission. **Black Body Radiation Laws:** Planck's law, Stefan Boltzmann law, Wien's Displacement law, Kirchhoff's law, Lambert cosine law, **Radiation Energy Exchange:** Concept of black and gray bodies, Radiation exchange between black surfaces, Radiation exchange between gray surfaces Shape Factor Concepts– Definition, relations and its properties. Radiation network for radiative exchange. Radiation between parallel plates, concentric Cylinders and concentric spheres & simple enclosures .	6

V Semester

ME2301 - HEAT TRANSFER

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1				

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to heat transfer	5th Edition(2006)	Incropera & Dewitt J. Wiley	John Wiley & Sons
2	Elements of heat transfer	Edition (2007)	M.N.Ozisik	McGraw-Hill
3	Heat transfer	4th Edition(2005)	S.P.Sukhatme	Universities press (India)
4	Heat Transfer	Edition (1998)	Yunus A Cengel	McGraw-Hill,
5	Fundamentals of Heat & Mass transfer	1st Edition (2006)	M. Thirumaleshwar	Pearson
6				

V Semester

ME2302 - LAB : HEAT TRANSFER

Objective	Course Outcome
The student should be able to 5) The contents of syllabus intend to understand basic principles and physical phenomenon of Thermal Energy transfer and to understand heat transfer applications and formulate the problem. 6) To apply experimental tools for analysis of heat transfer applications in engineering. 7) To receive results from experimental and the mathematical tools and interpret the results to provide solutions for improvement. 8) In all to generate interest in learning to develop intuitive understanding in Heat Transfer.**[a,e,k,l,m]**	**On completion of this course, the student will be able to** 5) Analyze and solve the problems of unidirectional steady state heat conduction systems. 6) Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient. 7) Design & analyze the heat exchangers with LMTD & ϵ-NTU methods 8) Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships.

List of Practical

A set of 9 Experiments from following list to be performed.

List of Practical: Minimum eight experiments from the following:

1D steady state Conduction:

1) Determination of **thermal conductivity of metal bar**.
2) Determination of **thermal conductivity of insulating material** in the powder form (Lagged Pipe).
3) Determination of thermal conductance of a **composite wall**.
4) Heat Transfer through **FINs**.

Steady State convection:

5) Determination of **forced convection heat transfer coefficient** for fluid flow through a closed conduit.
6) Determination of **natural convection heat transfer coefficient** for a vertical surface.

Heat Exchanger:

7) Determination of **effectiveness and overall heat transfer coefficient** for parallel flow and counter flow concentric tube heat exchangers.

Steady State Radiation

8) Determination of **emissivity** of non black surfaces.
9) Determination of **Stefan-Boltzmann constant.**

Study:

1) Study of different methods of temperature measurements with special emphasis on thermocouples.
2) Study of **heat pipes**
3) Study of **pool boiling phenomenon** (Nukiyama Curve).
4) Study of **condensation heat transfer** in film wise & drop wise modes.

V Semester

ME2303 - DYNAMICS OF MACHINERY

Objective	Course Outcome
To develop the concept of rigid body motion and impart knowledge of rigid body dynamics. To enables the students to analyze dynamic forces in mechanism. To introduce the concept of unbalanced forces need for balancing of various machines and the different ways to achieve balancing. To impart elementary knowledge of vibrations, its effect on machines .To prepares students for calculations of important parameters and vibration isolation	**On completion of this course, the student will be able to** 1) Differentiate static and dynamic forces on different machines and mechanisms. 2) Analyze the unbalanced in rotating & reciprocating machines and corrections required to balance the same. 3) Identify the vibrations in different machines. 4) Evaluate and justify vibrations

Unit No.	Contents	Max. Hrs.
1	**Introduction:** D'Alembert principle, Dynamic force analysis of simple mechanism **Gyroscope:** simple precession and gyroscopic couple, gyroscopic effect on airplane, ship, vehicles and grinding mills.	8
2	Governors **– Classification, Watt, Portal, Proell, Hartnell governors etc,** **Fly wheel:** Turning moment Vs crank angle diagram for single- cylinder and multiple-cylinder engines, punching machines etc. Flywheel selection.	7
3	**Balancing in rotating mechanism:** Static & Dynamic balancing in rotating masses, balancing of multiple masses rotating in same plane, Balancing of several masses rotating in different planes, Dynamic balancing machine.	7
4	Balancing of reciprocating masses**: Primary and secondary unbalanced forces of reciprocating masses. Partial balancing of unbalanced primary forces in a reciprocating engine.** Balancing of primary and secondary force and couples in multiple inline engine, Balancing of radial engines (Direct and reverse crank method)	8
5	**Vibration:** Derivation of equation of motion for vibratory system. Free vibration of single-degree-of-freedom system with and without damping. Logarithmic decrement and damping estimation. Forced vibration of single-degree-of-freedom and vibration isolation, whirling of shaft and critical speed of rotors.	8
6	**Torsional vibration:** Lagranges equations and introduction to multi degree freedom systems. Equation of motion for two-degree-of-freedom system. Natural frequencies and mode shapes vibration absorber. Torsional oscillation of two-disc and three disc rotors	7

V Semester

ME2303 - DYNAMICS OF MACHINERY

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Theory of Machines and Mechanism	4 Edition (2009)	Shigley	Oxford University
2	Theory of Machines and Mechanism	2 Edition (1999	Ghosh & Mallik	Affiliated East-West
3	Theory of Mechanism	2 Edition (2005)	Rattan S. S	Tata McGraw-Hill
4	Mechanism and Machine Theory	3rd edition 2004	Rao & Dukipatti	Wiley & Sons
5	Theory of Vibrations	2nd edition 1995	Thomson W T	Prentice Hall of India

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Theory of Machine	3rd Edition (2009)	Thomas Bevan	Pearson Education
2	Theory of Machines	4th Edition (2006)	Sandor & Erdman	Prentice Hall
3	Mechanical vibrations	3rd Edition (2009)	Grover M.P	prentice hall of india
4	Theory of Machine	3rd Edition (2009)	Thomas Bevan	Pearson Education
5	Theory of Vibrations	2nd edition 1995	Thomson W T	Prentice Hall of India

V Semester

ME2304 – LAB : DYNAMICS OF MACHINERY

Objective	Course Outcome
To develop the concept of rigid body motion and impart knowledge of rigid body dynamics. To enables the students to analyze dynamic forces in mechanism. To introduce the concept of unbalanced forces need for balancing of various machines and the different ways to achieve balancing. To impart elementary knowledge of vibrations, its effect on machines .To prepares students for calculations of important parameters and vibration isolation	**On completion of this course, the student will be able to** 1) Differentiate static and dynamic forces on different machines and mechanisms. 2) Analyze the unbalanced in rotating & reciprocating machines and corrections required to balance the same. 3) Identify the vibrations in different machines. 4) Evaluate and justify vibrations

List of Practical
A set of 8 Experiments from following list to be performed.

1. Study of static and dynamic force analysis
2. Determination of Gyroscopic couple through motorized Gyroscope
3. Experiments on Governors - Pronell Governor, Hartnell Governor
4. Determination of Balancing of rotating mass, statically and dynamically.
5. Determination of natural frequency of longitudinal vibration
6. Determination of natural frequency of transverse vibration of beam.
7. Determination of natural frequency of simply supported beam using dunkerlays method.
8. Determination of natural frequency of torsional vibration of single rotor.
9. Determination of natural frequency of torsional vibration of double rotor.
10. Determination of whirling speed of shaft.

V Semester

ME2305 - PRODUCTION MANAGEMENT

Objective	Course Outcome
The course aims to develop an insight into working of production systems, their evaluation analysis and control. The overall objective is to learn to plan, design, execute or operate, control and measure the efficiency/ effectiveness of production systems.	Students will have i) Ability to estimate and evaluate manage production system using work study. ii) Ability to design and evaluate plant layouts. iii) Ability to predict and evaluate future demand using forecasting. iv) Ability to estimate production costing and apply by judging production planning and control.

Unit No.	Contents	Max. Hrs.
1	Work Study: Productivity, factors affecting productivity. Measurement of productivity. Work study and methods study: Definitions, objectives, steps in method study, Process charts, string diagram, motion study, micro motion study, SIMO Chart	7
2	Work measurement: Objectives, definition, stop watch study, work sampling, PMTs, MTM & Work factor method Value analysis and value Engineering:, Introduction, steps involved in value analysis. Applications in Manufacturing.	8
3	Plant Layout: Types of Plant Layout, Layout Functions and problems, Organization, Automated material handling, Concepts of AGVs, AS/RS and other automated devices. Design of integrated plant layout for product handling system.	8
4	Forecasting: Need for forecasting, classification of forecasting methods, like judgmental technique, time series analysis, least square method, moving average method, exponential smoothing method.	7
5	Production planning and control: Definition, objectives of PPC, functions of PPC, types of production, Inventory control, EOQ, Techniques in inventory control and associated problems.	7
6	**Process analysis and Cost Estimation:** Steps involved in manual production planning, Selection of process, analysis. Aims of Cost Estimation, Difference between cost and Estimation, Elements of cost: material, Product cost, Analysis of overhead expenses, Product cost estimation.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Work study	4th Edition (1992)	George Kanawaty	ILO
2	Motion and Time study	1st Edition (1980)	Barnes	Wiley
3	Ergonomics	1st Edition (1985)	Murell	Chapman & Hall
4	Production Planning and Control	2nd Edition (2006)	Jain & Agrawal	McGraw-Hill
5	Industrial Engg. And Project management	2nd Edition (2006)	Mart and Telsang	S. Chand
6	Plant layout and Material Handling	1st Edition (1977)	James Apple	Wiley, Technology & Engineering

V Semester

ME2331 - OPERATION RESEARCH TECHNIQUES

Objective	Course Outcome
The course aims to develop the engineering - analysis capability for engineering-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course.	**On completion of this course, the student will be able to** 1) Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method 2) .To Solve Transportation and Assignment Models and analyze the concept of dynamic programming to Solve problems of discreet and continuous variables. 3) Analyze projects for minimum total cost and smooth level of resources. 4) Evaluation of different replacement policies and its application in operation research and analysis of the application of simulation, inventory control model and waiting line model

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PS	PS
CO	Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method.	3				3	2			1				3	
CO	To Solve transportation and Assignment Models and analyse the concept of dynamic programming to Solve problems of discreet and continuous variables.	3				2	3			3				3	
CO	Analyze projects for minimum total cost and smooth level of resources.	3			2	2	2				2	3		3	
CO	Evaluation of different replacement policies and its application in operation research and analyse of the application of simulation, inventory control model and waiting line mode.	3				2	2	1	1			2	3	3	

V Semester

ME2331 - OPERATION RESEARCH TECHNIQUES

Unit No.	Contents	Max. Hrs.
1	Introduction to OR & Basic OR Models, Definition Characteristics and limitations of OR. Linear programming solutions (LPP) by graphical methods and simplex method. Sensitivity analysis. **(CO-1)**	7
2	Assignment Model and Transportation Model. **(C0- 2)**	7
3	Dynamic programming - characteristics, approach and its formulations. Application of Dynamic programming in Employment smoothening problem, Resource allocation, Inventory control & Linear programming. (CO- 2)	6
4	Project Management: Network Scheduling by CPM & PERT, Cost considerations in PERT and CPM. (CO- 3)	7
5	Replacement Models: Replacement of Models that deteriorate with time,Concept of equivalence , Interest Rate and Present worth. Replacement of items that fails suddenly considering Individual and Group replacement policy. (CO- 4)	4
6	Queuing Theory: Queuing Systems, Kendelalls for representing queuing models, Classification of queuing models (No derivations expected), Simulations, Monte- Carlo Simulation. Inventory Control with Deterministic models. (CO- 4)	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Operation Research: Computer Oriented Algorithmic approach	2007	Billy E.Gillet	Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2	Operations Research	3rd edition 2008	Prem Kumar Gupta & D.S. Hira	S. Chand& Co.
3	Operations Research: Theory and Applications	2nd edition 2002	J.K. Sharma	Mac Millan
4	Introductory Operations Research	2006	S.C. Sharma	Discovery Publishing House
5	Optimization Theory and Application	2nd edition 2010	S.S. Rao	Halsted Press
6	Operations Research - An Introduction	9th Edition 2010	Hamdy A. Taha	Prentice Hall of India Pvt. Ltd., New Delhi.

V Semester

ME2332 - AUTOMOBILE ENGINEERING

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular automobiles. The modernization in automobile is also included to understand recent trend in the field.	1) Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle. 2) Student will be able to describe various power transmission systems from clutch to wheel in vehicle. 3) Student will be able to evaluate and describe control systems like steering and brakes in vehicle. 4) Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle.	3	2												3
CO2	Student will be able to describe_various power transmission systems from clutch to wheel in vehicle.	3	2												3
CO3	Student will be able to evaluate and describe control systems like steering and brakes in vehicle.	3	2												3
CO4	Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.	3			2					2					3

V Semester

ME2332 - AUTOMOBILE ENGINEERING

Unit No.	Contents	Max. Hrs.
1	• Introduction, Automobile history and development and classification. Vehicles layout. • Engine Classification, construction and working 2 stroke and 4-stroke cycle. • Introduction to Fuel supply system: Carburettor and fuel injection.(Only basic) • Engine cooling and lubrication systems. [CO-1]	7
2	Clutch – Necessity, requirements of a clutch system. Types of Clutches: Single & multi plate clutch, Diaphragm clutch and centrifugal clutch. Gear box: Necessity of gear box with gear theory, working principle, Classification: Sliding mesh, constant mesh, synchromesh, and Transfer case gear box, Gear Selector mechanism, Defects and remedies in Gear box. Working of CVT (Continuous variable transmission) [CO-2]	6
3	• Transmission system: Propeller shaft, Universal joint, Hotchkiss drive, torque tube drive. • Differential - Need and working principle and Differential lock. • Rear Axles and Front Axles • Wheel and Tyres: Classification, various constituents of tyres with cross section, specification, factors affecting tyre performance [CO-2]	7
4	• Steering systems, principle of steering, steering linkages, steering geometry and wheel alignment, steering gear box and its types. • Brakes - Need, types: Mechanical, hydraulic (Master and wheel cylinder), Air brakes. Drum and Disc brakes, Comparison • Suspension systems – Function, conventional and Independent suspension System, Telescopic shock absorber. [CO-3]	6
5	• Electrical systems: Battery construction. Specification. Operation and maintenance of Batteries. • Alternator, starter motor, Battery Ignition and magneto ignition systems, Lighting, Horn, Side indicator , wiper.(only basic) • Automobile air-conditioning, • Panel board instruments. [CO-4]	6
6	• Resistance to vehicle motion: Air, Road and gradient resistance and power calculation. • Advances in automobiles such as ABS, Power Steering. • Safety aspect in Automobile. • Overall Vehicle specifications • Servicing, Overhauling and Engine tune up. [CO-4]	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Automotive Technology		H.M.Sethi	Tata McgraHill
2	Automobile Engineering-I & II	First Edition - 2010	P.S.Gill	S.K.Kataria & sons
3	Automotive Mechanics		Joseph Heitner	
4	Motor Vehicle Technology		J.A. Dolan	
5	Automotive Engines		W.H. Crouse	

		June 2022	1.02	Applicable for AY 2022-23 Onwards
Chaiperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester

ME2333- PLASTIC ENGINEERING

Objective	Course Outcome
To Familiarize students with : 1) Various Plastic materials, their properties and Applications. 2) The various processing techniques of material, testing and applications of fibre reinforced plastics. 3) Learn the basic of machining and joining of plastics by various adhesions and welding techniques.	**Students will be able to :** 1) Students will be able to identify the plastic materials for some specified applications based 'on its property. 2) Students will be able to investigate suitable plastic Processing technique. 3) Students will be able to evaluate the suitable machining and joining **of plastic materials.**

Unit No.	Contents	Max. Hrs.
1	Chemistry and Classification of Polymers - Properties of Thermo Plastics - Properties of Thermosetting Plastics - Applications - Merits and Disadvantages.	7
2	Extrusion - Blow Molding – Thermo Forming – Rotomolding	8
3	Compression and Transfer Molding - study of compression molds	7
4	Injection Molding- study of injection molding machines and molds.	7
5	General Machining properties of Plastics - Machining Parameters and Their effect - Joining of Plastics -Mechanical Fasteners - Thermal bonding - Press Fitting. Testing of plastic	8
6	Fibers - Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers - Matrix Materials - Polymers, Metals and Ceramics. Open Mould Processes, Bag Molding, Compression Molding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting - Injection Molding - Application of PMC's.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Plastic Engineering		Patten	
2	Plastic Processing		R. J. Crawfortd	
3	Plastics Extrusion technology	1988	F.Hensen,	
4	Injection Moulding Machines	1983	F.ohannaber	Hanser Publishers,
5	Polymer extrusion	1990	C.Rauwendaal,	Hanser Publishers,
6	Blow Moulding Handbook	1989	D.V.Rosatao,	Hanser Publishers,
7	Modern Plastics Moulding		E.B Seamour,	John Wiley.
8	Manufacturing Engineering & Technology	6th Edition (2013)	S Kalpakjian & SR Schmid	Pearson Education Canada
9	Machining of Plastics	1981	Akira Kobyashi,	Mc-Graw Hill.

V Semester

OE-I : ME2334- CONTROL SYSTEMS ENGINEERING

Objective	Course Outcome
• To develop an ability to define transfer function. • To analyze the performance of control system in time domain and frequency domain	**Students will be able to :** 1) Describe the mathematical representation of various control system components and determine the transfer function of mechanical, electrical, thermal and fluid system. 2) Analyse the construction and working of various control system components and electrical motors. 3) Evaluate the performance of control system using time response analysis and stability analysis. 4) Analyze the performance of control system on the basis of frequency response and design suitable compensation for the control system

Unit No.	Contents	Max. Hrs.
1	Introduction, System concept Open and Closed loop control systems. Transfer function, Mathematical Modeling of Physical System and system representation through Block Diagram. Transfer function through Block Diagram Simplification. Signal Flow Graph, Masons Gain Formula Block diagrams of various control systems.	7
2	**Representation of Control components:** Mechanical and Electrical components; Analogous systems; Thermal and Fluid systems.	7
3	**Electrical systems: -** ac/dc servomotors; field controlled and armature controlled servomotors; positional servomechanisms; stepper motors. **Hydraulic systems: -** Hydraulic pumps (gear; vane; and reciprocating piston) Cylinders, Direction control valves (2, 3, 4 way) Flow control valve; Relief valve Hydraulic servomotor.	8
4	Transient and steady state response of first and second order systems Concept of stability; relative stability; Routh stability criteria.	8
5	Frequency response and its characteristics; Bode plots; Nyquist plots. Gain margin and phase margin. Identification of system transfer function.	8
6	Basic control actions; Proportional Integral and Derivative control actions and their effect on system performance. Root locus technique. Introduction to control system design log load compensation Feed Back Compensation and Pole -Zero placements.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Modern Control Engineering	3rd Edition (2009	Ogata	Prentice Hall
2	Control system Engineering	4th Edition (2007)	Nise	John Wiley & Sons
3	Control system	4th Edition (2009)	Nagrath & Gopal	New Age International
4	Modern Control System	12th Edition (2009)	Dorf	Pearson

V Semester

OE-II : ME2341- TOTAL QUALITY MANAGEMENT

Objective	Course Outcome
• The course aims to build an overall capability to understand Quality and its relevance in today's dynamic market. • Various Quality Improvement tools and technique shall be introduced and practiced so as to develop skills and knowledge to function as a good quality professional in the Engineering Profession.	**Students will be able to :** 1) Develop an understanding on quality management philosophies and frameworks. 2) Develop in-depth knowledge on various tools and techniques of quality management. 3) To Evaluate the applications of quality tools and techniques in both manufacturing and service industry 4) Ability to use quality management methods analyzing and solving problems of organization.

Unit No.	Contents	Max. Hrs.
1	Principles of Quality Management, Pioneers of TQM, Quality costs, Quality system Customer Orientation, Benchmarking, Re-engineering	7
2	Leadership, Organizational Structure, Team Building, Information Systems and Documentation – Quality Auditing, ISO 9000 - QS 9000.QMS, Quality awards.	7
3	Single Vendor Concept, J.I.T., Quality Function deployment, Quality Circles, KAIZEN, SGA POKA - YOKE, Taguchi Methods. SMED, Kanban system. Cost of quality. Robust design	8
4	Methods and Philosophy of Statistical Process Control, Control Charts for Variables and Attributes	8
5	Cumulative sum and exponentially weighted moving average control charts, Others SPC Techniques – Process Capability Analysis. Acceptance Sampling Problem, Single Sampling Plans for attributes, double, multiple and sequential sampling,]	8
6	Six sigma manufacturing concepts. Six-sigma philosophy Quality strategy and policy. Motivation and leadership theories. Continuous vs. breakthrough improvements. Management of change, DMAIC Methodology. Lean manufacturing	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Total Quality Management for Engineers	1991	Mohamed Zairi	Woodhead Publishing Limited 1991
2	Production and Operations mangament - Total Quality and Responsiveness	1995	Harvid Noori and Russel	McGraw-Hill Inc, 1995
3	Managing for Total Quality	1998	N.Logothetis	Prentice Hall of India Pvt .Ltd,1998
4	The Essence of Total Quality Management	1995	John Bank	Prentice Hall of India Pvt.Ltd., 1995.
5	Introduction to Statistical Quality Control	1991	Douglus C. Montgomery	2nd Edition, John Wiley and Sons, 1991.
6	Statistical Quality Control	1984	Grant E.L and Leavensworth	McGraw-Hill, 1984.

V Semester

OE-II : ME2342- RELIABILITY ENGINEERING

Objective	Course Outcome
1) To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply a few well understood basic principles to find its solution. 2) Learn how to get higher operating plant and equipment reliability that lifts efficiency and output of operating assets, stops equipment failures and creates higher plant and equipment reliability, with this subject.	1) Student will be able to use reliability modeling as a tool for evaluating system performance. 2) Student will be able to analyze the failure of a machine, determine the failure rate of systems or components. 3) Student will able to understand importance of the maintenance of engineering systems and factors affecting maintainability. 4) Student will be able to prepare the production & maintenance schedule of particular engineering system.

Unit No.	Contents	Max. Hrs.
1	**Fundamental concepts:-** Reliability definitions, failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, maintainability, availability , safety and reliability, Quality, cost and system effectiveness, Life characteristic phases, modes of failure, Quality and reliability assurance rules, product liability, Importance of Reliability,	7
2	**Probability theory:-** Set theory, laws of probability, total probability theorem, probability distributions, parameters and applications.	7
3	**System reliability and modeling:** Series and parallel components, mixed configuration, complex systems. Redundancy, element redundancy, unit redundancy, standby redundancy. Types of stand by redundancy, parallel components. Markov models for reliability estimation.	8
4	Maintainability and Availability: Objectives of maintenance, types of maintenance, Maintainability, factors affecting maintainability, system down time. Availability - Inherent, Achieved and Operational availability, reliability and maintainability trade-off. Markov models for availability estimation.	8
5	System reliability Analysis: Reliability allocation or apportionment. Reliability apportionment techniques . Reliability block diagrams and models. Reliability predictions. Life testing and accelerated testing.	8
6	Strength based reliability: Safety factor, safety margin, Stress strength interaction, Failure Mode, Effects and Criticality Analysis-, , FMECA examples, Ishikawa diagram .fault tree construction, basic symbols development of functional reliability block diagram, Fault tree analysis, fault tree evaluation techniques, Design of Mechanical components and systems:-Material strengths and loads.	7

V Semester

OE-II : ME2342- RELIABILITY ENGINEERING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Concepts of Reliability Engg	1985	L.S. Srinath	Affiliated East-Wast Press (P) Ltd
2	Reliability Engineering	1983	A.K. Govil	Tata McGraw-Hill Publishing Co. Ltd
3	Reliability Engineering	1984	E. Balagurusmy	Tata McGraw-Hill Publishing Co. Ltd
4	Engineering Reliability	1980	B.S. Dhillion, C. Singh	John Wiley & Sons
5	Probabilistic, Reliability	1968	M.L. Shooman	McGraw-Hill Book Co.,
6	Practical Reliability Engg	1985	Patric D.T.O'connor	Heyden and sons ltd.
7	Reliability in Engineering Design	1977	K.C. Kapur, L.R. Lamberson	John-Wiley and sons.
8	Reliability Engineering, Theory and Practice	3rd Edition, 1999	A.Birolini	Springer,

V Semester

OE-II : ME2343- POWER GENERATION ENGINEERING

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular automobiles. The modernization in automobile is also included to understand recent trend in the field.	1) Student will be able to describe basics of power generations systems. 2) Student will be able to analyze various conventional & non-conventional power plants. 3) Student will be able to analyze and examine combined operations of different power plants. 4) Student will be able to evaluate and describe Hydroelectric power plant nuclear power plant

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Student will be able to describe basics of power generations systems.	3	2												3
CO2	Student will be able to analyze various conventional & non-conventional power plants.	3	2												3
CO3	Student will be able to analyze and examine combined operations of different power plants.	3	2												3
CO4	Student will be able to evaluate and describe Hydroelectric power plant nuclear power plant	3			2					2					3

Unit No.	Contents	Max. Hrs.
1	**THERMAL POWER PLANT- I** Introduction to thermal power plants and power plant layouts. Site selection. Fuel characteristics, handling, storage, preparation & firing methods. Ash & dust collection and handling. • Boiler: classification, general arrangement, details of different components and system like draught system, steam turbine systems, condenser, cooling towers **[CO-1]**	7
2	**THERMAL POWER PLANT- II** Gas Turbine Power Plant: -Introduction, power plant layouts, Open cycle, close cycle power plants. Various components and systems. Methods to improve efficiency. Reheat and Regeneration cycle and their combinations Diesel Electric Power Plant: - Introduction, Outline, type of engines, different components, performance, plant layout. Comparison with other power plant. (visit to nearby power plant shall be arrange for the students) **[CO-2]**	8

3	**HYDROELECTRIC POWER PLANT.** Hydrology: - Rainfall, Runoff, Hydro graph, flow duration curve, mass curve. Hydroelectric power plant: - Site selection, classification of hydroelectric power plant, general arrangement, details of different components, turbine selection.Governing. • Comparison with other power plant. **[CO-2]**	7
4	**POWER PLANT ECONOMICS** Load Analysis - Fluctuating Load on power plants, Load curves, various terms & definition, peak load, effect of fluctuating load. • Economic Analysis: - Cost of electric energy **[CO-3]**	8
5	**NUCLEAR POWER PLANT** Introduction to Nuclear Engineering, Global scenario, prominent installations worldwide, present & proposed nuclear plant in India. Nuclear Reactors: - Types of reactors, PWR, BWR, CANDU, Gas cooled, liquid metal cooled, Breeder reactor. Operational requirements and difficulties, site selection for location of a nuclear power station Nuclear Waste Disposal. • Comparison with other power plant. **[CO-4]**	8
6	**COMBINED OPERATION OF DIFFERENT POWER PLANTS** Combined operation: - Need division, combination of different plant & their coordination, advantages. **NON CONVENTIONAL POWER GENERATION SYSTEMS** Introduction to Non Conventional power Generation Systems • Geo-Thermal Power Plant, Tidal Power Plant, Wind Power Plant, Solar Power Plant. **[CO-4]**	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Power Plant Engineering	2002	Domkundwar.	Dhanpat Rai & Co.
2	Power Plant Engineering	2007	Vopal & Slortzki	
3	Power Plant Engineering	2010	P K Nag	

V Semester

OE-II : ME2344- PROJECT EVALUATION & MANAGEMENT

Objective	Course Outcome
The course focuses on developing complete understanding of formulating a problem/project and finding possible solutions against the given constraints. The overall learning shall resolve project identification evaluating its technical and economic feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details.	**The students will be able** 1) To apply the concepts of monitoring and evaluation, appraise 2) To analyse the best monitoring methods, appreciate evaluation in the context of developmental project work 3) To perform problem analysis, determine relevant indicators and data necessary for evaluation, 4) Implement a monitoring and evaluation process, establish baselines and targets..

Unit No.	Contents	Max. Hrs.
1	**Project Identification** considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project demand forecasting, secondary data, accuracy, confidence level, uncertainty	7
2	**Technical feasibility**: Process selection, Level of automation, plant capacity, acquiring technology, Appropriate technology plant location, Equipment selection & procurement, Govt. policies. Value analysis and project evaluation:	7
3	**Economic feasibility:** Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Breakeven point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes.	9
4	**Project Planning and Control:** Work break down structure and network development. Basic Scheduling, Critical Path and four kinds of floats. Scheduling under probabilistic durations, Time Cost tradeoffs, CPM, PERT, Optimum project duration, resource allocation, updating	7
5	**Project report:** Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital	7
6	Initial review, performance analysis, ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion environ-mental & social aspects**.**	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Projects	7th Edition 2007	Prasanna chandra	Tata mc graw Hill publishing company Ltd.
2	CPM & PERT		L. S. Srinath	East West publisher
3	Projects	1963	P.K. Joy	Macmillon
4	Engineering Economy	5th edition	H. G Thuesen, W J Fabricky, G,J, Thuersen	Prentice-Hall
5	Finance series 'Project management' , Vol-I1 and Vol-III	2009	ICFAI	ICFAI,Press Hyderabad
6	Finance Management	6th Edition 2010	M.Y.Khan	Tata McGraw hill
7	Financial Management	4th Edition	Chandra, Prasanna	Tata McGraw-Hill Education, 1997
8	Engineering Economics	8th Edition	G. J. Thuesen, Wolter J. Fabrycky	Prentice Hall, 1993

		June 2022	1.02	Applicable for AY 2022-23 Onwards
Chaiperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester

OE-II : ME2343- POWER GENERATION ENGINEERING

Objective	Course Outcome
The course focuses on developing complete understanding of formulating a problem/project and finding possible solutions against the given constraints. The overall learning shall resolve project identification evaluating its technical and economic feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details.	**The students will be able** 5) To apply the concepts of monitoring and evaluation, appraise 6) To analyse the best monitoring methods, appreciate evaluation in the context of developmental project work 7) To perform problem analysis, determine relevant indicators and data necessary for evaluation, 8) Implement a monitoring and evaluation process, establish baselines and targets..

Unit No.	Contents	Max. Hrs.
1	**Project Identification** considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project demand forecasting, secondary data, accuracy, confidence level, uncertainty	7
2	**Technical feasibility**: Process selection, Level of automation, plant capacity, acquiring technology, Appropriate technology plant location, Equipment selection & procurement, Govt. policies. Value analysis and project evaluation:	7
3	**Economic feasibility:** Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Breakeven point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes.	9
4	**Project Planning and Control:** Work break down structure and network development. Basic Scheduling, Critical Path and four kinds of floats. Scheduling under probabilistic durations, Time Cost tradeoffs, CPM, PERT, Optimum project duration, resource allocation, updating	7
5	**Project report:** Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital	7
6	Initial review, performance analysis, ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion environ-mental & social aspects**.**	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Projects	7th Edition 2007	Prasanna chandra	Tata mc graw Hill publishing company Ltd.
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6	Finance Management	6th Edition 2010	M.Y.Khan	Tata McGraw hill
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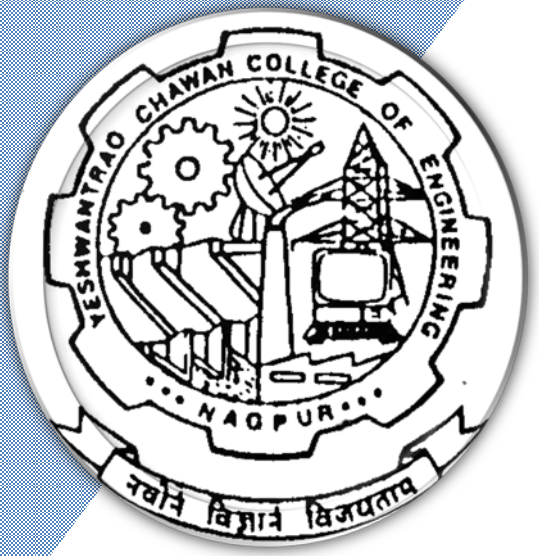
Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of **Technology**

SoE & Syllabus 20**20**

6th Semester

Mechanical Engineering

28 June 2019

VI Semester
GE2312 - Fundamental of Economics

Objectives	Outcome (Students will be able to)
Recognizes consumer's behavior and pricing.	Relate their buyer behaviour to particular product and the pricing in the market.
Extrapolates an operations in market with productions constrain.	Examine and classify various market structure and factors of production and its role in production process.
Describes the national income accounting and public finance.	Analyse the national income accounting and the various issues related to banking, taxation, and inflation.
Interprets international trade and institutions.	Elaborate about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institutions.

UNIT-1: Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, exceptions to law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, exception to law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. **(8 Hours)**

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation. **(6 Hours)**

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination. **(7 Hours)**

UNIT-4: National income accounting:
Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation. **(5 Hours)**

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (GST, Import duties), Revenue and capital expenditure.

(7 Hours)

VI Semester
GE2312 - Fundamental of Economics

UNIT-6: International Trade and Institutions

Definitions of closed vs. open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions. **(5 Hours)**

Text Books:

1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher, 2007

Reference Books:

1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

VI Semester
ME2351 - Fluid Machines

Objective	Course Outcome
Students should apply the fundamentals of fluid dynamics and thermodynamics to compressors. To understand basic cycles, types and components of I.C. Engines. To understand the basics of refrigeration, air conditioning.**[a,e,k]**	**CO:1** The student will be able to describe and analyze the working of Positive Displacemnt Pumps .[a,e,k]
	CO:2 The student will be able to describe and analyze the working Centrifugal Pumps .[a,e,k]
	CO:3 The student will be able to define evaluate Static and Stagnation properties and; describe and analyze the compressible flow.[a,e,k]
	CO:4 The student will be able to describe and analyze the working of compressors.[a,e,k]

Unit No.	Contents	Max. Hrs.
Unit 1	Classification of Positive displacement Pumps: Study of Rotary pumps such as vane pump, Gear pump and Screw pump. Reciprocating pumps: Basic principle, types, Main components, Slip, Work done. Indicator diagrams, Separation, Air vessels **[CO:1]**	**[8 hrs]**
Unit 2	Centrifugal Pumps: Components and Principles of operation, Classification, Priming, Fundamental equation, Various heads, Velocity triangles and their analysis, Effect of outlet blade angle, Vane shapes, Losses & efficiencies of pumps, N.P.S.H , Cavitations in pumps, Performance characteristics [**CO:1]**	**[7 hrs]**
Unit 3	Reciprocating compressors: - Parts, Operations, Work done during isothermal, polytropic & adiabatic compression process, P-V diagram, isothermal efficiency, Effect of clearance, volumetric efficiency, Mechanical efficiency. Multistaging in reciprocating compressor, condition for minimum work input, capacity control, Actual indicator diagram [**CO:1]**	**[8 hrs]**
Unit 4	Compressible Flow: Stagnation properties, speed of sound wave, Mach number, one dimensional isentropic flow, Stagnation properties, Isentropic flow through convergent-divergent nozzles, Adiabatic Expansion in Nozzles, Maximum Discharge Critical Pressure Ratio and effects of Friction, Calculation of Throat and Exit Areas, [**CO:2]**	**[7 hrs]**
Unit 5	Centrifugal compressor:-Principle, operation, parts, velocity diagram, static & stagnation quantities, work done by impeller, isentropic efficiency of compressor. Slip factor, pressure coefficient and power input factor. [**CO:3]**	**[7 hrs]**
Unit 6	Axial flow compressor:-Principle, operation, parts. Velocity diagram, work done, degree of reaction stage efficiency compressor characteristics, surging & chocking. [**CO:4]**	**[8 hrs]**

VI Semester
ME2351 - Fluid Machines

Reference books:				
1	Thermal Engineering	20 Edition (1994)	P.L.Ballaney	Khanna Publication
2	Thermal Engineering and heat engines	(1994)	R.Yadav	Central Publishing house
3	Heat power engg	3rd Edition (Yr of publication)	Kumar & Vasandani	Metro Politon Publisher
4	IC Engine	3rd Edition (2008)	V. Ganeshan	Tata McGraw Hill
5	Refrigeration & Air Conditioning	2nd Edition (2000)	C.P. Arora	Tata McGraw Hill
6	Internal Combustion Engines	3rd Edition (1968)	E.F. Obert	International Textbook Co.
7	Gas Turbine	5th Edition (1992)	Dubey & Khajuria	Dhanpat Rai Publications
8	Thermal Engineering	8th Edition (2010)	R.K.Rajput	Laxmi Publication

VI Semester
ME2352 - Fluid Machines Lab

List of Practical

A set of 8 Experiments from following list to be performed.

1) Study of Positive Displacement Rotary Pumps
2) **Trial on Reciprocating Pump**
3) **Trial on Centrifugal Pump**
4) Trial on reciprocating compressor **[CO:1]**
5) Trial on rotary Blower. **[CO:1]**
6) **Trial on Pelton wheel [CO:2]**
7) **Trial on Francis Turbine**
8) **Trial on Kaplan Turbine**
9) Performance testing of a single cylinder I.C. Engine. **[CO:2]**
10) Trial on Petrol Engine with energy balance sheet. **[CO:2]**
11) Heat balance on Multicylinder Diesel Engine. **[CO:2]**
12) Performance on Vapor Compression Refrigeration System (VCRS). **[CO:3]**
13) Performance on air-conditioning system. **[CO:4]**

1. Mapping:

MAPPING **COURSE OUTCOMES** (**CO's**) LEADING TO THE ACHIEVEMENT OF **PROGRAM OUTCOMES (PO's)**:

	PO's												
CO's	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***13***
i	*3*		*3*		*3*							*3*	*3*
ii	*3*		*3*		*3*							*3*	*3*
iii	*3*		*3*		*3*							*3*	*3*
iv	*3*		*3*		*3*							*3*	*3*
Avg.	**3**		**3**		**3**							**3**	**3**

Correlation levels 1,2 or 3 as defined below:
1: Slight (Low)
2: Moderate (Medium)
3: Substantial (High)

VI Semester
ME2353 –Computer Aided Design LAB

Objectives:	Course outcomes:
To educate students on -Main concepts of computer aided design -Graphics representation of curves. -Surface and solids.	Students will be able to: 1. Distinguish the various CAD CAM tools and also evaluate criteria for CAD CAM systems 2. Design 2D and 3D Transformation matrices 3. Calculate and analyse the parametric equations for wire frame. surface and solid modeling entities. 4. Design the applications of modeling and evaluate data exchange formats

List of Practical

A set of 10 Experiments from following list to be performed.

1. Introduction to CAD software.
2. Simple examples of two dimensional transformations
3. Simple examples on three dimensional transformations.
4. Programs on 2-D transformations- scaling, rotation, reflection and translation
5. 3-D Wireframe object modeling using any CAD software.
6. Generation of analytical curves using any CAD software
7. Generation of synthetic curves using any CAD software
8. Basics of surface modeling using Extrude, Revolve, fill, sweep, variable section sweep commands using any CAD software.
9. Creating fill surfaces, lofted multi-section surfaces, blended surfaces using any CAD software.
10. Analyzing the curve and surface quality using any CAD software.
11. Generation of at least two simple solid models showing geometric properties using any CAD software.
12. To generate at least two simple assembly model using any CAD software.
13. Solid model generation using feature based modeling using any CAD software
14. Drafting of the solid models previously developed in any CAD software.**[a,e,k]**
15. Programs on windowing and clipping.**[a,e,k]**

VI Semester
ME2354 – Design of Mechanical Drives

Objectives:	**Course Outcome:**
To develop the concept of drive system and impart knowledge of various components of industrial drives. To enable the students in selecting proper drive system. To make the students capable of selecting proper gear drive and design the components of geared system. To emphasize the need of reducing cyclic fluctuations in speed by providing appropriate flywheel. To enable to take up small projects in design of haulage system.	Students will be able to: 1. Dscribe the design process, material selection & calculations of stresses in flat belt, V belt, chain drive and rope drive, and finding its ailure criteria. 2. Design the various gear drive such as spur, helical, worm & worm wheel and bevel gears, and finding its failure criteria. 3. Summarize the knowledge on shafts, coupling and flywheel and finding its failure criteria. 4. Evaluate the radial and thrust load for journal bearings, antifriction bearings and finding its failure criteria.

Unit No.	Contents	Max. Hrs.
Unit 1	**Flat belt drive:** Types of belts & belt material, analysis of belt tension, condition for transmitting maximum power, design of flat belt, flat belt pulley. **V belt drive:** Types of V-belt, analysis of V-belt tension, design of V belt pulley.	**[8 hrs]**
Unit 2	**Chain Drive:** Design of roller chain drive, types of chain, concept of chordal action, lubrication ,types of sprocket, **Rope drive:** Introduction to haulage system, construction of rope, design of wire rope, sheave and drums Electric motor rating, their Characteristics, controls, selection motors.	**[7 hrs]**
Unit 3	**Gear drive:** Review of Kinematics of gears & terminology, interference, tooth profiles, formative number of teeth etc. Bukingham equation, design of spur gear drive, helical gear drive.	**[8 hrs]**
Unit 4	**Worm gear drive:** Types and proportion of worm and worm gear, force analysis, beam strength of worm gear teeth, dynamic tooth load, wear load, thermal rating of worm gear, design of worm and worm gear. **Bevel gear drive:** Types of bevel gear, proportions of bevel gear, force analysis of bevel gear drive design of bevel gear drive.	**[8 hrs]**
Unit 5	**Coupling: Types of shaft coupling, design of flange coupling, flexible bush coupling.** Flywheel: Coefficient of fluctuation of energy and Coefficient of fluctuation of speed, energy store in flywheel, stresses in flywheel, design of flywheel.	**[7 hrs]**
Unit 6	**Bearing:** Surface finish, friction wears, lubrication, oil seals, design of journal bearings for radial and thrust loads, selection of ball and roller bearing for radial and thrust loads. Failures of antifriction bearing, design of hydrostatic pocket type thrust bearing such as circular step thrust bearing, bearing housing.	**[7 hrs]**

VI Semester
ME2354 –Design of Mechanical Drives

Text books:				
1	Mechanical Design of Machine	4th Edition (1965)	Maleev, Hartman	International Textbook Co.
2	Machine Design	3rd Edition (1968)	Black P.H	Tata McGraw Hill
3	Mechanical Engg. Design	8th Edition (2008)	Shigley	Tata McGraw Hill
4	Design Data book	1st Edition (2005)	Shiwalkar B.D	Central Techno Publication
5	Design of Machine Elements	Edition (Yr of publication)	Bhandari V. B	Publisher
6	Machine Design	2nd edition	Norton	McGraw publication

Reference books:				
1	Hand book of Machine Design	3rd Edition (2004)	Shiglay&Mischke	Tata McGraw Hill
2	Mechanical Engineering Hand book (Vol 1 & 2)	Vol 1: 12 Edition (1950) Vol 2: 11Edition	Kent	J.Wiley& Sons inc
3	PSG. Tech. Machine Tool Design Data Book	(1966)	CMTI	PSG College of Technology

VI Semester
ME2361 – PE-I : Finite Element Method

Objective	Course Outcome
To develop ability to analyze simple mechanical engineering problems. To understand and apply basic governing principals in logical manner to find solutions. [e]	(I) The students will be able to understand fundamentals of finite element method.[e]
	(II) The students will be able to analyse the Mechanical engineering problems[e]
	(III) The students will be able to find solutions for simple mechanical Engineering problems.. [e]
	(Iv) The students will be able to analyze structure.. [e]

Unit No.	Contents	Max. Hrs.
1	Fundamentals of stress & strain, stress & strain components, stress strain relationship, Elastic constants, plane stress, plane strain., differential equation of equilibrium, compatibility equations, boundary conditions, Saint Venant's principle.	7
2	Fundamental concepts of FEM -' Historical background, Scope of FEM in Engg. Applications, Principle of minimum potential energy. Concept of Virtual work. Raleigh-Ritz method. FEM analysis procedure. Mathematical understanding required for FEM, Matrix algebra & operations, Eigen values & Eigen vectors. Methods for solution of simultaneous equations. like Gauss elimination. Matrix decomposition method. Concept of discritization of body into elements. degrees of freedom, bandwidth, Basic types of 2-D & 3-D elements, displacement models, convergence requirements, shape function. Programming for above matrices	7
3	Finite element modeling and analysis of one dimensional problems: Finite element modeling & analysis using Bar & Beam element -stiffness matrix, assembly, boundary conditions, load vector, temperature effects. Two dimensional plane trusses-Local & Global coordinate system, element stiffness matrix, assembly, boundary conditions, load vector, force & stress calculations. Programming for simple bar and beam elements.	8
4	Two dimensional problems using CST & LST -formulation of CST & LST elements, elemental stiffness matrix, assembly, boundary conditions, load vector. stress calculation. Temperature effect . Axi-symmetric solids subjected to axi-symmetric loading -axi-symmetric formulation using CST ring, element, stiffness matrix, boundary conditions, load vector, calculation of stresses. Programming for simple 2-D problems using CST and LST elements.	8
5	Introduction to Isoperimetric & Higher order elements. Introduction to Numerical Integration. Introduction to dynamic analysis, formulation of mass matrix for one-dimensional bar element, free vibration analysis using one-dimensional bar element. Torsion of prismatic bars using triangular elements. Programming for these elements.	7
6	Application of commercial software for simple machine elements and interpretation of results.	8

VI Semester
ME2361 – PE-I : Finite Element Method

Text books:				
S.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Introduction to Finite Elements in Engineering	4th edition 2011	Chandrupatla T.R; Belegundu AD	Pearson Education
2	Theory of Elasticity	2nd edition 1951	Timoshenko S.P	Tata McGraw-Hill Education
3	Concept and applications of Finite element Analysis	2nd edition revised, 2010	Cook RD	I. K. International Pvt Ltd
4	The Finite Element Method -A basic introduction for engineers	2nd edition	Griffiths D. W; Nethercot D.A	BSP Professional, 1983
5	Finite element methods	6th edition, 2005	O. C. Zienkiewicz, Richard Lawrence Taylor, Perumal Nithiarasu, J. Z. Zhu	Butterworth-Heinemann
6	Applied elasicity	--	Chi The Wang	Amazon
7	Finite to Infinite	--	--	Infinite seris

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Study, analyse and develop the fundamentals of Finite Elements Method for mechanical engineering problems.	3	3			3	2	1	1	2	1	1		3	1
CO2	Evaluate the stresses, strains and deformation in simple machine elements and design solutions for simple problems.	3	3	3		3	3	1	1		1	1	1	3	3
CO3	Build the solutions using the commercial softwares for simple machine elements.	3	3			3	2	1	1	2	1	2	1	3	3
CO4	PE-III: Lab: FINITE ELEMENT METHOD	3	3			3	2	1	1	2	1	1		3	1

VI Semester
ME2362 – PE-I : Lab: Finite Element Method

Objectives:	Course outcomes:
• To develop an ability to analyze simple mechanical engineering problems using analysis software • To examine and build the solutions using the commercial softwares for simple machine elements [PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]	*After completion of the course students would be able to* **1.** Study, analyse and develop the fundamentals of Finite Elements Method for mechanical engineering problems. **2.** Evaluate the stresses, strains and deformation in simple machine elements and design solutions for simple problems. **3.** Build the solutions using the commercial softwares for simple machine elements.

List of Practical:-

1. To study about Finite Element Methods **[PO-1,3,5,6,7,8,9,10,11,PSO-1,2]**
2. To determine stress and strain in 1-D bar element **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2**
3. To determine stress and strain in Composite element **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]**
4. To determine principle stress and strain in CST element **[PO-1,2,3,5,6,7,8,9,10,11,PSO-1,2]**
5. To determine stress and strain in CST element **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]**
6. To study the performance of structural tutorial **[PO-1,3,5,6,7,8,9,10,11,PSO-1,2]**
7. Deflection of Beam (Simply Supported Beam) **[PO-1,2,3,5,6,7,8,9,10,11,12,PSO-1,2]**
8. Tutorial of 2D truss analysis in Mechanical APDL (Ansys). **[PO-1,2,3,5,6,7,8,9,10,11,2,PSO-1,2]**

VI Semester
ME2363 – PE-I : Industrial Fluid Power

Objective	Course Outcome
• To understand the working principle of hydraulic and pneumatic components and its selection. • To design hydraulic and pneumatic circuits for different applications.	1) To **investigate** the hydraulic fluids and **apply** the fluid power laws and principals for **analysis** of simple fluid power system. 2) To **identify**, **analyze**, and **justify** selection of suitable components of fluid power system for specific applications based on its function, performance and working characteristics. 3) To **design** and **examine** the fluid power system and to **compose** and **interpret** its circuit diagrams **using** standard symbols. 4) To **examine** the safety measures, maintenance, and trouble shooting for fluid power systems.

Unit No.	Contents	Max. Hrs.
1	**Fluid power systems:** Components, advantages, applications in the field of M/c tools, material handling, hydraulic presses, mobile & stationary machines, clamping & indexing devices etc. **Transmission of power at static & dynamic states**. Pascal's law and its application to hydraulics, Bernoulli's principle , continuity equation, analysis of simple hydraulic jack . **Types of Hydraulic fluid,** petroleum based, synthetic & water based. Properties of fluids. Selection of fluids, additives, effect of temperature & pressure on hydraulic fluids, SAE grades and ISO viscosity numbers. **Filters**, strainers, types and sources of contamination of fluid & its control, effects, ISO contaminant code. JIC symbols/ISO Symbols for hydraulic & pneumatic circuits. **Hydraulic Reservoirs and Power Pack** : functions and its elements, standard designs.	5
2	**Pumps:** Types, classification, principle of working & constructional details of pumps used in Hydraulic system such as vane pump, gear pumps, radial & axial plunger pumps, power and efficiency calculations, characteristic Curves, selection of pumps for hydraulic power transmission. **Accumulators & Intensifiers**: Types & functions of accumulators & intensifiers, applications, selection & design procedure.	6

VI Semester
ME2363 – PE-I: Industrial Fluid Power

Unit No.	Contents	Max. Hrs.
3	**Unit 3** **[5 hrs]** **Control Of Fluid Power:** Necessity of pressure control, directional control and flow control valves, **methods of actuation of valves.** **Pressure Control Valves**: Principle of pressure control valves, types, constructional features, direct operated, pilot operated, relief valves, pressure reducing valve, sequence valve. **Flow Control Valves:** Principle of operation, types, constructional features, pressure compensated, temperature Compensated flow control valves, meter in & meter out flow control circuits, bleed off circuits. **Direction Control Valves:** constructional features , types, Check valves, types of D.C. valves:- Two way two position, four way three position, four way two position valves, open center, close center, tandem center valves, method of actuation of valves, manually operated, solenoid operated, pilot operated etc	5
4	**Actuators:** Classification, constructional features and working, Linear & Rotary actuators. **Hydraulic motors:** Types, vane, gear piston, radial piston. Theoretical torque, power & flow rate hydraulic motor performance. **Hydraulic Cylinders:** Types of cylinder & mountings, cushioning, calculations of force, velocity and power from a cylinder. Design consideration for cylinders.	5
5	**Design and analysis of Hydraulic Circuit such as:** 1) Control of single and Double -acting hydraulic cylinder, 2) regenerative circuit, 3) pump unloading circuit, 4) double pump hydraulic system, 5) counter balance valve application, 6) hydraulic cylinder sequencing circuits, 7) cylinder synchronizing circuit using different methods, 8) hydraulic circuit for force multiplication; 9) speed control of hydraulic cylinder metering in, metering out and bleed off circuits. 10) Pilot pressure operated circuits. 11) Hydraulic circuit examples with accumulator /intensifier. 12) circuit to lift and hold heavy load, 13) Pressure control for cylinders, 14) Flow divider circuits **Safety precautions, maintenance and trouble shooting of Hydraulic Circuits.**	6

VI Semester
ME2363 – PE-I: Industrial Fluid Power

Unit No.	Contents	Max. Hrs.
6	**Pneumatics:** **Introduction** to pneumatic power sources, Characteristics of compressed air , air compressors used and Components of pneumatic system. **Air preparation units**, filters, regulators & lubricators and silencer. compressed air distribution system in a plant; **Actuators**, linear, single & double acting, rotary actuators, air motors, **Pressure Regulating Valves, Directional Control Valves, Flow Control Valves**. methods of actuation, , use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, **Signal Processing Elements:** Use of Logic gates - OR and AND gates in pneumatic applications. Practical examples involving the use of logic gates. **Pneumatic circuits** for industrial applications & automation.	6

Books recommended :

1. Introduction to Hydraulics and Pneumatics, 2nd. ed. by **Ilango** and Soundararajan, PHI.
2. Fluid Power with Applications by A. **Esposito**, 6th Ed, Pearson Prentice Hall.
3. Pneumatic Systems : Principles and Maintenance by S.R. **Majumdar**, Tata McGraw Hill.
4. Fluid Power and Control Systems by E. C. **Fitch**, Jr, Mc Graw Hill Book Co.
5. Industrial Hydraulics by Banks and Banks, Prentice Hall.
6. Oil Hydraulic Systems, Principle and Maintenance by S R **Majumdar**, McGraw-Hill.
7. **Srinivasan**. R., "Hydraulic and Pneumatic Controls", Vijay Nicole Imprints Private Limited, 2011.
8. Fluid Power: Generation, Transmission and Control, **Jagadeesha** T., Thammaiah Gowda, Wiley.
9. Product Manuals and books from Vickers/ Eaton, FESTO, SMC pneumatics can be referred.

Reference Books:

1. Industrial Hydraulics by John **Pippenger** and Tyler Hicks, McGraw Hill.
2. William W.Reaves, "Technology of Fluid Power", Delmer Publishers, 1997.
3. Petor Rohner, "Fluid Power Logic circuit", Design Macmillon Press Ltd., 1990.
4. FESTO, "Fundamentals of Pneumatics", Vol I, II and III.
5. The Analysis & Design of Pneumatic Systems by B. W. **Anderson**, John Wiley.
6. Control of Fluid Power Analysis and Design by Mc Clay **Donaldson**, Ellis Horwood Ltd.
7. Hydraulic and Pneumatic Controls: Understanding made Easy, K.**Shanmuga** Sundaram, S.Chand & Co Book publishers, New Delhi, 2006 (Reprint 2009)
8. Basic Pneumatic Systems, Principle and Maintenance by S R Majumdar, McGraw-Hill.
9. Basic fluid power Dudley, A. Pease and John J. Pippenger, , Prentice Hall, 1987
10. Thomson, "Introduction to Fluid power", Prentice Hall, 2004.
11. Pinches, Industrial Fluid Power, Prentice hall

VI Semester
ME2363 – PE-I: Industrial Fluid Power

CO-PO Weightage details 2020 **Industrial Fluid Power (Lab)** **CODE:6ME03**

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PS	PS
CO1	To investigate the hydraulic fluids and apply the fluid power laws and principals for analysis of simple fluid power system.	3	3	2	1	3	1	2	1	1	1	2	2	3	3
CO2	To identify, analyze, and justify selection of suitable components of fluid power system for specific applications based on its function, performance and working characteristics.	3	3	3	1	3	1	1	1	1	1	2	2	3	3
CO3	To design and examine the fluid power system and to compose and interpret its circuit diagrams using standard symbols.	3	3	3	1	2	1	1	1	1	1	2	2	3	3
CO4	To examine the safety measures, maintenance, and trouble shooting for fluid power systems.	3	2	3	1	3	1	2	1	1	1	2	2	3	3

VI Semester
ME2364 – PE-I : Lab: Industrial Fluid Power

Objective	Course Outcome
• To understand the working principle of hydraulic and pneumatic components and its selection. • To design hydraulic and pneumatic circuits for different applications.	1. To **investigate** the hydraulic fluids and **apply** the fluid power laws and principals for **analysis** of simple fluid power system. 2. To **identify**, **analyze**, and **justify** selection of suitable components of fluid power system for specific applications based on its function, performance and working characteristics. 3. To **design** and **examine** the fluid power system and to **compose** and **interpret** its circuit diagrams **using** standard symbols. 4. To **examine** the safety measures, maintenance, and troubleshooting for fluid power systems.

List of Experiments: Minimum Eight out of the following areas shall be performed:

A. Experiments on Hydraulics Circuits:

1. Extend-Retract and Stop system of a linear actuator.
2. Regenerative circuit.
3. Speed Control circuits: meter-in, meter-out and bleed off.
4. Sequencing circuit
5. Use of solenoid operated DCV.
6. Traverse and Feed circuit.

B. Experiments on Pneumatic Circuits:

7. Study of Compressor, FRL unit and 5/3 DCV.
8. Reciprocating motion of a single and a double acting actuators.
9. Speed control circuits.
10. Automatic to & fro motion of a pneumatic linear actuator.
11. Sequencing circuit.
12. Logical circuits.

Other practical work:

13. Design **report** of a hydraulic or pneumatic system using **manufacturer's catalogue**.
14. Study of accumulators and intensifiers.
15. **Industrial visit** to study automation by means of hydraulic and pneumatics such as LPG bottling plant etc
16. Study of **compressed air generation and distribution** systems.
17. Study of **simple hydraulic systems** used in practice such as hydraulic clamps, jack, dumper, forklift etc.
18. **Other circuits possible on the trainer kit, relevant to the syllabus**

VI Semester
ME2364 – PE-I : Lab: Industrial Fluid Power

C. Students should build up the above circuits on computer using software and simulate the flow of fluid during the operation if possible. Afterwards, they themselves can physically connect the circuit on the hydraulic/pneumatic trainer and run the circuit.

Major Equipment:
1. A hydraulic trainer
2. A pneumatic trainer
3. Simulation Software (not mandatory)

List of Open Source Software/learning website:
1. Autosim Premium
2. Hydrosym

ACTIVE LEARNING ASSIGNMENTS:
Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered.

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech SoE and Syllabus 2020

(Revised Scheme of Examination w.e.f. 2020-21 onward)

SoE No. **ME-202.1**

MECHANICAL EGNINEERING

VI Semester

ME2365 – PE-I : I.C. Engines

Objectives:	Course Outcome
To understand basic working cycles, types and development of I.C. Engines. To study the various systems related to I.C. Engines. To understand testing and performance of Engines. To study fuels, combustion, pollution and its control of engines..	*On completion of this course, the student will be able :* 1. Student should able to analyze basic working cycles, construction and and systems of I.C. Engines. 2. Student should able to analyze fuels, combustion process, pollution and its control of engines. 3. Student should able conduct a trial for Engine performance evaluation.

Unit No.	Contents	Max. Hrs.
1	Engines classification, Working cycles and operation, P-V, Valve Timing diagrams, Engine components and their material .Engine cycle Energy Balance, various losses in the engine like Frictional losses, blow by losses, pumping loss etc. Engine Lubrication systems, cooling systems and their importance.	7
2	I.C.Engines fuel and its desirable properties. Requirements of S.I and C.I. Engine fuel Other fuel like CNG, LPG, Alcohols Rating of I.C. engine fuels	8
3	Fuel supply systems for S. I. Engine: A-F mixture requirements, Basic principle, Simple Carburetor and systems like main metering, choke, idle, acceleration pump. Operating difficulties for carburetors. Petrol Injection SPFI., MPFI, Direct Gasoline Injection, Ignition system & components for S.I.Engine - Battery, Magneto & Electronic .	8
4	Combustion in S. I. Engine: Stages of combustion with p-θ diagram. Factors affecting various stages of combustion. Abnormal combustion Pre ignition, Detonation and Knocking. HUCR,S.I.Engine combustion chamber.	7
5	Fuel supply systems for C.I.Engine: Requirements of an ideal FI system, Types of Injection, Fuel injection pumps, fuel injectors and nozzles. Combustion in C. I. Engines. Stages of combustion with p-θ diagram, Factors affecting various stages of combustion. Abnormal combustion Diesel Knock, Supercharging and turbo charging in engine.	7
6	Engine performance Parameters. MEP, Torque ,speed, power, Specific fuel consumption and various efficiencies., Air measurement, Excess air and Volumetric efficiency, Measurement and Testing of friction power ,indicated power, Brake power, Fuel consumption, Air consumption, etc. Heat balance sheet calculation. Air pollution from I.C.Engines and their control using EGR, Catalytic converters, particulate traps.	8

VI Semester
ME2365 – PE-I : I.C.Engines

.**Reference books:**

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Internal Combustion Engine Fundamentals	1988	John B. Heywood	McGraw-Hill
2	Internal Combustion Engines and Air pollution	1973	Edward F. Obert	
3	Internal Combustion Engines	2007	M. C. Mathur, R.D. Sharma.	McGraw-Hill
4	Internal Combustion Engines	2007	V. Ganesan	McGraw-Hill
5	Internal Combustion Engines	2010	V. M. Domkundwar	Dhanpat Rai & Co
6	Internal Combustion Engines	2012	R.K.Rajput	Laxmi publications (P) Ltd.

VI Semester
ME2366 – PE-I : I.C. Engines LAB

List of Practical

1. Study and demonstration of working of 2-S & 4-S Engines.
2. Study and demonstration of Lubrication & Cooling systems.
3. Study of fuel systems for S.I. engines
4. Study of fuel systems for C.I. engines.
5. Determination of Air: Fuel ratio for Petrol Engine.
6. Determination of Air: Fuel ratio for Diesel Engine
7. Determination of BP/FP/IP of Engine.
8. Heat balance sheet calculation.
9. Visit to Automobile Industry / workshop.

VI Semester
ME2367 – PE-I: Refrigeration & Cryogenic

Objectives	Course Outcome
• To study and analyse Vapour Compression Refrigeration Systems. • To study vapour absorption and other refrigeration systems. • To study and analyse Air Cycle Refrigeration Systems. • To study cryogenic technology	1. The student will be able to describe, analyze and evaluate Vapour Compression Refrigeration System. 2. The student will be able to describe and analyze other refrigeration system such as Vapour Absorption Refrigeration System, Electrolux refrigeration system, steam jet refrigeration systems, thermoelectric refrigeration and vortex tube refrigeration 3. The student will be able to describe, analyze and evaluate Air Cycle Refrigeration Systems. 4. The student will be able to describe and analyze Cryogenic Systems.

Unit No.	Contents	Max. Hrs.
1	**Air refrigeration systems** Gas cycle refrigeration, reversed Brayton /Joules/Bell Coleman cycle, aircraft refrigeration, simple cycle, boot strap cycle, reduced ambient air cycle, regenerative cycle. **[CO3]**	7
2	**Vapor Compression Refrigeration system** Introduction to refrigeration, applications of refrigeration, development of simple saturated Vapour compression Refrigeration cycle, effect of change in evaporator and condenser pressure, effect of pressure drops, polytropic compression, sub cooling, superheating. **[CO:1]**	8
3	**Multistage Refrigeration systems** Working and analysis of multistage systems multiple evaporator and multiple compressor systems. **[CO:I]**	7
4	**Components of Vapour compression system** Various components used in refrigeration system like compressors, condensers, evaporators, expansion devices and its types, cooling towers, various control use in refrigeration system **Refrigerants** Types and classification, properties and nomenclature, environment friendly refrigerants. **[CO:1]**	8
5	**Other refrigeration systems** Vapor absorption systems (NH3- H20, LiBr- H2O) , Electrolux refrigeration system, Steam jet refrigeration systems, Thermoelectric refrigeration, Vortex tube refrigeration. **[CO:2]**	7
6	**Cryogenics** Introduction and applications of cryogenics, Cascade refrigeration, Joules Thomson effect, methods of air liquefaction, Linde's and Claude's cycle .Liquefaction of hydrogen, Liquefaction of helium, cryogenic insulation. Hazards and safety, production of dry ice. **[CO:4]**	8

VI Semester
ME2367 – PE-I: Refrigeration & Cryogenic

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	The student will be able to describe, analyze and evaluate Vapour Compression Refrigeration System.	3		3		3							3	3	3
CO2	The student will be able to describe and analyze other refrigeration system such as Vapour Absorption Refrigeration System, Electrolux refrigeration system, steam jet refrigeration systems, thermoelectric refrigeration and vortex tube refrigeration	3		3		3							3	3	3
CO3	The student will be able to describe, analyze and evaluate Air Cycle Refrigeration Systems.	3		3		3							3	3	3
CO4	The student will be able to describe and analyze Cryogenic Systems.	3		3		3							3	3	3

Recommended Books:

1. Dossat Roy J.; Principles of Refrigeration, 4th Ed.; Pearson Education Asia Publication
2. Arora C.P.; Refrigeration and Air conditioning, 2nd Ed.; Tata Mc Graw Hill Publication
3. Ballaney P.L.; Refrigeration and Air conditioning; Khanna publishers
4. Prasad Manohar; Refrigeration and Air conditioning, 2nd Ed.; New edge Publication
5. Arora, Domkundwar; A course in Ref. &Air Conditioning, 7th Ed.; Dhanpat Rai Publications.
6. Pita Edward G.; Air conditioning principles and systems, 4th Ed.; Prentice Hall
7. ASHRAE handbook and CARRIER hand book.

VI Semester
ME2368 – PE-I: Refrigeration & Cryogenic Lab

Objectives	Course outcome
1 To study and analyse Vapour Compression Refrigeration Systems. 2 To study vapour absorption and other refrigeration systems. 3 To study various components used in Refrigeration Systems. 4 To study the refrigeration system and components used in Industry.	1. The student will be able to describe and analyse Vapour Compression Refrigeration System. 2. Student will be able to describe various components and controls used in vapour compression refrigeration system 3. The student will be able to describe Vapour Absorption Refrigeration System. 4. Student will be able to describe refrigeration system and other components used in Industry.

List of experiment

1. Experiment on Determination of COP of Refrigeration trainer [CO:1]
2. Trial on ice-plant test rig [CO:1]
3. Study of expansion devices used in vapour compression refrigeration system [CO:2]
4. Study of condensers and cooling towers used in vapour compression refrigeration system [CO:2]
5. Study of Evaporators used in vapour compression refrigeration system [CO:2]
6. Study of vapour absorption refrigeration system [CO:3]
7. Study of Electrolux refrigeration system [CO:3]
8. Study of controls used in refrigeration system [CO:2]
9. Visit to air liquefaction plant [CO:4]
10. Visit to cold storage [CO:4]
11. Visit to Industrial cooling tower [CO:4]
12. Visit to ice plant [CO:4]

VI Semester
ME2368 – PE-I: Refrigeration & Cryogenic Lab

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	The student will be able to describe, analyse and evaluate Vapour Compression Refrigeration System.	3		3		3			3				3	3	3
CO2	Student will be able to describe various components and control used in vapour compression refrigeration system	3		3		3			3				3	3	3
CO3	The student will be able to describe Vapour Absorption Refrigeration System	3		3		3			3				3	3	3
CO4	Student will be able to describe refrigeration system and other components used in Industry.	3		3		3			3				3	3	3

VI Semester
ME2369 – PE-I: Computer Integrated Manufacturing

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.	CO1 : The Students will have ability to design and evaluate experimentation on CNC machines. CO2: Designing of GT cell layouts for transforming into flexible manufacturing system. CO3: The students will be able to compose and transform robot programs various industrial applications. CO4: The students will have ability to justify CAPP and CAQC to design computer integrated manufacturing

Unit No.	Contents	Max. Hrs.
1	Concept and scope of CIM, components of CIM, benefits, limitations.Basics of computer graphics NC basics, NC words, Manual part programming (NC part programming) Punch Tape, Tape Format CNC , DNC, APT programming Adaptive control, application. Tooling for CNC machine.	7
2	Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT. Part families , classification and coding , Production flow analysis , Machine cell design , Benefits	7
3	Introduction & Components of FMS , Application work stations , Computer control and functions , Planning, scheduling and control of FMS , Scheduling , Knowledge based scheduling , Hierarchy of computer control , Supervisory computer Manufacturing data systems , data flow , CAD/CAM considerations , Planning FMS database	8
4	Industrial robotics Robot anatomy, Robot control, accuracy, repeatability, End Effectors Sensor, Introduction to robot programming, Robot application (Material handling processing assembly and inspection) introduction to robot Kinematics.	8
5	Process Planning in the Manufacturing cycle , Process Planning and Production Planning Process Planning and Concurrent Engineering, CAPP, Variant process planning , Generative approach , Forward and Backward planning, Input format, Logical Design of a Process Planning , Implementation considerations ,manufacturing system components, Automated material handling systems, AS/RS, general considerations , selection, evaluation and control . Inspection and Quality control, CAQC, CMM types, working, applications Expert process planning	10
6	Totally integrated process planning systems, Integration of CNC robotics for CIM, Agile manufacturing, Nano Manufacturing. Simulation	5

VI Semester
ME2369 – PE-I: Computer Integrated Manufacturing

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Systems Approach to Computer Integrated Design and Manufacturing	1996	Nanua Singh	John Wiley & Sons, 1996.
2	Automation, Production Systems and Computer Integrated Manufacturing	2002	Groover M.P	Prentice-Hall of India Pvt. Ltd., New Delhi, 2002
3	Handbook of Flexible Manufacturing Systems	1991	Jha, N.K	Academic Press Inc., 1991
4	Group Technology in Engineering Industry	1979	Burbidge, J.L	Mechanical Engineering pub. London, 1979.
5	G.T Planning and Operation, in The automated factory-HandBook: Technology and Management	1991	Askin, R.G. and Vakharia, A.J	Cleland, D.I. and Bidananda, B (Eds), TAB Books, NY, 1991.
6	Cellular Manufacturing Systems		Irani, S.A	Hand Book
7	Planning, design and analysis of cellular manufacturing systems	1995	Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds)	Elsevier

VI Semester
ME2370 – PE-I: Computer Integrated Manufacturing Laboratory

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.	CO1 : The Students will have ability to design and evaluate experimentation on CNC machines. CO2: Designing of GT cell layouts for transforming into flexible manufacturing system. CO3: The students will be able to compose and transform robot programs various industrial applications. CO4: The students will have ability to justify CAPP and CAQC to design computer integrated manufacturing

List of Practical

1. Study of CIM.
2. Study of CAD systems
3. Numerical control – Fundamental & Application
4. CNC- Lathe – Features, Specification, & Part Program.
5. CNC- Milling – Features, Specification, & Part Program.
6. Group Technology.
7. FMS & CIM.
8. Computer Aided Process Planning.
9. Manual Part Programming.
10. APT Part Programming.
11. Robots Fundamental and Applications
12. AGVS- Fundamental and applications
13. CNC Lathe – Programming, Simulation & Actual Machining of Part.(Thread Cutting , Facing , Turning , Grooving etc.)
14. CNC Milling – Programming , Simulation & Actual Machining of Part. (Profile Cutting , Various Interpolation , Pocketing , Mirroring etc.)
15. Programming , Simulation of Robot

VI Semester
ME2371 – PE-I: Mechatronics

Objective	Course Outcome
(1) Understand the concept of Mechatronics (2) Develop the ability to understand the working of various electronically and computer control devices. (3) Concept development to bridge the existing gap between machines, Automation and Computer control system.**[a,b,c,i,j]**	(I) Students will be able to model various mechatronic systems.
	(II) Students will be able to understand the working of various motors used in mechatronic systems
	Analyze the characteristics and use of various IC's.
	(III) Student will be able to analyze the characteristics and use various IC's.
	(IV) Students will be able to analyze the internal hardware structure in Mechatronics Systems.

Unit No.	Contents	Max. Hrs.
1	Introduction, sensors, actuators, modeling of systems. Recent trend of designing machine units along with electronic circuits for operation and supervision of mechanisms. Techniques of interfacing mechanical devices with computer hardware.	7
2	Basic principles ,working and specific applications of armature and field controlled D.C. Motors, Variable voltage and variable frequency control of 3 phase and single phase Induction motors, speed control of synchronous motors, Different types of stepper motors-Constriction ,working and application. Position control of stepper motors.	8
3	Common and commercial I.Cs used for amplification, timing and digital indication. Different types of actuators, working of synchro-transmitter and receiver set, Pressure to current (P/I) and I/P conversion. Electrical and hydraulic servomotors. Design of solenoid plungers and pressure and force amplification devices.	8
4	Add-on cards for sampling and actuation, 4-20 mA ports, AD-DA conversion, Peripheral interface organization, general layout of data bus and data transfer through serial and parallel modes of communication, schemes of computer networking and hierarchy in supervisory control.	7
5	Study of various integrated systems by using block diagrams. Study of systems used in Ink Jet Printers, Photo copying, Washing Machines, IC Engine fuel injection system etc	7
6	General philosophy of Artificial Neural Network simulations, Fuzzy logic for operation and control of mechatronic systems.	7

VI Semester
ME2371 – PE-I: Mechatronics

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Introduction to Mechatronics and Measurement Systems	2007	Michael B.Histand and David G. Alciatore	Tata McGraw-Hill Education
2	Mechatronics	2007	Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ.,	Chapman and Hall, 1991
3	Microprocessor Architecture, Programming and Applications	2002	Ramesh.S, Gaonkar	Prentice Hall
4	Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics	1996	Lawrence J.Kamm	John Wiley and Sons
5	Introduction to Microprocessors for Engineers and Scientists	2004	Ghosh, P.K. and Sridhar	PHI Learning Pvt. Ltd.

VI Semester
ME2372 – PE-I: Mechatronics Laboratory

Objective	Course Outcome
(1) Understand the concept of Mechatronics (2) Develop the ability to understand the working of various electronically and computer control devices. (3) Concept development to bridge the existing gap between machines, Automation and Computer control system.	(I) Students will be able to model various mechatronic systems.. (II) Students will be able to understand the working of various motors used in mechatronic systems. Analyze the characteristics and use of various IC's. (III) Student will be able to analyze the characteristics and use various IC's. (IV) Students will be able to analyze the internal hardware structure in Mechatronics Systems.

List of Practical (Minimum 10 Experiments)

1. Verification of P, P+I, P+D, P+I+D control actions.
2. Demonstration on XY position control systems.
3. Demonstration on linear conveyor control system.
4. Demonstration on rotary table positioning systems.
5. Demonstration on different switches and relays.
6. Analysis of control system using software like MATLAB/SIMULINK or equivalent.
7. Development of ladder diagram/programming PLC for level control, position control or any other mechanical engineering application.
8. Demonstration on A/D and D/A converters.
9. Demonstration on Flip Flops and Timers.
10. Demonstration on Application of Op – Amp circuits.
11. Demonstration on Data acquisition system.
12. Demonstration on Microcontrollers.

VI Semester
ME2373 – PE-I : Thermal Engineering Systems

Objective	Course Outcome
	CO:1 The student will be able to describe and analyze the Solar and Biogas Energy Systems [**PO: 1,2,3,4,5,6,7,8,9,10,11,12 PSO-1,2**] **CO:2** The student will be able to describe and analyze the working of I.C.Engines. [**PO: 1,2,3,4,5,7,8,9,10,11,12 PSO-1,2**] **CO:3** The student will be able to describe and analyze the working of Refrigeration systems [**PO: 1,2,3,4,5,7,8,9,10,11,12 PSO-1,2**] **CO:4** The student will be able to define evaluate Psychromatic properties and; describe and analyze the air conditioning processes. [**PO: 1,2,3,4,5,7,8,9,10,11,12 PSO-1,2**]

Unit No.	Contents	Max. Hrs.
1	Solar Energy: Introduction, solar constant, spectral distribution of solar radiation, beam & deffuse radiation, Solar radiation geometry, solar angles, estimation of average solar radiation, radiation on horizontal and tilted tilted surface.	5
2	Solar flat plate collectors: Types of collectors, liquid flat plate collectors, solar air heaters Concentrating collectors: line focusing, point focusing and non focusing type Applications of solar energy to water heating, space heating, space cooling, drying refrigeration, distillation, pumping. Solar furnaces, solar cookers, solar thermal electric conversion, solar photo- voltaics	6
3	***Wind Energy:*** **-**Power in wind, forces on blades, wind energy: Basic principle of wind energy conversion, basic components of WECS Classification of WEC systems, savonius and darrieus rotars applications of wind energy ***Biogas: -*** Introduction, bio gas generation, fixed dome & floating drum biogas plants their constructional details, raw material for biogas production, factors affecting generation of biogas and methods of maintaining biogas, production, fuel properties of biogas and utilisation of biogas	5
4	I.C.Engines: Air standard cycles, parts of I.C.Engines, working of I.C. Engines, Classification of IC Engines, I.C.Engines Testing:-Measurement of power: indicated, friction &brake power, measurement of speed, fuel & air consumption, calculation of indicated &brake thermal efficiency, volumetric efficiency, mechanical efficiency, Heat balance sheet.	6

VI Semester
ME2373 – PE-I : Thermal Engineering Systems

5	Refrigeration: Introduction, unit of refrigeration, Vapour compression refrigeration system.	5
6	Air conditioning: Introduction, psychrometric properties, Evaporative cooling, Bypass factor, Air Conditioning Processes, Typical summer and winter air conditioning system(concept only). **[CO:4]**	6

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	3	2	3	3	2	2	3	3	3	3	3	3	3
CO2		3	3	1	2	3	1	1	2	2	2	1	2	3	3
CO3		3	3	1	2	3	1	1	2	2	2	1	2	3	3
CO4		3	3	1	2	3	1	1	2	2	2	1	2	3	3

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Non Conventional Energy Sources - G D Rai	2000	Dr.C.P. Arora	Tata McGraw-Hill Education
2	Solar Energy	2008	Dr.. -S.P. Sukhatme	Tata McGraw-Hill
3	Internal Combustion Engines	2007	V. Ganesan	McGraw-Hill
4	Refrigeration & Air Conditioning	2nd Edition (2000)	C.P. Arora	Tata McGraw Hill

REFERENCE BOOKS:

1	Refrigeration & Air-conditioning	1986	Stocker & Jones	McGraw-Hill
2	Principle of Refrigeration & Air-conditioning	1997	Roy J.Dossat	Prentice Hall
3	ASHRAE hand books	2003		ASHRAE
4	Air conditioning Principles & System. Energy approach	1989	E.G. Pita	Wiley
6	Basic Refrigeration& Air-conditioning	2005	P.N. Ananthnarayanan	Tata McGraw-Hill Education

VI Semester
ME2374 – PE-I : Thermal Engineering Systems Laboratory

List of Practical

A set of 8 Experiments from following list to be performed.

1. Solar Radiation Measurements **[CO:1]**
2. Flat Plate Solar Water Heater **[CO:1]**
3. Flat Plate Solar Air Heater **[CO:1]**
4. Flat Plate Collector with Reflector **[CO:1]**
5. Parabolic Tube Collector **[CO:1]**
6. Evacuated Tube Collector **[CO:1]**
7. Solar Cookers 8. Thermal Storage System **[CO:1]**
8. Study on Solar Cell Characteristics**[CO:1]**
9. Demostration of 2 stroke and 4 stroke engine **[CO:2]**
10. Performance testing of a single cylinder I.C. Engine. **[CO:2]**
11. Trial on Multicylinder Petrol Engine with energy balance sheet. **[CO:2]**
12. Heat balance on Multicylinder Diesel Engine. **[CO:2]**
13. Performance on Vapor Compression Refrigeration System (VCRS). **[CO:3]**
14. Experiment on desert cooler. **[CO:4]**
15. Demonstration & Study on household Refrigerator. **[CO:3]**
16. Performance on air-conditioning system. **[CO:4]**

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	3	2	3	3	2	2	3	3	3	3	3	3	3
CO2		3	3	1	2	3	1	1	2	2	2	1	2	3	3
CO3		3	3	1	2	3	1	1	2	2	2	1	2	3	3
CO4		3	3	1	2	3	1	1	2	2	2	1	2	3	3

VI Semester
OE-III : ME2381 – Operation Research Techniques

Objective	Course Outcome
The course aims to develop the engineering - analysis capability for engineering-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course.	After completion of this course, Students will be able to 1) Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method. 2) To Solve Transportation and Assignment Models and analyze the concept of dynamic programming to Solve problems of discreet and continuous variables. 3) Analyze projects for minimum total cost and smooth level of resources. 4) Evaluation of different replacement policies and its application in operation research and analysis of the application of simulation, inventory control model and waiting line model.

Unit No.	Contents	Max. Hrs.
1	Introduction to OR & Basic OR Models, Definition Characteristics and limitations of OR. Linear programming solutions (LPP) by graphical methods and simplex method. Sensitivity analysis. **(CO-1)**	7
2	Assignment Model and Transportation Model. **(CO-2)**	7
3	Dynamic programming - characteristics, approach and its formulations. Application of Dynamic programming in Employment smoothening problem, Resource allocation, Inventory control & Linear programming. (CO- 2) [6 hrs]	6
4	Project Management: Network Scheduling by CPM & PERT, Cost considerations in PERT and CPM. **(CO- 3)**	7
5	Replacement Models: Replacement of Models that deteriorate with time,Concept of equivalence , Interest Rate and Present worth. Replacement of items that fails suddenly considering Individual and Group replacement policy. **(CO- 4)**	6
6	Queuing Theory: Queuing Systems, Kendelalls for representing queuing models, Classification of queuing models (No derivations expected), Simulations, Monte- Carlo Simulation. Inventory Control with Deterministic models. (CO- 4)	4

VI Semester
OE-III : ME2381 – Operation Research Techniques

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PS	PS
CO	Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method.	3				3	2			1				3	
CO	To Solve transportation and Assignment Models and analyse the concept of dynamic programming to Solve problems of discreet and continuous variables.	3				2	3			3				3	
CO	Analyze projects for minimum total cost and smooth level of resources.	3			2	2	2				2	3		3	
CO	Evaluation of different replacement policies and its application in operation research and analyse of the application of simulation, inventory control model and waiting line mode.	3				2	2	1	1			2	3	3	

Text books:

Sr. No	Title of the book	Edition(Year of publication)	Author(s)	Publisher
1	Introduction to Operation Research: Computer Oriented Algorithmic approach	2007	Billy E.Gillet	Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2	Operations Research	Third edition 2008	Prem Kumar Gupta & D.S. Hira	S. Chand& Co.
3	Operations Research: Theory and Applications	Second edition 2002	J.K. Sharma	Mac Millan
4	Introductory Operations Research	2006	S.C. Sharma	Discovery Publishing House
5	Optimization Theory and Application	Second edition 2010	S.S. Rao	Halsted Press
6	Operations Research - An Introduction	Ninth Edition 2010	Hamdy A. Taha	Prentice Hall of India Pvt. Ltd., New Delhi.

VI Semester
OE-III : ME2382 – Automobile Engineering

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular automobiles. The modernization in automobile is also included to understand recent trend in the field.	(1) Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle.
	(2) Student will be able to describe various power transmission systems from clutch to wheel in vehicle.
	(3) Student will be able to evaluate and describe control systems like steering and brakes in vehicle.
	(4) Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.

Unit No.	Contents	Max. Hrs.
1	• Introduction, Automobile history and development and classification. Vehicles layout. • Engine Classification, construction and working 2 stroke and 4-stroke cycle. • Introduction to Fuel supply system: Carburettor and fuel injection.(Only basic) • Engine cooling and lubrication systems. [CO-1]	7
2	Clutch – Necessity, requirements of a clutch system. Types of Clutches: Single & multi plate clutch, Diaphragm clutch and centrifugal clutch. Gear box: Necessity of gear box with gear theory, working principle, Classification: Sliding mesh, constant mesh, synchromesh, and Transfer case gear box, Gear Selector mechanism, Defects and remedies in Gear box. Working of CVT (Continuous variable transmission) [CO-2]	6
3	• Transmission system: Propeller shaft, Universal joint, Hotchkiss drive, torque tube drive. • Differential - Need and working principle and Differential lock. • Rear Axles and Front Axles • Wheel and Tyres: Classification, various constituents of tyres with cross section, specification, factors affecting tyre performance. [CO-2]	7
4	• Steering systems, principle of steering, steering linkages, steering geometry and wheel alignment, steering gear box and its types. • Brakes - Need, types: Mechanical, hydraulic (Master and wheel cylinder), Air brakes. Drum and Disc brakes, Comparison • Suspension systems – Function, conventional and Independent suspension System, Telescopic shock absorber. [CO-3]	6
5	• Electrical systems: Battery construction. Specification. Operation and maintenance of Batteries. • Alternator, starter motor, Battery Ignition and magneto ignition systems, Lighting, Horn, Side indicator , wiper.(only basic) • Automobile air-conditioning, • Panel board instruments. [CO-4]	6

VI Semester
OE-III : ME2382 – Automobile Engineering

Unit No.	Contents	Max. Hrs.
6	• Resistance to vehicle motion: Air, Road and gradient resistance and power calculation. • Advances in automobiles such as ABS, Power Steering. • Safety aspect in Automobile. • Overall Vehicle specifications • Servicing, Overhauling and Engine tune up. [CO-4]	6

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PS	PS
CO	Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle.	3	2												3
CO	Student will be able to describe_various power transmission systems from clutch to wheel in vehicle.	3	2												3
CO	Student will be able to evaluate and describe control systems like steering and brakes in vehicle.	3	2												3
CO	Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.	3			2					2					3

Reference books:

S.N.	Title of Book	Edition	Authors	Publication
1	Automotive Technology		H.M.Sethi	Tata McgraHill
2	Automobile Engineering-I & II	First Edition - 2010	P.S.Gill	S.K.Kataria & sons
3	Automotive Mechanics		Joseph Heitner	
4	Motor Vehicle Technology		J.A. Dolan	
5	Automotive Engines		W.H. Crouse	

VI Semester
OE-III : ME2383 – Control Systems Engineering

Course Objectives	Course Outcome
• To develop an ability to define transfer function. • To analyze the performance of control system in time domain and frequency domain.	(I) Describe the mathematical representation of various control system components and determine the transfer function of mechanical, electrical, thermal and fluid system. (II) Analyse the construction and working of various control system components and electrical motors. (III) Evaluate the performance of control system using time response analysis and stability analysis. (IV) Analyze the performance of control system on the basis of frequency response and design suitable compensation for the control system

Unit No.	Contents	Max. Hrs.
1	Introduction, System concept Open and Closed loop control systems. Transfer function, Mathematical Modeling of Physical System and system representation through Block Diagram. Transfer function through Block Diagram Simplification. Signal Flow Graph, Masons Gain Formula Block diagrams of various control systems.	7
2	Representation of Control components: Mechanical and Electrical components; Analogous systems; Thermal and Fluid systems.	7
3	Electrical systems: - ac/dc servomotors; field controlled and armature controlled servomotors; positional servomechanisms; stepper motors. Hydraulic systems: - Hydraulic pumps (gear; vane; and reciprocating piston) Cylinders, Direction control valves (2, 3, 4 way) Flow control valve; Relief valve Hydraulic servomotor.	8
4	Transient and steady state response of first and second order systems Concept of stability; relative stability; Routh stability criteria.	8
5	Frequency response and its characteristics; Bode plots; Nyquist plots. Gain margin and phase margin. Identification of system transfer function.	8
6	Basic control actions; Proportional Integral and Derivative control actions and their effect on system performance. Root locus technique. Introduction to control system design log load compensation Feed Back Compensation and Pole -Zero placements.	7

Text books:

1	Modern Control Engineering	3rd Edition (2009	Ogata	Prentice Hall
2	Control system Engineering	4th Edition (2007)	Nise	John Wiley & Sons
3	Control system	4th Edition (2009)	Nagrath & Gopal	New Age International
4	Modern Control System	12th Edition (2009)	Dorf	pearson

VI Semester

OE-III : ME2384 – Robotics and Subtractive Manufacturing

VI Semester
OE-IV : ME2391 – Total Quality Management

COURSE OBJECTIVES	COURSE OUTCOMES
• The course aims to build an overall capability to understand Quality and its relevance in today's dynamic market. • Various Quality Improvement tools and technique shall be introduced and practiced so as to develop skills and knowledge to function as a good quality professional in the Engineering Profession.	1. Develop an understanding on quality management philosophies and frameworks. 2. Develop in-depth knowledge on various tools and techniques of quality management. 3. To Evaluate the applications of quality tools and techniques in both manufacturing and service industry 4. Ability to use quality management methods analyzing and solving problems of organization.

Unit No.	Contents	Max. Hrs.
1	Principles of Quality Management, Pioneers of TQM, Quality costs, Quality system Customer Orientation, Benchmarking, Re-engineering	7
2	Leadership, Organizational Structure, Team Building, Information Systems and Documentation – Quality Auditing, ISO 9000 - QS 9000.QMS, Quality awards.	7
3	Single Vendor Concept, J.I.T., Quality Function deployment, Quality Circles, KAIZEN, SGA POKA -YOKE, Taguchi Methods. SMED, Kanban system. Cost of quality. Robust design	8
4	Methods and Philosophy of Statistical Process Control, Control Charts for Variables and Attributes	8
5	Cumulative sum and exponentially weighted moving average control charts, Others SPC Techniques – Process Capability Analysis. Acceptance Sampling Problem, Single Sampling Plans for attributes, double, multiple and sequential sampling,	8
6	Six sigma manufacturing concepts. Six-sigma philosophy Quality strategy and policy. Motivation and leadership theories. Continuous vs. breakthrough improvements. Management of change, DMAIC Methodology. Lean manufacturing	7

VI Semester
OE-IV : ME2391 – Total Quality Management

Reference books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Total Quality Management for Engineers	1991	Mohamed Zairi	Woodhead Publishing Limited 1991
2	Production and Operations mangament - Total Quality and Responsiveness	1995	Harvid Noori and Russel	McGraw-Hill Inc, 1995
3	Managing for Total Quality	1998	N.Logothetis	Prentice Hall of India Pvt .Ltd,1998
4	The Essence of Total Quality Management	1995	John Bank	Prentice Hall of India Pvt.Ltd., 1995.
5	Introduction to Statistical Quality Control	1991	Douglus C. Montgomery	2nd Edition, John Wiley and Sons, 1991.
6	Statistical Quality Control	1984	Grant E.L and Leavensworth	McGraw-Hill, 1984.

VI Semester
OE-IV : ME2392 – Reliability Engineering

Objective	Course Outcome
1.To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply a few well understood basic principles to find its solution. 2.Learn how to get higher operating plant and equipment reliability that lifts efficiency and output of operating assets, stops equipment failures and creates higher plant and equipment reliability, with this subject.	(I) Student will be able to use reliability modeling as a tool for evaluating system performance. (II) Student will be able to analyze the failure of a machine, determine the failure rate of systems or components. (III) Student will able to understand importance of the maintenance of engineering systems and factors affecting maintainability. (IV) Student will be able to prepare the production & maintenance schedule of particular engineering system.

Unit No.	Contents	Max. Hrs.
1	Fundamental concepts:- Reliability definitions, failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, maintainability, availability , safety and reliability, Quality, cost and system effectiveness, Life characteristic phases, modes of failure, Quality and reliability assurance rules, product liability, Importance of Reliability,	7
2	Probability theory:- Set theory, laws of probability, total probability theorem, probability distributions, parameters and applications.	8
3	System reliability and modeling: Series and parallel components, mixed configuration, complex systems. Redundancy, element redundancy, unit redundancy, standby redundancy. Types of stand by redundancy, parallel components. Markov models for reliability estimation.	7
4	Maintainability and Availability: Objectives of maintenance, types of maintenance, Maintainability, factors affecting maintainability, system down time. Availability - Inherent, Achieved and Operational availability, reliability and maintainability trade-off. Markov models for availability estimation.	8
5	System reliability Analysis: Reliability allocation or apportionment. Reliability apportionment techniques . Reliability block diagrams and models. Reliability predictions. Life testing and accelerated testing.	7
6	Strength based reliability: Safety factor, safety margin, Stress strength interaction, Failure Mode, Effects and Criticality Analysis-, , FMECA examples, Ishikawa diagram .fault tree construction, basic symbols development of functional reliability block diagram, Fault tree analysis, fault tree evaluation techniques, Design of Mechanical components and systems:-Material strengths and loads.	8

VI Semester
OE-IV : ME2392 – Reliability Engineering

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Concepts of Reliability Engg	1985	L.S. Srinath	Affiliated East-Wast Press (P) Ltd
2	Reliability Engineering	1983	A.K. Govil	Tata McGraw-Hill Publishing Co. Ltd
3	Reliability Engineering	1984	E. Balagurusmy	Tata McGraw-Hill Publishing Co. Ltd
4	Engineering Reliability	1980	B.S. Dhillion, C. Singh	John Wiley & Sons
5	Probabilistic, Reliability	1968	M.L. Shooman	McGraw-Hill Book Co.,
6	Practical Reliability Engg	1985	Patric D.T.O'connor	Heyden and sons ltd.
7	Reliability in Engineering Design	1977	K.C. Kapur, L.R. Lamberson	John-Wiley and sons.
8	Reliability Engineering, Theory and Practice	Third Edition, 1999	A.Birolini	Springer,

VI Semester
OE-IV : ME2393 – Power Generation Engineering

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular automobiles. The modernization in automobile is also included to understand recent trend in the field.	(1) Student will be able to describe basics of power generations systems.
	(2) Student will be able to analyze various conventional & non-conventional power plants.
	(3) Student will be able to analyze and examine combined operations of different power plants.
	(4) Student will be able to evaluate and describe Hydroelectric power plant nuclear power plant

Unit No.	Contents	Max. Hrs.
1	**THERMAL POWER PLANT- I** Introduction to thermal power plants and power plant layouts. Site selection. Fuel characteristics, handling, storage, preparation & firing methods. Ash & dust collection and handling. • Boiler: classification, general arrangement, details of different components and system like draught system, steam turbine systems, condenser, cooling towers **[CO-1]**	7
2	**THERMAL POWER PLANT- II** Gas Turbine Power Plant: -Introduction, power plant layouts, Open cycle, close cycle power plants. Various components and systems. Methods to improve efficiency. Reheat and Regeneration cycle and their combinations Diesel Electric Power Plant: - Introduction, Outline, type of engines, different components, performance, plant layout. Comparison with other power plant. (visit to nearby power plant shall be arrange for the students) **[CO-2]**	8
3	**HYDROELECTRIC POWER PLANT.** Hydrology: - Rainfall, Runoff, Hydro graph, flow duration curve, mass curve. Hydroelectric power plant: - Site selection, classification of hydroelectric power plant, general arrangement, details of different components, turbine selection. Governing. • Comparison with other power plant. **[CO-2]**	7
4	**POWER PLANT ECONOMICS** Load Analysis - Fluctuating Load on power plants, Load curves, various terms & definition, peak load, effect of fluctuating load. • Economic Analysis: - Cost of electric energy **[CO-3]**	4
5	**NUCLEAR POWER PLANT** Introduction to Nuclear Engineering, Global scenario, prominent installations worldwide, present & proposed nuclear plant in India. Nuclear Reactors: - Types of reactors, PWR, BWR, CANDU, Gas cooled, liquid metal cooled, Breeder reactor. Operational requirements and difficulties, site selection for location of a nuclear power station Nuclear Waste Disposal. • Comparison with other power plant. **[CO-4]**	8

VI Semester
OE-IV : ME2393 – Power Generation Engineering

Unit No.	Contents	Max. Hrs.
6	**COMBINED OPERATION OF DIFFERENT POWER PLANTS** Combined operation: - Need division, combination of different plant & their coordination, advantages. **NON CONVENTIONAL POWER GENERATION SYSTEMS** Introduction to Non Conventional power Generation Systems • Geo-Thermal Power Plant, Tidal Power Plant, Wind Power Plant, Solar Power Plant. **CO-4]**	7

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PS	PS
CO	Student will be able to describe basics of power generations systems.	3	2												3
CO	Student will be able to analyze various conventional & non-conventional power plants.	3	2												3
CO	Student will be able to analyze and examine combined operations of different power plants.	3	2												3
CO	Student will be able to evaluate and describe Hydroelectric power plant nuclear power plant	3			2					2					3

Reference books:

S.N.	Title of Book	Edition	Authors	Publication
1	Power Plant Engineering	2002	Domkundwar.	Dhanpat Rai & Co.
2	Power Plant Engineering	2007	Vopal & Slortzki	
3	Power Plant Engineering	2010	P K Nag	

VI Semester
OE-IV : ME2394 – Project Evaluation & Management

Objective	Course Outcome
The course focuses on developing complete understanding of formulating a problem/project and finding possible solutions against the given constraints. The overall learning shall resolve project identification evaluating its technical and economic feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details.	The students will be able 1. To apply the concepts of monitoring and evaluation, appraise 2. To analyse the best monitoring methods, appreciate evaluation in the context of developmental project work 3. to perform problem analysis, determine relevant indicators and data necessary for evaluation, 4. Implement a monitoring and evaluation process, establish baselines and targets..

Unit No.	Contents	Max. Hrs.
1	**Project Identification** considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project demand forecasting, secondary data, accuracy, confidence level, uncertainty	7
2	**Technical feasibility**: Process selection, Level of automation, plant capacity, acquiring technology, Appropriate technology plant location, Equipment selection & procurement, Govt. policies. Value analysis and project evaluation:	7
3	**Economic feasibility:** Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Breakeven point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes.	9
4	**Project Planning and Control:** Work break down structure and network development. Basic Scheduling, Critical Path and four kinds of floats. Scheduling under probabilistic durations, Time Cost tradeoffs, CPM, PERT, Optimum project duration, resource allocation, updating	7
5	**Project report:** Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital	7
6	Initial review, performance analysis, ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion environ-mental & social aspects.	8

VI Semester
OE-IV : ME2394 – Project Evaluation & Management

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Projects	Seventh edition 2007	Prasanna chandra	Tata mc graw Hill publishing company Ltd.
2	CPM & PERT		L. S. Srinath	East West publisher
3	Projects	1963	P.K. Joy	Macmillon
4	Engineering Economy	Fifth edition	H. G Thuesen, W J Fabricky, G,J, Thuersen	Prentice-Hall
5	Finance series 'Project management' , Vol-I1 and Vol-III	2009	ICFAI	ICFAI,Press Hyderabad
6	Finance Management	Sixth edition 2010	M.Y.Khan	Tata McGraw hill
7	Financial Management	Fourth edition	Chandra, Prasanna	Tata McGraw-Hill Education, 1997
8	Engineering Economics	Eighth edition	G. J. Thuesen, Wolter J. Fabrycky	Prentice Hall, 1993

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PS	PS
CO	Analyze and solve the problems of unidirectional steady state heat conduction and lumped heat capacitance systems.	3	3	3	2	3	1	2	1	1	1	2	2	3	3
CO	Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient.	3	3	3	2	3	1	2	1	1	1	2	2	3	3
CO	Design & analyze the heat exchangers with LMTD & ϵ-NTU methods.	3	3	3	2	3	1	2	1	1	1	2	2	3	3
CO	Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships.	3	3	3	2	3	1	2	1	1	1	2	2	3	3

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

7th & 8th Semester

Mechanical Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. ME-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	ME2401	Automation In Production	**T**	3	0	0	3	3	30	20	50	3
2	7	PC	ME2402	**Lab:-** Automation In Production	**P**	0	0	2	2	1		60	40	
3	7	PE		Professional Elective II	**T**	3	0	0	3	3	30	20	50	3
4	7	PE		Professional Elective III	**T**	3	0	0	3	3	30	20	50	3
5	7	PE		**Lab:-** Professional Elective III	**P**	0	0	2	2	1		60	40	
6	7	PE		Professional Elective IV	**T**	3	0	0	3	3	30	20	50	3
7	7	PE		Professional Elective V	**T**	3	0	0	3	3	30	20	50	3
8	7	STR	ME2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	ME2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				
Professional Electives -II														
1	7	PE-II	ME2411	PE II : Tool Design										
2	7	PE-II	ME2412	PE II : Additive Manufacturing										
3	7	PE-II	ME2413	PE II : Fuel Cell Technology										
4	7	PE-II	ME2414	PE II : Refrigeration and Air Conditioning										
5	7	PE-II	ME2415	PE II : Material Handling Systems										
6	7	PE-II	ME2416	PE II : Reliability Engineering										
7	7	PE-II	ME2417	PE II : Advanced Manufacturing Techniques										
8	7	PE-II	ME2418	PE II : Optimization Techniques										
Professional Electives -III														
9	7	PE-III	ME2421	PE III : Vibration										
10	7	PE-III	ME2422	PE III : Lab:- Vibration										
11	7	PE-III	ME2423	PE III : Comuter Aidded Design and Manufacturing										
12	7	PE-III	ME2424	PE III : Lab:- Comuter Aidded Design and Manufacturing										
13	7	PE-III	ME2425	PE III : Vehicle Engineering										
14	7	PE-III	ME2426	PE III : Lab:- Vehicle Engineering										
15	7	PE-III	ME2427	PE III : Solar Energy and It'S Utilisation										
16	7	PE-III	ME2428	PE III : Lab:- Solar Energy and It'S Utilisation										
17	7	PE-III	ME2429	PE III : CNC & Robotics										
18	7	PE-III	ME2430	PE III : Lab:- CNC & Robotics										
19	7	PE-III	ME2433	PE III :Pipe Design Engineering										
20	7	PE-III	ME2434	PE III : Lab:- Pipe Design Engineering										
21	7	PE-III	ME2435	PE III : Earth Moving Equipments										
22	7	PE-III	ME2436	PE III : Lab:- Earth Moving Equipments										
Professional Electives -IV														
23	7	PE-IV	ME2441	PE IV : Sysnthesis of Mechanism										
24	7	PE-IV	ME2442	PE IV : Design for Manufacturing & Assembly										
25	7	PE-IV	ME2443	PE IV : Renewable Energy System										
26	7	PE-IV	ME2444	PE IV : Engineering of Plastics										
27	7	PE-IV	ME2445	PE IV : Finance & Cost Management										
28	7	PE-IV	ME2446	PE IV : Artificial Intelligence										
29	7	PE-IV	ME2447	PE IV : Maintenance Management										
30	7	PE-IV	ME2448	PE IV : Total Quality Management										
31	7	PE-IV	ME2449	PE IV : Project Evaluation & Management										
Professional Electives -V														
32	7	PE-V	ME2461	PE V : Stress Analysis										
33	7	PE-V	ME2462	PE V : Product Design and Development										
34	7	PE-V	ME2463	PE V : Power Plant Engineering										
35	7	PE-V	ME2464	PE V : Value Engineering										
36	7	PE-V	ME2465	PE V : Design of Experiments and Taguchi Methods										
37	7	PE-V	ME2466	PE V : Industrial Safety										
38	7	PE-V	ME2467	PE V : Control System Engineering										
39	7	PE-V	ME2468	PE V : Tribology										
40	7	PE-V	ME2469	PE V : Turbines										

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

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SoE No. ME-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Mechanical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	ME2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	ME2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**87**	**0**	**44**	**132**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

VII Semester
ME2401 - Automation in Production systems

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles.	Students will have (I) Ability to design and evaluate product layout using line balancing. (II) Ability to compose and evaluate CNC programs. (III) Ability to examine the use of robot and automated material handling to design automated system. (IV) Ability design GT cells to build FMS.

Unit-1 **[7 hrs]**

Automation- Definition, types, reasons for automating, arguments for and against automation. Types of production, functions in manufacturing, Automated Flow 'Lines - Buffer storage. Analysis of flow lines- General terminology and analysis, analysis of transfer lines without storage, partial automation, and automated flow lines with storage buffers, manual assembly lines. Line Balancing Problem, Methods of line balancing. Automated Assembly Systems- Types, parts delivery system ,Throughput analysis for line balancing , Introduction to Simulation software's ,SIMUL8,WITNESS for line balancing

Unit-2 **[8 hrs]**

Numerical Control Production Systems- Basic concepts coordinate system and machine motion- Types of NC systems- Point to point, straight cut and continuous path. Machine control unit and other components, Tape and tape readers.
NC part programming- word address format, methods of part programming, Computer numerical control ,manual part programming: APT programming, Direct numerical control.. Adaptive control. Applications of CNC. CAM software's ,Post -processing in CAM

Unit-3 **[8 hrs]**

Industrial Robotics- Introduction, robot anatomy, robot control systems, accuracy and repeatability and other specifications, end effectors, sensors, introduction to robot programming, Robot applications- Characteristics of robot applications, work cell layout, robot applications in material handling, processing, assembly and inspection. Introduction of DH notations ,Robot simulation softwares

Unit-4 **[7 hrs]**

Automated material handling & storage-Conveyor systems: Automated Guided Vehicle Systems -

Types: - Driverless trains, AGVS pallet trucks, AGVS unit-load carriers. Vehicle guidance & Routing, Traffic control & safety, System management, Analysis of AGVS systems, AGVS applications. AGVS industrial case studies

Automated Storage & Retrieval System -

Types :- Unit load AS/RS , mini load AS/I{S , man on board AS/RS , automated item retrieval system, deep lane AS/RS -Basic components & special features of AS/RS , Carousel storage systems , Work in process storage, quantitative analysis. AS/RS industrial case studies

Unit-5 **[7 hrs]**

Automated inspection & Group technology:- Automated inspection principles & methods -100% automated inspection, off -line & on -line inspection, distributed inspection & final inspection; Sensor technologies for automated inspection , coordinate measuring machines -constructional , operation & benefits; Machine vision - image acquisition & digitization, image processing & analysis, interpretation, machine vision applications; Other optical inspection methods -Scanning laser systems , linear allay devices, optical triangulation techniques. Introduction to Group Technology. GT classification, GT Coding system, PFA ,GT interface for FMS ,GT industrial case studies

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VII Semester
ME2401 - Automation in Production systems

Unit 6 **[7 hrs]**

Computer aided manufacturing: -Manufacturing planning, manufacturing control ; Computer integrated manufacturing ;
Flexible manufacturing systems -Components, Types of systems, FMS layout configuration computer functions, data files, system reports, FMS benefits. Desiginig FMS system ,Case studies of FMS
Computer aided process planning: Retrieval CAPP systems, generative CAPP systems, benefits of CAPP. Shop floor control. CAPP software's ,CAPP industrial case studies

Sem	Course code	Course title	CO	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
VIII	8ME	Automation in Production	I.	The students will have ability to design and evaluate product layout using line balancing	3		3			3								
			II.	The students will be able to compose and evaluate CNC Programs.			3			3							2	
			III.	The students will be able to examine use of robot and automated material to design automated systems			3			3							2	
			IV.	The students will be able to design GT cells to built FMS.			3			3							2	

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Automation, production System & CIMS	Third edition (2007)	M P, Groover PHI	Prentice Hall
2	CAD/CAM	Fifth edition (2008)	Zimmers & Groover PIII	Pearson Education India
Reference Books:				
1	Numerical Control And Computer Aided Manufacturing	13th edition (2007)	Rao, N K Tiwari, T K Kundra	Tata McGraw-Hill Education
2	Computer Control of Manufacturing Systems	2005	Koren	Mcgraw Hill

ME2402 – Lab: Automation in Production systems

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles	The Students will be able to (I) Designing, experimentation and evaluation of CNC programs. (II) Designing and justifying robot programming for industrial applications. (III) Transform manual GT cell to build FMS. (IV) Evaluate and justify use of automated material handling and inspection for building automated industries.

Sem	Course code	Course title	CO	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
VIII	8ME1	Automation in Production Lab	I.	The students will have ability to design and evaluate product layout using line balancing	3	2	3	2	2	3	2		2	2	3	2		
			II.	The students will be able to compose and evaluate CNC Programs.	3	2	3		2	3		2	2	2	2	2	2	
			III.	The students will be able to examine use of robot and automated material to design automated systems	3	2	3	2	2	3		2	2	2	2	2	2	
			IV.	The students will be able to design GT cells to built FMS.	3		3		2	3	2		2	2	2	2	2	

Practicals:

1) Practice Programming on Manual Part Program **,**Drilling ,Milling
2) Performance, Simulation on CNC milling with Siemens 828D controller (atleast two Complex Geometries)
3) Performance, Simulation on lathe with Siemens 828D controller (at- least two Complex Geometric)

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ME2402 – Lab: Automation in Production systems

4) Practice Programming on APT
5) Case Study on Automated System of any Industry.
6) Performance/ Practical on Robot. Robot programming using Teach pendant
7) Forward and Inverse kinematics using Simulation softwares
8) Part Coding and Group Technology case studies
9) Study of FMS industrial case studies
10) Study of Automated material handling ,AGVS ,AS/RS with industrial case studies
11) Study of Automated inspection with latest industrial case studies
12) Performance on Additive manufacturing system using MAKERBOT replicator

VII Semester
ME2411– PE-II : Tool Design

COURSE OBJECTIVES:	**Course Outcome**
1. To provide the knowledge of the tools for machining, production, inspection, press working and forging. 2. To learn the procedure of design and manufacturing of tools	CO I: Student will be able to explain the fundamentals of Tool Design CO II: Design various cutting tools, Sheet Metal Dies, Jigs / Fixtures and Forging dies CO III: Evaluate the failure modes of tools and costing CO IV: Compose planning for manufacturing of tools for various components

Unit1 **[8 Hrs]**

Design of single Point Cutting Tool ,Theory of metal Cutting Introduction, Mechanics of chip formation, Cutting tool materials, Single point cutting tool, Designation of cutting tools, ASA system, Importance of Tool angles, Orthogonal rake system, Classification of cutting tools, Types of chips, determination of shear angle, velocity relationship, force relations, Merchant's Theory, Cutting power, Energy consideration in metal cutting, Tool wear, Tool life, Tool life criteria, variable affecting tool life, Machine ability [**1,3, 5,6,9,11,12**]

Unit2 **[8hrs]**

Form tools- Introduction, Types, design of form tools. Drills- Introduction, Types, Geometry, Design of drill. Milling cutters - Introduction, Types, Geometry, and Design of milling cutters**. [1,3,5,6,9,11,12]**

Unit3 **[10hrs]**

Press tool Design

Introduction, Press operations - Blanking, piercing, Notching, Perforating, Trimming, Shaving, Slitting, Lancing, Nibbling, Bending, Drawing, Squeezing. Press working equipment - Classification, Rating of a press, Press tool Equipment, arrangement of guide posts. Press selection, press working

\Terminology, Working of a cutting die, Types of dies - Simple dies, inverted die, Compound dies, combination dies, progressive dies, Transfer dies, multiple dies Principle of metal cutting, strip layout, clearance, angular clearance, clearance after considering elastic recovery, cutting forces, method of reducing cutting forces, Die block, Die block thickness, Die opening, Fastening of die block, back up plate, Punch, Methods of holding punches, Strippers. Stoppers, Stock stop, Stock guide, Knockouts, Pilots. Blanking & Piercing die design - Single & progressive dies. **[1,3, 5,6,9,11,12]**

Unit4 **[10hrs]**

Bending Forming & Drawing dies Bending methods - Bending Terminology, V- Bending, Air bending, bottoming dies, spring back & its prevention. Design Principles - Bend radius, Bend allowance, Spanking, width of die opening, Bending pressure. Metal flow during drawing, Design, Design consideration - Radius of draw die, Punch radius, Draw clearance, Drawing speed, Calculating blank size, Number of draws, Drawing pressure, Blank holding pressure.[**1,3**, **5,6,9,11,12**]

Unit5 **[7 Hrs]**

Forging Die Design: Introduction, Classification of forging dies, Single impression dies, Multiple Impression dies. Forging design factors - Draft, fillet & corner radius, parting line, shrinkage & die wear, mismatch, finish allowances, webs & ribs Preliminary forging operation - fullering, edging, bending, drawing, flattering, blacking finishing, cutoff. Die design for machine forging - determination of stock size in closed & open die forging. Tools for flash trimming & hole piercing, materials & manufacture of forging dies.[**1,3**, **5,6,9,11,12**]

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Unit6 **[10 Hrs]**

Design of jigs & fixture: - Introduction, locating & clamping - principle of location, principle of pin location, locating devices, radial or angular location, V - location, bush location. Design principle for location purpose, principle for clamping purposes, clamping devices, design principles common to jigs & fixtures. Drilling Jigs: - Design principles, drill bushes, design principles for drill bushings, Types of drilling jigs - Template jig, plate type jig, open type jig, swinging leaf jig, Box type jig, channel type jig . Jig feet. Milling Fixtures: - Essential features of a milling fixtures, milling machine vice, Design principles for milling fixtures, Indexing jig & fixtures, Automatic clamping Devices. [**1,3**,**5,6,9,11,12**]

Sem	Course code	Course title	CO	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
VII	ME14	PE-I: Tool Design	I	Student will be able to explain the fundamentals of Tool Design	3	2	3		3	3	1	1	3	1	2	2	3	
			V.	Design various cutting tools, dies, Jigs & Fixtures and Forging dies	1	2	3		3	3	1	1	3	1	2	2	3	
			VI.	Evaluate the failure modes of tools and cost estimation	3	2	3		3	3	1	1	3	1		1	3	
			VII.	Compose planning for manufacturing of tools for various parts	3	2	3		3	3	1	1	2	1	1	1	3	

.**Reference books:**

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	"Tool design"	2001	Donaldson	TATA Mc-Graw Hill.
2	"Fundamentals of Tool design	1988	ASTME,	TATA Mc-Graw Hill.
3	"Fundamentals of Tool design"	1962	Pollock,	Reston Publishing Company
4	Fundamentals of Tool design"	1971	Kempster	Hall of India Pvt. Ltd
5	Computer aided fixture design	--	Rong , Yeming	Marcel Dekker

		June 2021	1.00	Applicable for AY 2021-22 Onwards
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VII Semester
ME2412– PE-II : Additive manufacturing

Objective: The main objective of this course is to acquaint students with the concept of AM, various AM technologies, selection of materials for AM, modeling of AM processes, and their applications in various fields.

UNIT	Hrs.
Unit 1 Introduction to Additive Manufacturing (AM) General overview Introduction to reverse engineering Traditional manufacturing vis AM Computer aided design (CAD) and manufacturing (CAM) and AM Different AM processes and relevant process physics AM process chain Application level: Direct processes – Rapid Prototyping, Rapid Tooling. Rapid Manufacturing; Indirect Processes - Indirect Prototyping. Indirect Tooling, Indirect Manufacturing	**[7Hrs]**
Unit 2 Materials science for AM Discussion on different materials used Use of multiple materials, multifunctional and graded materials in AM Role of solidification rate Evolution of non-equilibrium structure property relationship Grain structure and microstructure.	**[7Hrs]**
Unit 3 AM technologies Powder-based AM processes involving sintering and melting (selective laser sintering, shaping, and electron beam melting. involvement). Printing processes (droplet based 3D Solid-based AM processes - extrusion based fused deposition modeling object Stereo lithography Micro- and Nano-additive.	**[12Hrs]**
Unit4 Mathematical Model for AM Transport phenomena models: temperature, fluid flow and composition, buoyancy driven tension driven free surface flow pool) Case studies: Numerical Modeling of AM process, Powder bed melting based process, Droplet based printing process Residual stress, part fabrication time, cost, optimal orientation and optimal Defect in AM and role of transport Simulations (choice of parameter, Mo de! validation for different)	**[13Hrs]**
Unit5 Process selection, planning, control for AM Selection of AM technologies using decision methods, Additive manufacturing process plan: strategies and post processing. Monitoring and control of defects, transformation	**[7Hrs]**
UNIT-6: Powder Metallurgy: Powder manufacture and Conditioning, Production of Sintered Structural Components, Self-lubricating bearing, Cemented Carbides, Ceramics, Sintered Carbide cutting tools.	**[8 hrs]**

VII Semester
ME2413– PE-II : Fuel Cell Technology

OBJECTIVES	OUTCOMES
• Provide thorough understanding of performance characteristics of fuel cell power plant and its components • Outline the performance and design characteristics and operating issues for various fuel cells • The students will have sufficient knowledge for working in a fuel cell industry or R&D organization	By the conclusion of this course, each student should : 1. Have thorough understanding of performance behaviour, operational issues and challenges for all major types of fuel cells. 2. Apply know-how of thermodynamics, electrochemistry, heat transfer, and fluid mechanics principles to design and analysis of this emerging technology. 3. Apply techniques, skills, and modern engineering tools necessary for design and analysis of innovative fuel cell systems. 4. Develop enough skills to design systems or components of fuel cells.

Unit I: Introduction to Fuel Cells
Brief history of fuel cells, Operating principles, Types of fuel cells- Solid Oxide Fuel Cell (SOFC), Alkaline Fuel Cell (AFC), Molten Carbonate Fuel Cell (MCFC), Phosphoric Acid Fuel Cell (PAFC), Fuel Cell Stack, Advantages, Limitations and Applications of Fuel Cell, Polarization curve for performance characterization of fuel cells, Representing various losses (Activation, Ohmic, concentration loss), Hydrogen Production, Storage and Transportation.

Unit II: Fuel Cell Thermodynamics
Heat Potential (Enthalpy of Reaction), Work Potential (Gibbs free energy), Reversible fuel cell voltage (Nernst equation), Fuel Cell Efficiency.

Unit III: Fuel Cell Electrochemistry
Electrochemical Reaction Basics, Faraday's law, Tafel equation, Butler – Volmer equation, Exchange Current.

Unit IV: Fuel Cell Charge Transport and Mass Transport
Ion Transport (Electrolyte), Electron Transport, Gas phase (single phase) mass transport in different fuel cell components (Diffusion layer, flow channels), Multiphase Mass Transport in fuel cell components, Fuel Crossover and Internal Currents, Heat generation and transport in fuel cell.

Unit V: Fuel Cell Characterization
In Situ Versus Ex Situ Characterization, Polarization Test, Electrochemical Impedance Spectroscopy, Linear Sweep Voltammetry, Cyclic Voltammetry, Current Interrupt, High frequency resistance.

Unit VI: Polymer Electrolyte Membrane Fuel Cell (PEMFC)
\Components and Materials: Membrane, Catalyst Layer, Bipolar Plate, Current Collector, Water Management, Thermal Management, Direct Liquid Fuel Cell (DLFC), Advantage of Liquid Fuel over Gaseous Fuel, Different types of DLFC, Direct Methanol Fuel Cell (DMFC).

Textbooks/Reference Books

1. O'Hayre, R.P.,S. Cha, W. Colella, F.B.Prinz, Fuel Cell Fundamentals, Wiley, NY (2006).
2. J. Larminie and A. Dicks, Fuel Cell Systems Explained, 2nd Edition, Wiley (2003).
3. Matthew M. Mench, Fuel Cell Engines, Wiley (2008).
4. S. Srinivasan, Fuel Cells: From Fundamentals to Applications, Springer (2006)
5. X. Li, Principles of fuel cells, Taylor & Francis (2005).

VII Semester
ME2414– PE-II : Refrigeration and Air Conditioning

Course Objectives	Course Outcome
OBJECTIVES To familiarize with terminologies associated with refrigeration and Air conditioning. To understand principle of Refrigeration and Air conditioning systems.. TO understand basic and applied psychrometry. To understand air conditioning load calculations and duct design. To understand energy conservations and management	1) The student will be able to understand and determine various psychrometric properties of air, analyze various psychrometric process and will be able to apply it to live problems 2) The students will be able to design air distribution system 3) The student will be able to analyze various types of VCRS refrigeration systems 4) The students will also have brief knowledge of non VCRS refrigeration systems & cryogenic systems

Unit 1 **[7 Hrs]**

PSYCHROMETRY: Introduction, psychometric properties of air, psychometric chart, psychometric processes bypass factor, apparatus dew point temperature.

HUMAN COMFORT: ***Mechanism of body heat losses, factors affecting human comfort, effective temperature, comfort chart.*** *[CO-1]*

Unit 2 **[8 Hrs]**

ADVANCED PSYCHROMETRY: Application of psychrometry to various air-conditioning systems. RSHF, GSHF, ESHF, air washers, air coolers.

HEAT LOAD CALCULATIONS: ***Data collection for load calculation. Various components of heat load estimate. Methods of cooling load calculation. Demonstration of air conditioning systems to students.*** *[CO-1]*

Unit 3 **[7 Hrs]**

AIR TRANSMISSION & DISTRIBUTION:

Principle of air distribution, types of grills & diffusers & their selection criteria, air alteration, types of air filters, distribution of air through ducts, pressure losses in ducts, methods of duct design, duct friction chart, air conditioning controls. [CO-2]

Unit 4 **[8 Hrs.]**

REFRIGERATION: Introduction, Definition, Applications.

Study of simple vapour compression refrigeration system.

Analysis of simple vapour compression refrigeration system, effect of sub cooling, superheating, polytropic compression & pressure drops on the performance of the system. Demonstration of performance of VCRS to students. **[CO-4]**

Unit 5 **[8 Hrs]**

MULTISTAGE VAPOUR COMPRESSION REFRIGERATION SYSTEMS:

\Multiple compressor & multiple evaporator systems, cascade refrigeration systems. Study of equipments such as compressors, evaporators, expansion devices & controls defrosting methods (types & principle only). Testing & charging of refrigeration systems. Demonstration of of above equipments to students.

REFEGERANTS:

Nomenclature of refrigerants, refrigerant properties, mixture refrigerants, global warming potential & Ozone depletion potential, Montreal & Kyoto protocol, alternate refrigerants. **[CO-4]**

Unit 6. **[7 Hrs]**

STUDY OF VAPOUR ABSORPTION REFRIGERATION SYSTEM:

Introduction Ammonia-Water, Lithium bromide-water systems, three fluid refrigerators.

OTHER REFRIGERATION TECHNIQUES:

Air cycle refrigeration, Applications in air refrigeration systems, Vortex tube, and thermoelectric refrigeration.

CRYOGENICS:

Introduction, Application of cryogenics, Joule- Thomson coefficient, inversion curve, methods of liquefaction of air **[CO-4]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
2	Refrigeration & Air-conditioning	2005	Dr. P.L. Ballany	Khanna
3	Refrigeration & Air-conditioning	2000	Dr.C.P. Arora	Tata McGraw-Hill Education
4	Refrigeration & Air-conditioning	2007	Dr. Manohar	New Age International
5	Refrigeration & Air-conditioning	2007	S.V. Domkundwar	Dhanpat Rai Company (P) Ltd
REFERENCE BOOKS:				
1	Refrigeration & Air-conditioning	1986	Stocker & Jones	McGraw-Hill
2	Principle of Refrigeration & Air-conditioning	1997	Roy J.Dossat	Prentice Hall
3	ASHRAE hand books	2003		ASHRAE
4	Air conditioning Principles & System. Energy approach	1989	E.G. Pita	Wiley
6	Basic Refrigeration& Air-conditioning	2005	P.N. Ananthnarayanan	Tata McGraw-Hill Education

VII Semester
ME2415– PE-II : Material Handling System

Objective	Course Outcome
To develop the awareness about principles and practices of material handling equipments. Study the different components design and applications of material handling devices.[c,e]	Students will be able to: 1. Explain the various typs of Material handling systems. 2. Design the various rope and chain assisted material handling systems. 3. Explin various attachments, drives and safety components of material handling system. 4. Analyze and select various material handling systems for different material handling situations.

Unit1 **[8 Hrs]**

Types of intraplant transporting facility, principles of material handling and classification of material handling equipments, selection of material handling equipment, hoisting equipment, screw type, hydraulic and pneumatic conveyors, general characteristics of hoisting machines, surface and overhead equipments, general characteristics of surface and overhead equipments and their applications. Introduction to control of hoisting equipments.

Unit2 **[8 Hrs]**

Component selection and design Flexible hoisting appliances like ropes and chains, welded load chains, roller chains, selection of chains, hemp rope and steel wire rope, selection of ropes, rope reeving arrangement and pulley blocks fastening of chains and ropes, different types of load suspension appliances, fixed and movable pulleys, different types of pulley systems, multiple pulley systems. Chain and ropes heaves and sprockets.

Unit3 **[7 Hrs]**

Load handling attachments, standard forged hook, hook weights, hook bearings, cross piece and casing of hook, crane grab for unit and piece loads, carrier beams and clamps, load platforms and side dump buckets, Electromagnetic lifting system, grabbing attachments for loose materials, crane attachments for handling liquid materials.

Unit 4 **[8 Hrs]**

Arresting gear, ratchet type arresting gear, roller ratchet, shoe brakes and its different types like electromagnetic, double shoe type, thrusters operated, controlled brakes, shoe brakes, Electro-Hydraulic thrusters safety handles, load operated constant force and variable force brakes, Rope drum design and assembly, design of guides and column,

Unit5 **[8 Hrs]**

Different drives of hoisting gears like individual and common motor drive for several mechanisms, travelling gear, travelling mechanisms for moving trolleys and cranes on runway rails, mechanisms for trackless, rubber-tyre and crawler cranes, motor propelled trolley hoists and trolleys, rails and travelling wheels, slewing, jib and lifting gears. Operation of hoisting gear during transient motion, selecting the motor rating and determining braking torque for hoisting mechanisms, selecting the motor rating and determining braking torque for travelling mechanisms, slewing mechanisms, jib and lifting mechanisms. (Elementary treatment is expected)

Unit6 **[7 Hrs]**

Cranes with rotary pillar, cranes with a fixed post, jib cranes with trolley, portal cranes with luffmg boom, cantilever cranes, cage elevators, safety devices of elevators, belt and chain conveyors and their power calculations, vibrating and oscillating conveyors, pneumatic and hydraulic conveyors, screw conveyors, hoppers, gates and feeders. Introduction to AGV's as new material handling device, use of robot for material handling.

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Materials Handling Equipment-	1964	N. Rudenko ,	Envee Publishers, New Dehli
2	Materials Handling Equipment-	1968	M.P. Alexandrov.	Mir publications

VII Semester
ME2416– PE-II : Reliability Engineering

Objective	Course Outcome
1.To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply a few well understood basic principles to find its solution. 2.Learn how to get higher operating plant and equipment reliability that lifts efficiency and output of operating assets, stops equipment failures and creates higher plant and equipment reliability, with this subject.	(I) Student will be able to use reliability modeling as a tool for evaluating system performance. (II) Student will be able to analyze the failure of a machine, determine the failure rate of systems or components. (III) Student will able to understand importance of the maintenance of engineering systems and factors affecting maintainability. (IV) Student will be able to prepare the production & maintenance schedule of particular engineering system.

Unit	Contents	Max. Hrs.
1	Fundamental concepts:- Reliability definitions, failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, maintainability, availability, safety and reliability, Quality, cost and system effectiveness, Life characteristic phases, modes of failure, Quality and reliability assurance rules, product liability, Importance of Reliability,	**7**
2	Probability theory:- Set theory, laws of probability, total probability theorem, probability distributions, parameters and applications.	**8**
3	System reliability and modeling: Series and parallel components, mixed configuration, complex systems. Redundancy, element redundancy, unit redundancy, standby redundancy. Types of stand by redundancy, parallel components. Markov models for reliability estimation.	**7**
4	Maintainability and Availability: Objectives of maintenance, types of maintenance, Maintainability, factors affecting maintainability, system down time. Availability - Inherent, Achieved and Operational availability, reliability and maintainability trade-off. Markov models for availability estimation.	**8**
5	System reliability Analysis: Reliability allocation or apportionment. Reliability apportionment techniques . Reliability block diagrams and models. Reliability predictions. Life testing and accelerated testing.	**7**
6	Strength based reliability: Safety factor, safety margin, Stress strength interaction, Failure Mode, Effects and Criticality Analysis-, , FMECA examples, Ishikawa diagram .fault tree construction, basic symbols development of functional reliability block diagram, Fault tree analysis, fault tree evaluation techniques, Design of Mechanical components and systems:-Material strengths and loads.	**8**

Reference books:				
S.N.	**Title of the book**		**Author(s)**	**Publisher**
1	Concepts of Reliability Engg	1985	L.S. Srinath	Affiliated East-Wast Press (P) Ltd
2	Reliability Engineering	1983	A.K. Govil	Tata McGraw-Hill Publishing Co. Ltd
3	Reliability Engineering	1984	E. Balagurusmy	Tata McGraw-Hill Publishing Co. Ltd
4	Engineering Reliability	1980	B.S. Dhillion, C. Singh	John Wiley & Sons
5	Probabilistic, Reliability	1968	M.L. Shooman	McGraw-Hill Book Co.,
6	Practical Reliability Engg	1985	Patric D.T.O'connor	Heyden and sons ltd.
7	Reliability in Engineering Design	1977	K.C. Kapur, L.R. Lamberson	John-Wiley and sons.
8	Reliability Engineering, Theory and Practice	Third Edition, 1999	A.Birolini	Springer,

VII Semester
ME2417– PE-II : Advanced Manufacturing Techniques

Objective	Course Outcome
To develop the ability to understand & analyze different advanced manufacturing processes and different advanced manufacturing machines. **(a,c,k)**	Upon successful completion of the course, the student will be able to: CO I- Distinguish the various non-traditional manufacturing process based on energy sources. CO II Evaluate various advanced manufacturing process for new materials and the requirements of complex features on the basis of various parameters. CO III- Justify the various advanced welding techniques for different applications. CO IV- Evaluate the application of additive manufacturing advanced manufacturing techniques in industries.

Unit 1 **[8hrs]**

Mechanical Processes: Need, classification of AMT, Abrasive jet Machining, Water jet Machining & ultrasonic Machining, Abrasive-Water Jet Machining, Abrasive Flow Machining, Magnetic Abrasive Finishing & Ultrasonic Machining. (CO I)

Unit 2 **[6 hrs]**

Chemical Processes & Electro-chemical Processes: Electrochemistry of ECM, tool design, effect of variable on performance chemical milling, Chemical Engraving, Photo chemical machining, EC grinding. (CO II)

Unit 3 **[9 hrs]**

Thermo-electric Processes: Electric Discharge Machining, Wire Electric Discharge Machining. Electron Beam Machining, Laser Beam Machining, Ion Beam Machining & Plasma Arc Machining. (CO II)

Unit 4 **[6hrs]**

High energy rate forming processes: Burnishing, ballizing process and other miscellaneous forming processes, electroforming. Thermoform High velocity forming, Vacuum forming. (CO II)

Unit 5 **[8 hrs]**

Unconventional welding techniques: laser, electron beam, plasma arc, atomic hydrogen, submerged arc, explosive welding techniques, solid phase welding, technique such as ultrasonic welding, friction welding.(CO III).

Unit 6 **[7 hrs]**

Additive Manufacturing : Overview, Basic principle need and advantages of additive manufacturing, Procedure of product development in additive manufacturing, Classification of additive manufacturing processes, Materials used in additive manufacturing, Challenges in Additive Manufacturing.(CO IV)

Reference Books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Manufacturing Science	2007	A. Ghosh & A. Mallik.	Ellis Horwood, 1986
2	Non Traditional Machining	2005	P.C. Paonoey & H. S. Shan.	Tata McGraw-Hill Education, 1980
3	New Technology		A Bhattacharya	
4	Advance machining process		V.K.Jain	Allied publisher

VII Semester
ME2418– PE-II : Optimization Techniques

Objective	Course Outcome
The course aims to develop the most fundamental concepts in the field of optimization The basic principles of linear optimization for decision-making, using practical examples will help us learn to identify decision variables, objective function, and constraints of a problem, and use them to formulate and solve an optimization problem. This course is designed to connect data and models to real world decision-making scenarios in the field of manufacturing, finance, Project management, human resource management through various optimization tools which also includes the most recent global optimization. Thus, detailed treatment of various data analysis and handling technique will lead to complete understanding and modeling the processes including its optimization, is envisaged in this course.	After completion of this course, Students will be able to: **I.** Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method. **II.** To Solve Transportation and Assignment Models and analyse the concept of dynamic programming to Solve problems of discreet and continuous variables. **III.** Analyze projects for minimum total cost and smooth level of resources. **IV.** Evaluation of different replacement policies and its application in operation research and analysis of the application of simulation, inventory control model and waiting line model.

Unit 1: **[7 hrs]** Introduction to Linear Programming Problems: Formulation of LPP, Geometry of LPP and Graphical Solution of LPP, Simplex Method, Big M- Method, Two Phase Method. (CO-I)
Unit 2: **[7 hrs]** Alternative Specifications & Special Cases in Linear Optimization, Modeling & Solving Linear Problems in Excel. (C0-I)
Unit 3: Transportation Problem and Assignment Problem. (CO-II) **[7 hrs]**
Unit 4: **[7 hrs]** Replacement Models: Replacement of Models that deteriorate with time, Concept of equivalence, Interest Rate and Present worth. Replacement of items that fails suddenly considering Individual and Group replacement policy. (CO-IV)

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Unit 6: **[7 hrs]**

Global Optimization: Dynamic programming, Evolutionary Algorithms (Any one like…..Genetic, Ant Colony, Scatter, etc.) Queuing Theory: Queuing Systems, Kendelalls for representing queuing models, Classification of queuing models (No derivations expected), The First Model. (CO-IV)

Sem	Course code	Course title	CO	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
V	8M	Optimization for Decision Making	VIII.	Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method.	3				3	2								
			IX.	To Solve transportation and Assignment Models and analyze the concept of dynamic programming to Solve problems of discreet and continuous variables.					2	3			3					
			X.	Analyze projects for minimum total cost and smooth level of resources.					2	2					3			
			XI.	Evaluation of different replacement policies and its application in operation research and application of global optimization and waiting line mode.					2	2						3		

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Introduction to Operation Research: Computer Oriented Algorithmic approach	2007	Billy E.Gillet	Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2	Operations Research	Third edition 2008	Prem Kumar Gupta & D.S. Hira	S. Chand& Co.
3	Operations Research: Theory and Applications	Second edition 2002	J.K. Sharma	Mac Millan
4	Introductory Operations Research	2006	S.C. Sharma	Discovery Publishing House
5	Optimization Theory and Application	Second edition 2010	S.S. Rao	Halsted Press
6	Operations Research - An Introduction	Ninth Edition 2010	Hamdy A. Taha	Prentice Hall of India Pvt. Ltd., New Delhi.

VII Semester
ME2421– PE-III : Vibration

Objective	Course Outcome
To develop in students fundamentals knowledge of vibrations. To familiarize with energy methods for multi degree freedom systems. To impart, knowledge of vibration of continuous systems and applications of factor in vibration analysis. TO impart knowledge of use of FFT in vibration analysis for condition monitoring purpose	(I) The student will have ability to analyze various types of Vibrations..[b,e] (II) The student will have ability to measure Vibrations and carryout its analysis..[b,e]

Unit 1 **[7 hrs]**
SINGLE DEGREE OF FREEDOM: Free body diagram, free & forced vibration, un damped and damped single degree of freedom systems subjected to harmonic and other periodic excitations. Impulse response, convolution integral and response to arbitrary excitation. Vibration isolation and transmissibility. Solution using Laplace transform, Rungakutta method, structural damping

Unit2 **7 hrs]**
Energy method applied to TWO degree freedom system. Lagranges equation. Generalized mass formulation of mass , damping and stiffness matrix and its numerical solutions . Vibration absorber, conservative and non conservative systems. Geared rotor system, Influence Coefficients and flexibility matrix of bending vibration of beam and multi-disc rotor. Mode shapes and orthogonality principle

Unit3 **[8 hrs]**
Numerical techniques for Multi **degree** freedom system. systems. Matrix iteration method. Holzer"s method for torsional vibration. Dunkerley's method for critical speed determination of multi disc rotor. Rayleigh quotient sweeping matrix method for determination of all the natural frequencies and mode shapes. Rayleigh Ritz method. Modal matrix and expansion theorem. Free and forced response by modal analysis.

Unit4 **[8 hrs]**
Vibration of continuous system. Axial vibration of rod, bending vibration of beam and torsional vibration of shaft. Hamilton's principle and derivation of equation of motion, Rayleigh quotient. Modal co-ordinates and modal forces. Free and forced response through modal analysis.

Unit5 **[8 hrs]**
Vibration pickup, seismometers, accelerometer, proximity probe spectrum analyzer, FET & DFT (Discrete FT), torsional, Vibration measurement, Digital vibration measurement, philosophy of vibration. condition monitoring

Unit6 **[7 hrs]**
Introduction to Finite element method in vibration of continuous system. Natural frequencies and mode shape computation for simple rod and beam problem

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Theory of vibration	2001	Thomson W.T	Prentice hall
2	Elements of vibration analysis	1986	Meirovitch L	McGraw-Hill Science/Engineering/Math; 2 Sub edition (January 1, 1986)
3	Mechanical vibration	1984	Rao J.S.;Gupta K	Wiley Eastern, c1984

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
4	Theory of vibrations	1983	Morse TSE; Hinkle	New Delhi: CBS Publishers, 1983.
5	Advanced theory of vibration	1992	Rao J.S	Wiley, 1992
6	Vibration condition Monitoring of Machines	2000	Rao J.S	Alpha Science International Limited, 2000
7	Random vibration		Gandall& Mark	

VII Semester
ME2422– PE-III : Lab: Vibration

Objective	Course Outcome
To do Experimentation on Types of Vibrations. To do analysis of Vibration of different systems and machines using different methods And through Instrument. [b,e]	Students will be able to: 1. Analyze the various types of vibrations. 2. Evaluate vibrations and carry out its analysis. 3. Predict/judge vibration parameters and evaluate through different approaches for multidegree freedom system. 4. Form and work on transformation of matrices for vibration for evaluating frequencies..

List of Practical

1. To determine transmissibility of single degree freedom system using load cells and exciter
2. To Study the Transverse Vibrations of Cantilever Beam and to determine the frequency or period of Vibration (oscillation) theoretically and actually by experiment
3. To determine natural frequency of Torsional vibration of geared system
4. To Study the forced vibration of equivalent spring mass System
5. Study and determination of modes shapes for two degree and three degree freedom systems
6. To Study the Free Vibration of two rotor and three rotor System and to determine the natural frequency of vibration theoretically & experimentally.
7. To verify the Dunkerley's Rule.
8. Determination of Whirling of shaft.
9. To study the effect of damping on natural frequency and plot frequency response curves at various damping coefficient.
10. To determine vibration parameters (Amplitude Velocity acceleration for machines using FFT
11. To diagnose faults in simple machines like pumps motor gearbox using FFT.
12. To remove dynamic unbalance using FFT.

VII Semester
ME2423– PE-III : Computer Aided Design & Manufacturing

Objectives:	**Course outcomes:**
To educate students on -Main concepts of computer aided design -Graphics representation of curves. -Surface and solids	*After completion of the course students would be able to* 1. Distinguish the various CAD CAM tools and also evaluate criteria for CAD CAM systems 2. Design 2D and 3D Transformation matrices 3. Calculate and analyse the parametric equations for wire frame. surface and solid modeling entities **4.** Design the applications of modeling and evaluate data exchange formats

Unit 1 CAD TOOLS **[6 hrs]**

Definition of CAD Tools, Types of system, CAD/CAM system evaluation Criteria, functional areas of CAD, Modelling and viewing, efficient use of CAD software.

Unit2 Two/Three Dimensional Transformations **[8hrs]**

Two & Three dimensional geometric and co-ordinate transformations like scaling, translation, rotation, reflection, shear. Concept of homogeneous representation and concatenated transformations. Inverse transformations.

Unit 3 Wire Frame Modeling **[7 hrs]**

Types of mathematical representation of curves, wire frame models, wire frame entities, parametric representation of analytical and synthetic curves- Hermit cubic splines, Bezier curves, B Splines

Unit4 Surface Modeling **[8 hrs]**

Mathematical representation of surfaces, Surface model, Surface entities, surface representation, parametric representation of surfaces, plane surface, ruled surface, surface revolution, Tabulated surface.

Unit 5 Solid Modeling & Data Exchange **[8 hrs]**

Solid Representation - Boundary Representation (B-rep), Constructive Solid Geometry (CSG) and other **methods, Evaluation** of data-exchange formats, IGES data representations and structure

Unit 6 Manufacturing **[8 hrs]**

Introduction to NC and CNC, Machine tools- Construction features with structure- Drives and CNC controllers. Manual part programming (Lathe & Milling machines) Introduction of CAM package. Group Technology, Cellular Manufacturing-Composite part concept-Types of Flexibility – FMS – FMS Components, Application and Benefits.

Sem	Course code	Course title	C	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
V	ME	COMPUTER AIDED DESIGN	1	Distinguish the various CAD CAM tools and also evaluate criteria for CAD CAM systems	3				3	3	2		2	2	1		1	2
			2	Design 2D and 3D Transformation matrices	3		3		3	3	2		2	1			3	2
			3	Calculate and analyse the parametric equations for wire frame. surface and solid modeling entities	3				3	3	2		1	1			2	1
			4	Evaluate data exchange format, also develop part programme for Lathe & Milling Machine	3		3		3	3	2	1	2	2	1		3	1

Textbooks:

1 CAD/CAM, theory & practice: Ibrahim Zeid
2 Procedural elements for computer graphics: D Rogers
3 Computer Graphics: D Hearn & M.P.Baker
4 Computer Graphics: S Harrington.
5 Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2008.
6 Radhakrishnan P, Subramanyan S. and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi,2000

VII Semester
ME2424– PE-III : Lab : Computer Aided Design & Manufacturing

Objectives:	Course outcomes:
• To educate Main concepts of computer aided design & Manufacturing • To use Graphics representation of curves	*After completion of the course students would be able to* 1. **Study, design and develop the model for mechanical engineering parts.** 2. **Conceptualize & model any machine component** 3. **Build the CAD Model and CAM Model for simple machine elements**.

List of Practical:-

1.	To study Introduction to CAD software.
2.	To Solve Simple examples of two dimensional transformations
3.	To Solve Simple examples on three dimensional transformations
4.	Programs on 2-D transformations- scaling, rotation, reflection and translation
5.	3-D Wireframe object modeling using any CAD software
6.	Generation of analytical curves using any CAD software
7.	Generation of synthetic curves using any CAD software
8.	Basics of surface modeling using Extrude, Revolve, fill, sweep, variable section sweep commands using any CAD software
9.	Creating fill surfaces, lofted multi-section surfaces, blended surfaces using any CAD software
10.	To generate at least two simple assembly model using any CAD software.

VII Semester
ME2425– PE-III : Vehicle Engineering

Objective		Course Outcome	Unit
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular vehicle. The modernization in automobile is also included to understand recent trend in the field**.**	**(1)**	**Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle. (PO-1,PO-2,PO-13)**	**1**
	(2)	**Student will be able to describe_various power transmission systems from clutch to wheel in vehicle. (PO-1,PO-2,PO-13)**	**2,3**
	(3)	**Student will be able to evaluate and describe_control systems like steering and brakes in vehicle. (PO-1,PO-2,PO-13)**	**4**
	(4)	**Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle. (PO-1,PO-2,PO-4,PO-13)**	**5,6**

UNIT-1: **[8 hrs]**

- Introduction, Automobile history and development and classification. Vehicles layout.
- Various engine system and components
- Introduction to Fuel supply system: for Petrol and Diesel Engine.
- Engine cooling and lubrication systems.,

UNIT-2: **[8 hrs]**

- Resistance to vehicle motion: Air, Road and gradient resistance and power calculation.
- Clutch – Necessity, requirements of a clutch system. Types of Clutches: Single & multi plate clutch, Diaphragm clutch and centrifugal clutch.
- Gear box: Necessity of gear box, working principle, Classification: Sliding mesh, constant mesh, synchromesh, synchromesh and Transfer case gear box, Gear Selector mechanism, lubrication and control. Introduction to Automatic Transmission

UNIT-3: **[8 hrs]**

- Transmission system: Propeller shaft, Universal joint, constant velocity joint, Hotchkiss drive, torque tube drive.
- Differential - Need and working. Differential lock.
- Rear Axles and Front Axles.
- Wheel and Tyres: tyres specification, factors affecting tyre performance.

UNIT-4: **[8 hrs]**

- Steering systems, principle of steering, steering linkages, steering geometry and wheel alignment, steering gear box and its types.
- Suspension systems – Function, conventional and Independent suspension System, shock absorber
- Brakes - Drum and Disc brakes, Comparison, Mechanical, hydraulic (Master and wheel cylinder), Air brakes.

UNIT-5: **[8 hrs]**

- Electrical systems: Battery construction. Specification. Operation of Batteries. Charging of battery, Alternator.
- Starting system, Battery Ignition and magneto ignition systems, Lighting, Horn, Side indicator, wiper. and other electrical systems.

UNIT-6: **[8 hrs]**

- Automobile air-conditioning,
- Panel board instruments .
- Overhauling, Engine tune up.
- Recent Advances in automobiles such as ABS, Power Steering, Collision avoidance, Navigational aids etc.

Reference books:

S.N.	Title of Book	Edition	Authors	Publication
1	Automotive Technology		H.M.Sethi	Tata McgraHill
2	Automobile Engineering-I & II	First Edition - 2010	P.S.Gill	S.K.Kataria & sons
3	Automobile Engineering	First Edition - 2015	Dr.D.S.kumar	S.K.Kataria & sons
4	Automotive Mechanics		Joseph Heitner	
5	Automotive Engines		W.H. Crouse	

VII Semester
ME2426– PE-III : Lab. Vehicle Engineering

Objective	Course Outcome		Unit
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular vehicle. The modernization in automobile is also included to understand recent trend in the field**.**	(1)	Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle. (PO-1,PO-2,PO-13)	**1**
	(2)	Student will be able to describe_various power transmission systems from clutch to wheel in vehicle. (PO-1,PO-2,PO-13)	**2,3**
	(3)	Student will be able to evaluate and describe_control systems like steering and brakes in vehicle. (PO-1,PO-2,PO-13)	**4**
	(4)	Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle. (PO-1,PO-2,PO-4,PO-13)	**5,6**

List of Practical: Minimum eight practical to be conducted

1. Demonstration to understand vehicle layout and important constituents of four wheel ,two-wheel & four-wheel drive vehicle
2. Demonstration to understand various components and working of 2S & 4S Engine.
3. Demonstration to understand working of single plate/Multiplayer/Diaphragm automobile clutch.
4. Demonstration of synchromesh gearbox with gear shifting mechanism.
5. Demonstration of final drive and differential.
6. Demonstration of working Hydraulic braking system and comparison with other braking system.
7. Demonstration to understand front wheel steering geometry and steering mechanism.
8. Demonstration to understand suspension system and working of shock absorber.
9. Demonstration of various components of battery and working of its charging system.
10. Demonstration of vehicle starting system(Kick start and Self-start).
11. Demonstration to understand working principle of Electric horn, Brake light and side indicator.
12. Visit to workshop to understand wheel balancing.
13. Visit to servicing station for vehicle maintenance, repairs and report.

VII Semester
ME2427– PE-III : Solar Energy & Utilization

Objective	Course Outcome

Unit1 Basics of solar energy **[7hrs]**

Brief History of solar energy &utilization, Various approaches of utilizing solar energy, Blackbody radiation, Relation between radiation field energy density and radiation spectrum, Planck's formula in energy unit, Maximum spectral density, Planck's formula in wavelength unit, Wien displacement law, Stefan - Boltzmann law, Photoelectric effect, Einstein's theory of photons, Einstein's derivation of the black-body formula.

Unit2 Solar radiation, measurement and estimation **[8hrs]**

History of solar energy utilization, basic definitions, Solar radiation and modeling, Empirical equations for predicting the availability of solar radiation, Measurement of global, direct and diffuse radiation, Radiation computations on inclined surfaces, Angstrom's turbidity, Solar chart, Standard radiation scale, Measurement of solar radiation, Solar energy measuring instruments, Pyranometer, Pyrheliometer, Sunshine recorder, Estimation of average solar radiation, Ratio of beam and total radiation on tilted surface of that on horizontal surface.

Unit3 Concentration of solar energy **[7hrs]**

Three types of imaging optics: trough or linear collectors, central receiver with heliostats, and parabolic dish concentrator with on -axis tracking, Solar thermal electricity is using Stirling engine or Ranking engine, Solar photovoltaic with concentration.

Unit4 Solar Thermal systems: **[7hrs]**

Liquid Flat, Plate collector, air heater and concentrating collector, Solar pond, Solar distillation, Solar drying. Thermal storage. Solar Passive Architecture Passive heating and cooling of Buildings. Solar Cooking, Distillation, Desalination, Solar Drying, Solar Chimney.

Unit5 Solar cells: **[8Hrs]**

Formation of a PN–junction, Space charge and internal field, Quasi - Fermi levels, The Shockley diode equation, Structure of a solar cell, The solar cell equation, Fill factor and maximum power, Various electron, hole-pair recombination mechanisms, Crystalline silicon solar cells, Thin film solar cells: CIGS, Cite and silicon - Tandem solar cells, Dye - sensitized solar cells, Organic solar cells. Photovoltaic applications: battery charger, domestic lighting, street lighting, water pumping etc., solar PV power plant, Net metering concept.

Unit6 Storage of solar energy: **[8Hrs]**

Types of Energy Storage, Thermal Storage, Simple water and rock bed storage, pressurized water storage system, Electrical Storage, Fundamental concept of batteries, measuring of battery performance, charging and discharging of a battery, storage density, energy density, and safety issues. Types of batteries, Chemical Storage, Fuel Cell, History of Fuel cell, Principles of Electrochemical storage, Types, Hydrogen oxygen cells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, detailed analysis, advantage and drawback of each type, hydro-

storage.

.Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1.	Solar Energy Utilization	2010	Rai, G.D.	Khanna Publishers, N. Delhi
2.	Solar Energy	3rd Edition, 2008	Sukhatme S.P.,	Tata McGraw Hills P Co.
3.	Solar Energy Thermal Process	2007	Duffie, J.A., and Beckman	John Wiley and Sons, NewYork,
4.	The Physics of Solar Cells	2003	Nelson	Imperial College Press
5.	Solar Energy: Principles of Thermal Collection and Storage	3rd Edition, 2008	S Sukhatme and J Nayak	Tata McGraw Hill,

VII Semester
ME2428– PE-III : Lab. : Solar Energy & Utilization

List of Experiments

1. Solar Radiation Measurements
2. **Flat Plate Solar Water Heater**
3. **Flat Plate Solar Air Heater**
4. **Flat Plate Collector with Reflector**
5. Parabolic Tube Collector
6. Evacuated Tube Collector
7. **Solar Cookers**
8. Thermal Storage System
9. **Study on Solar Cell Characteristics**
10. **Testing of SPV Standalone Systems**
11. **Testing of SPV system with tracking unit**
12. **Performance Evaluation of SPV**

VII Semester
ME2429– PE-III : CNC and Robotics

Objective	Course Outcome
To understand the need and process of automation in industry. Study the Computer Numerically Controlled machines and Robots, their components, functions, functions, programming and applications.[k,m]	Students will be able to: 1. Explain the structure of NC, CNC and DNC 2. Design the tooling of CNC and compose program for CNC. 3. Explain the structure and kinematics of Robot. 4. Explain the various grippers and sensors, deign the applications and compose the program for Robot.

Unit 1 **[7 hrs]**

Concepts of NC, CNC, DNC. Classification of CNC machines, MCU architecture and functionality, Machine configurations, Types of control, CNC controller's characteristics, Interpolators**.**

Unit 2 **[8 hrs]**

Qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices, of CNC Machines.

Programming CNC machines, Part print analysis and Process planning, Advanced Programming features , Canned cycles. APT part programming CAD/CAM, Parametric Programming.**[**

Unit 3 **[8 hrs]**

Manual part programming for CNC turning, milling and machining center. Wire EDM machines. Computer assisted part programming techniques, Conversational and Graphics based software, Solid based part programming. Freeform surface machining. Simulation and Verification of CNC programs, Adaptive CNC control techniques. Integration of CNC machines for CIM.

Unit 4 **[7 hrs]**

Robotics, Basic concepts , Robot configurations , Basic robot motions , Types of drives , Applications

Transformations and kinematics, Vector operations, Translational transformations and Rotational transformations Properties of transformation matrices,

Homogeneous transformations and Manipulator, Forward solution, Inverse solution, Introduction to robot dynamics.

Controls, Control system concepts, Analysis, control of joints, Adaptive and optimal control.

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Unit 5 **[8 hrs]**

End effectors, Classification, Mechanical, Magnetic, Vacuum, and Adhesive, Drive systems, Force analysis and Gripper design.

Robot programming, Methods, Languages ,Computer control and Robot Software – Programming Languages, Robot application (Assembly, inspection, material handling, processing) **[k,m]**

Unit 6 **[7 hrs]**

Sensory devices, Non optical and optical position sensors, Velocity and Acceleration, Range, Proximity, touch, Slip, Force, Torque. Machine vision, Image components , Representation , Hardware , Picture coding , Object recognition and categorisation Integration of Robots with CNC machines for CIM. **[k,m]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Robot Engineering An Intergrated approach	2004	Klafter R.D., Chmielewski T.A. and Negin M	Springer
Reference :				
1	CNC Technology and Programming	2003	Krar, S., and Gill	Industrial Press Inc
2	An Introduction to CNC Machining	1991	Gibbs, D.	Industrial Press
3	Computer Numerical Control Concepts and Programming	1991	Seames, W.S.	Thomson Learning EMEA, Limited
4	Computer Numerical Control for Machining	1993	Lynch, M	McGraw-Hill
5	Computer Control of Manufacturing Systems	2005	Koren Y	Tata McGraw-Hill Education
6	Robotics control, sensing, vision, and intelligence	2004	Fu K.S., Gonzalez R.C., and Lee C.S.G.	Tata McGraw-Hill Education
7	*Robotics Technology and Flexible Automation*	2001	*Deb S.R*	Tata McGraw-Hill Education
8	Introduction to Robotics Mechanics and Control	2008	Craig J.J	Pearson Education India

VII Semester
ME2430– PE-III : Lab. : CNC and Robotics

Objective	Course Outcome
To understand the need and process of automation in industry. Study the Computer Numerically Controlled machines and Robots, their components, functions, functions, programming and applications.[k,m]	Students will be able to: 1. Explain the structure of NC, CNC and DNC 2. Design the tooling of CNC and compose program for CNC. 3. Explain the structure and kinematics of Robot. 4. Explain the various grippers and sensors, deign the applications and compose the program for Robot.

List of Practical

1) Demonstration on Automation through development in NC machines.
2) Numerical control – Fundamental & Application.
3) Manual Part Programming.
4) APT Part Programming.
5) CNC- Lathe – Features, Specification, & Part Program.
6) CNC Lathe – Programming, Simulation & Actual Machining of Part.
7) Thread Cutting, Facing, Turning, Grooving etc.
8) CNC- Milling – Features, Specification, & Part Program.
9) CNC Milling – Programming, Simulation & Actual Machining of Part.
   (Profile Cutting, Various Interpolation, Pocketing, Mirroring etc.)
10) Robots Fundamental and configurations.
11) Robots Applications
12) Programming, Simulation of Robot.
13) Problems on Robot kinematics.

VII Semester
ME2433– PE-III : Piping Design and Engineering

Objective	Course Outcome
• The student should be able to acquire elementary knowledge of Piping Design and Engineering. • To impart the knowledge on selection of components for piping design • To impart the knowledge about selection of equipment for piping design • To impart basic knowledge on piping Engineering flow diagram and process system • To impart basic knowledge to Designing & engineering of Piping Diagram • To impart knowledge on ASME Engineering and pressure design	After completion of this course, Students will be able to **1.** Describe the basic concepts of Piping design and Engineering **2.** Apply the basic concepts involved in selection of components and equipment in piping design. **3.** Apply the knowledge of design and engineering for preparation of process diagram and piping diagram **4.** Describe the application of international standards for piping design

Unit 1 **[8 hrs]**

Fundamentals of Piping Design and Engineering

Introduction to piping designing & engineering, Evolution of piping, Manufacturing methods, Piping materials and selection, Pipe dimensioning, Schedule numbers, Common piping abbreviations, Major organizations for standards, Commonly American code in piping ASME/ANSI, Common abbreviations. **[CO-1]**

Unit 2 **[8 hrs]**

Basic Piping components

Type of Fittings - elbows, weld tee, stub in, couplings, reducers, weld cap, screwed and socket welded fittings, Pipe nipples, flanged fittings and use of fittings, Type Flange -Types, P-T ratings and facings, Gaskets, bolts and nuts, Major Valves - Types, Materials operations, applicability, codes and specifications. **[CO-2]**

Unit 3 **[6 hrs]**

Piping Equipment

Horizontal vessels/accumulators, fractionation columns, pumps, heat exchangers, re-boiler, air cooled heat exchanger, cooling towers, heaters/boilers, storage tanks, fractional distillation process and vendor data drawings, Prepare layout of Different type lights.**[CO-2]**

Unit 4 **[7 hrs]**

Piping Engineering flow diagram and process system

Uses of flow diagrams, process flow diagrams, mechanical flow diagrams, utility flow diagrams, piping symbols, line symbols, valve symbols, piping isometrics, general arrangement drawings- sections/elevations/ detail drawings, plot plan procedures, Purpose of P&ID'S, study of P&ID'S, stages of development of P&ID'S, symbols usage according to industrial practices, Purpose of P&ID in process industrial/plants. **[CO-3]**

Unit 5 **[8 hrs]**

Designing & engineering of Piping Diagram

Plant Co-ordinate Systems, Site Plans, Unit Plot Plan, Equipment Location Drawing, Foundation Location Drawing, Pipe Rack Spacing, Drawing pipe in the rack, pipe insulation shoes, pipe guides, field supports, dummy supports, hanger rods, spring hangers, pick-up pipe supports, plant utilities, control valve manifolds, utility stations, sewer and underground piping system.**[CO-3]**

Unit 6 **[8 hrs]**

ASME Engineering and pressure design

Pipe wall thickness calculations, operating pressure, design pressure, operating & design temperature ,max allowable operating pressure, Pressure design of Pipe, elbows, mitre bends, reinforcement pad calculation for branch connections, flanges, blanks, expansion joints and gaskets. **[CO-4]**

Se	Course code	Course title	CO	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
VIII	ME 1485	Piping Design and Engineering	1.	Describe the basic concepts of Piping design and Engineering	3	2	3			3							3	2
			2.	Apply the basic concepts involved in selection of components and equipment in piping design.	3	2	3			3							3	2
			3.	Apply the knowledge of design and engineering for preparation of process diagram and piping diagram	3	2	3			3							3	2
			4.	Describe the application of international standards for piping design	2	2	3			3							3	1

Reference books:

1	Piping Handbook	07th Edition (2010)	Mohinder L Nayyar	McGraw-Hill Publishing

2	Offshore engineering an Introduction	1995	Angus Mather	Witherby & Company Ltd.
3	Handbook of piping design	1st Edition (2010)	G. K. Sahu	New age International
4	The fundamentals of piping Design	1st Edition (2007)	Peter Smith	Gulf Publishing Company

VII Semester
ME2434– PE-III : Lab. : Piping Design and Engineering

Objective	Course Outcome
• The student should be able to acquire elementary knowledge of Piping Design and Engineering. • To impart the knowledge on selection of components for piping design • To impart the knowledge about selection of equipment for piping design • To impart basic knowledge on piping Engineering flow diagram and process system • To impart basic knowledge to Designing & engineering of Piping Diagram • To impart knowledge on ASME Engineering and pressure design	After completion of this course, Students will be able to **1.** Describe the basic concepts of Piping design and Engineering **2.** Apply the basic concepts involved in selection of components and equipment in piping design. **3.** Apply the knowledge of design and engineering for preparation of process diagram and piping diagram **4.** Describe the application of international standards for piping design

List of Practical

A set of Experiments from following list to be performed.

1. Study of Fundamentals of Piping Design and Engineering using AVEVA PDMS Software. CO1
2. User interface Basics about AVEVA PDMS Software. CO1
3. Displaying modelled element. CO2
4. Working with 3D Views.CO2
5. Attributes, positioning and orientation. CO2
6. General Utilities. CO3
7. Introduction to model editor CO3
8. Introduction to Aveva primitives for piping design.CO4
9. Drafting Features – Automatic Drawing production CO3
10. Draft explorer and viewing control along with draft Hierarchy CO3
11. Dimensioning the drawing – Equipment, piping and structural arrangement CO4

Sem	Course code	Course title	CO	Co contain	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO 12	PSO-1	PSO-2
VIII	ME 1486	Piping Design and Engineering	1	Describe the basic concepts of Piping design and Engineering	3	2	3			3							3	2
			2.	Apply the basic concepts involved in selection of components and equipment in piping design.	3	2	3			3							3	2
			3.	Apply the knowledge of design and engineering for preparation of process diagram and piping diagram	3	2	3			3							3	2
			4.	Describe the application of international standards for piping design	2	2	3			3							3	1

Reference books:

1	Piping Handbook	07th Edition (2010)	Mohinder L Nayyar	McGraw-Hill Publishing
2	Offshore engineering an Introduction	1995	Angus Mather	Witherby & Company Ltd.
3	Handbook of piping design	1st Edition (2010)	G. K. Sahu	New age International
4	The fundamentals of piping Design	1st Edition (2007)	Peter Smith	Gulf Publishing Company

VII Semester
ME2435– PE-III : Earthmoving Equipments

Objective	Course Outcome
1. To introduce and understand the simple Hydraulic power systems and to realize its importance in the world of power transmission. 2. To study various fluids, filters and seals for hydraulic systems 3. To study various components of fluid power systems . 4. To understand symbols associated with Hydraulic circuits and Electronic circuitd. 5. To understand Electronics diagnostic and Computer Aided Diagnostic systems. **6.** Maintenance, troubleshooting and safety practices for Earthmoving equipments.	Students will be able to: (I) To understand and apply fluid power laws and principles (II) Students will be able to understand the basic fluid power hardware system components. (III) Students will be able to interpret and draw hydraulics and electronic system circuits. (IV) Students will be able to design, analyze, use, maintain, carryout troubleshooting, and establish safety procedures of Earthmoving equipments.

Unit 1 : Introduction **[8 hrs]**
Earthmoving equipments: Introduction, Types and applications.
Hydraulic systems: Components, advantages, applications in the field of Earthmoving Equipments.
Seals, sealing materials, selection of seals.
Filters, strainers, sources of contamination of fluid & its control.
Hoses & Pipes: Types, materials, pressure drop in hoses/pipes, valves and fittings. Hydraulic piping connections.
Types of Hydraulic fluid petroleum based, synthetic & water based. Properties of fluids. Selection of fluids, additives, effect of temperature & pressure on hydraulic fluids.

Unit 2 : Mechanical Systems: **[7 hrs]**
Super Structure : Cabin:- dashboard , drive controls and hydraulic controls. Boom, arm and related components.
Under Carriage : Transmission system: drive system , hydraulic systems for earthmoving, Turning system . Gear box and related components.
Attachments : Buckets: Backacter, cam shelve, screening adapter, special buckets.
End effectors: Earthwork attachments, drilling and boring attachment, piling attachment, crusher adapters, breakers, jaws, grabbing and loading attachments.

Unit 3 : Hydraulic Systems: **[7 hrs]**
Pumps: Types, classification, principle of working & constructional details of vane pump, gear pumps, radial & axial plunger pumps, power and efficiency calculations, characteristic Curves, selection of pumps for hydraulic power transmission.
Accumulators & Intensifiers: Types & functions of accumulators & intensifiers, applications, selection & design procedure.

Unit 4 : Hydraulic Systems : **[8 hrs]**
Valves: Types & functions of valves, applications, selection
Actuators: Linear & Rotary actuators.
Hydraulic motors: Types, vane, gear piston, radial piston. Hydraulic motor performance.
Hydraulic Cylinders: Types of cylinder & mountings, calculations of piston velocity, thrust under static & dynamic applications. Design consideration for cylinders.
Hydraulic Circuits: JIC symbols / ISO Symbols for hydraulic circuits
Different hydraulic circuits used in Construction equipments. Hydraulic circuit analysis

Unit 5 : Electrical and Electronics System: **[7 hrs]** Basic electrical components switches, cables, colour coding of cables, Relays,. The basic connections – series and parallel circuits. Electric circuits of earthmoving equipments.. **Electronics Circuits:** Symbols for Electronics circuits Different Electronics circuits used in earthmoving equipments. Electronics circuit analysis
Unit 6 : Maintenance of Earthmoving Equipments: **[8 hrs]** Preventive, predictive & breakdown maintenance. Trouble shooting & safety precautions. Electronics diagnostic and Computer Aided Diagnostic systems.

Text books:			
Title of the book	**Edition (Year of publication)**	**Author(s)**	**Publisher**
Introduction to Fluid Power	2002	James L Johnson	**Delmar Thomson Learning**
Fluid Power With Applications	6th	Anthony Esposito	PEARSON Prentice Hall
Industrial Hydraulics	3rd or above	J.J. Pipenger & T. G. Hicks	McGraw Hill Co.
Pneumatic Systems: Principles and Maintenance	16th (2006)	S. R. Majumdar	Tata McGraw-Hill Education
Reference Books:			
Power pneumatics	(2007)	Michael J. Pinches	Prentice Hall
Vickers manuals on Industrial Hydraulics	3rd edition or above	Vickers	Vickers, 1996
Hydraulics & Pneumatics	4th edition	Harry L. Stewart	Industrial Press
Fluid Power Design Handbook	3rd edition	Franklin D. Yeaple	Marcel Dekker, 1996

VII Semester
ME2436– PE-III : Lab. : Earthmoving Equipments

Objective	Course Outcome
1. To introduce and understand the simple Hydraulic power systems and to realize its importance in the world of power transmission. 2. To study various fluids, filters and seals for hydraulic systems 3. To study various components of fluid power systems . 4. To understand symbols associated with Hydraulic circuits and Electronic circuits. 5. To understand Electronics diagnostic and Computer Aided Diagnostic systems. **6.** Maintenance, troubleshooting and safety practices for Earthmoving equipments.	Students will be able to: (I) To understand and apply fluid power laws and principles (II) Students will be able to understand the basic fluid power hardware system components. (III) Students will be able to interpret and draw hydraulics and electronic system circuits. (IV) Students will be able to design, analyze, use, maintain, carryout troubleshooting, and establish safety procedures of Earthmoving equipments.

Practical:

1. Practical based on syllabus.
2. Industry visit / site visit to experience actual working of Earthmoving equipments.
3. Visit to Service station / workshop of Earthmoving equipments
4. Hands on experience of diagnosis, trouble shooting and repairing of Earthmoving equipments.

VII Semester
ME2441– PE IV : Sysnthesis of Mechanism

Objective	Course Outcome
To make the students understand various types of mechanisms and criterion used in their selection. To give detailed knowledge of type, number and dimensional synthesis of mechanisms. To introduce various graphical and analytical methods so as to enable students to design the mechanisms to meet kinematic needs. Introducing various optimization techniques for synthesis.	CO-I Describe the fundamentals of kinematic synthesis and its application. CO-II Formulate mathematical model of function generation, path generation and motion generation. CO-III Apply various graphical and analytical methods to design the mechanisms to meet kinematic needs. CO-IV Evaluate the various optimisations techniques for synthesis.

Unit 1 **[7 hrs]**

Introduction to kinematics, types of mechanism, kinematics synthesis, science of relative motion, tasks of kinematic synthesis with practical applications, Degree of freedom, class-I, class-II chain, Harding's notation, Grashof criterion, Grubler's criterion.

Unit 2 **[8 hrs]**

Introduction to position generation problem, concept of pole, two &three position generation synthesis, pole triangle, Relationship between moving & fixed pivots, Four position generation, opposite pole quadrilateral, center point &circle point curve, Burmester's point. Matrix method for position generation problem, rotation matrix, displacement matrix.

Unit 3 **[7 hrs]**

Introduction to function generation problem, co-ordination of input-output link motion, relative pole technique, inversion technique, overlay technique, graphical synthesis of quick return mechanisms for optimum transmission angle. Types of errors, accuracy points, cheby sher's spacing, frudenstein's equation with problems.

Unit 4 **[8 hrs]**

Introduction to path generation problem, synthesis for path generation with and without prescribed timing using graphical method. Coupler curves, cognate linkages, Robert's law of cognate linkages.

Complex number method for path generation problem 3 precision points.

Unit 5 **[7 hrs]**

Synthesis for infinitesimally separated position, concept of polode and centrod, Euler's savery equation, inflection circle, Bobbilier and Hartman's construction.

Unit 6 **[8 hrs]**

Optimal synthesis of planer mechanisms, powell's search method, least square method, penalty function. Introduction to spatial mechanisms, D-H notations, introduction to kinematic analysis of robot arm.

Reference books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Applied linkage synthesis	Fifth edition	Tao D.C.	New York, NY,
2	Advanced mechanism design	1984	Erdman A.G.; Sandor G.N	Prentice-Hall, 1984
3	Kinematics and mechanism design	Third edition 2010	Sue C.H; Radchiffe C.W	

VII Semester
ME2442– PE IV : Design for Manufacturing & Assembly

VII Semester
ME2443– PE IV : Renewable Energy System

Objective	Course Outcome
To realize the importance of various renewable energy sources in this era of energy crisis. To study the theory of conversation of various renewable energy such thermal, electrical, etc. Apply thermodynamics cycles to above systems. To study Magneto Hydrodynamic systems.	**CO-I**: Students will be able to analyse solar energy and equipment's related to solar energy **CO-II**: Students will be able to realize the potential of Solar Energy, biomass, biogas, gasifiers. **CO-III**: Students will be able to analyse the potential of Wind, OTEC & Tidal energy development **CO-IV**: Students will be able to know the awareness of geothermal energy and MHD power generation

Unit 1 **[8 hrs]**

Solar Energy: Introduction, solar constant, spectral distribution of solar radiation, beam & diffuse radiation, measurement of solar radiation and measuring instruments. Solar radiation geometry **[CO - I]**

Unit 2 **[8 hrs]**

Solar Collectors: Types of solar collectors, Solar flat plate collector, analysis of solar flat plate collector Concentrating Collectors: Line focusing, point focusing and non-focusing type, central receiver concept of power generations compound parabolic collector, comparison of flat & concentrating collectors. **[CO - I]**

Unit 3 **[8 hrs]**

Solar energy storage, sensible, latent and thermo chemical storage, solar pond

Applications of Solar Energy: Water Heater, air Heater, Apace Heating, Power Generation

Solar photo- voltaic cell,

Biogas and Biomass: - Types of Biogas plants, Methods of Biogas generation, factors affecting the biogas generation, site selection, gasifiers, classification of gasifiers & constructional details chemistry of gasification fuel properties, applications of gasifiers. **[CO – II]**

Unit 4 **[7 hrs]**

Wind energy*:* - Basic principle of wind energy conversion, Classification of WEC systems, savonius and darrieus rotars applications of wind energy. Site selection, Merits & demerits of wind power generation, combined wind/Diesel power plants, combined Solar/Wind power plant.

OTEC & Tidal energy: Introduction: - ocean thermal electric conversion open and closed cycle of OTEC, hybrid cycle, energy from tides basic principles of tidal power & components of tidal power plants, single & double basin arrangement, estimation of tidal power and energy, Advantages & Limitation of Tidal Power, Energy from ocean waves -energy availability, wave energy conversion devices. [CO – III]

Unit 5 **[7 hrs]**

Geothermal power generation: Geothermal energy: Introduction, Thermal Gradient, Resources of Geothermal Energy: Hydrothermal, petro-Geothermal, Geopressure sources, classification of geothermal systems vapour dominated system, liquid dominated system, total flow concept, Merits and Demerits of Geothermal Energy Sources, applications of geothermal energy, operational & environmental problems, advanced concepts in Geothermal Energy. **[CO - IV]**

UNIT 6 **[7 hrs]**

Magneto Hydro Dynamic power generation: Introduction, working principles of MHD power generation, MHD open and closed systems, power output from MHD generators, design problems of MHD generation, gas conductivity, seeding, Application of MHD Power generation.

Fuel cells: overview, working principle of Operation of Fuel cells, Types of Fuel cells, Design of PEMFC system **[CO - IV]**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Energy Technology	3rd edition	Parulekar & Rao	Khanna Publishers
2	Non Conventional Energy Sources		G D Rai	Standard Publishers Distributors
Reference book				
1	Solar Energy	3rd edition	S.P. Sukhatme	Tata McGraw-Hill Education,
2	Solar Energy	3rd edition, 2006	John A. Duffie, William A. Beckman	Wiley
3	Solar energy engineering	2007	Jui Sheng Hsieh	Prentice-Hall,

VII Semester
ME2444– PE IV : Engineering of Plastics

Objective	Course Outcome
To familiarize students with : 1. Various Plastic materials, Their properties and applications 2. Different plastic processing techniques.**[c]**	1. Students will be able to identify the plastic materials for some specified applications based on its property. 2. Students will be able to investigate suitable plastic Processing technique. 3. Students will be able to evaluate the suitable machining and joining of plastic materials. 4. Students will be able to justify the suitable Solid State Fabrication Techniques

Unit 1 **[7 Hrs]**

Chemistry and Classification of Polymers - Properties of Thermo Plastics - Properties of Thermosetting Plastics - Applications - Merits and Disadvantages.**[c]**

Unit 2 **[7 Hrs]**

Extrusion - Blow Molding – Casting – Thermo Forming – Rotomolding Study of molds [**c]**

Unit 3 **[8 Hrs]**

Compression and Transfer Molding - Injection Molding- study of compression and injection molding moulds [**c]**

Unit 4 **[8 Hrs]**

General Machining properties of Plastics - Machining Parameters and Their effect - Joining of Plastics - Mechanical Fasteners - Thermal bonding - Press Fitting. Testing of plastic [**c]**

Unit 5 **[8 Hrs]**

Fibers - Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers - Matrix Materials - Polymers, Metals and Ceramics. Open Mould Processes, Bag Molding, Compression Molding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting - Injection Molding - Application of PMC's. [**c]**

Unit 6 **[7 Hrs]**

Solid State Fabrication Techniques - Diffusion Bonding - Powder Metallurgy Techniques - Plasma Spray, Chemical and Physical Vapor Deposition of Matrix on Fibers - Liquid State Fabrication Methods - Infiltration - Squeeze Casting - Rheo Casting - Compocasting - Application of MMCS. [**c]**

.**Reference books:**

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Product Design and Process Engineering	1995.	Harold Belofsky,	Hanser Publishers,
2	High Performance Polymers	**1991**	Bera, E and Moet	Hanser Publishers,
3	Plastics Extrusion technology	**1988**	F.Hensen,	

.**Reference books:**				
4	Injection Moulding Machines	**1983**	F.ohannaber	Hanser Publishers,
5	Polymer extrusion	**1990**	C.Rauwendaal,	Hanser Publishers,
6	Blow Moulding Handbook	**1989**	D.V.Rosatao,	Hanser Publishers,
7	Modern Plastics Moulding		E.B Seamour,	John Wiley.
8	Plastics Moulding	**1952**	John Dalmonte,	John Wiley.
9	Machining of Plastics	**1981**	Akira Kobyashi,	Mc-Graw Hill.
10	Composite Materials science and Engineering	**1998**	Krishan K.Chawla	Springer-Verlag, 1987.

VII Semester
ME2445– PE IV : Finance & Cost Management

Objective	Course Outcome
•To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply a few well understood basic principles of Management to find its solution. •To be able to take a proper decision at proper time which will be beneficial in future.	(I) The student will have ability to evaluate the cost of the product (II) The student will have the ability to Analyze the financial requirement. (III) The student will have improved Decision making ability. (IV) The student will have ability to take a proper decision on waste or scrap material.

Unit 1 **[7 Hrs]**

Business Finance:

Need for finance, sources of finance (fixed and working capital), equity and preference shares, deposits from public, debentures, bonds, term loans, financial institutions in India, Financial statements and their analysis.

Unit 2 **[7 Hrs]**

Concept of Cost:

Concept of cost, classification of cost, direct and indirect , fixed and variable , semi variable, product and period, controllable and uncontrollable costs, opportunity costs , sunk cost, joint cost, prime cost, factory cost, cost of production, selling and distribution cost, administrative cost, cost of sales.

Unit 3 **[7 Hrs]**

Cost ascertainment and cost reduction:

Concept of overhead, collection of overheads, allocation and appointment, absorption of overheads, absorption rates, under – over absorption , cost centers, cost units, cost statement sheet.

Areas of cost reduction, techniques, productivity.

Unit 4 **[8 Hrs]**

Costing System:

Job costing, contract costing, cost plus contracts, batch costing, process costing, simple process costing, normal abnormal losses and gains, waste, scrap & spoilage, joint & byproducts, operating costing.

Unit 5 **[8 Hrs]**

Cost Planning and Control:

Concept of budgeting, advantages and limitations, budgetary control, key factors, fixed and flexible budget.

Standard costing, selling of standards, variance analysis.

Unit 6 **[8 Hrs]**

Decision Making:

Marginal costing, break even analysis, cost volume, profit analysis, application of costing to various decisions like make or buy, add or drop products, cost or process further, operate or shut down, replace or retain.

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Principles and Practice of Cost Accounting	Fifth edition	N.K.Prasad	Pearson Education
2	Cost Accounting		Jawahar Lal	
3	Management Accountancy	Third edition2010	J. Batty	Tata Mc Graw Hill
4	Financial Management		Khan and Jain	
5	Financial Management	2007	Prasanna Chandra	Tata Mc Graw Hill
6	Engineering Economy	1973	Paul Degarmo	Macmillan, 1973
7	Cost Accounting	2008	B.K.Bhar	Academic publishers
8	Costing and finance management	2012	Mrunalini Naik	Thakur publications

VII Semester
ME2446– PE IV : Artificial Intelligence

Objective	Course Outcome
• To learn about the automation of machines tools making the system intelligent. • Understanding the different techniques used for implementation of artificial intelligence	(I) The student will have ability to analyze the concept of NLP,Expert System and role of Knowledge base in Artificial Intelligence. (II) The student will have ability to understand the rule based System and rules for conflict resolution. (III) The student will have ability to analyze the role of Knowledge Engineer and Domain Expert with the help of routine example.. (IV) The student will have ability to analyze the NN/ANN applications in Mechanical Engineering.

Unit 1 **[7 hrs]**

Human and machine intelligence, Artificial Intelligence (AI), Programming in AI environment,. Natural Language processing (NLP) Architecture of an Expert system, Knowledge base, inference engine forward and backward chaining, Selection of inference mechanism.

Unit 2 **[7 hrs]**

Introduction, to Rule Based System, Conflict Resolution, Advantages and Drawbacks of Rule Based Systems Clausal Form Logic; Rule Base Verification, Refinement and Validation

Unit 3 **[9 hrs]**

Creating Knowledge Base, Knowledge Engineer and Domain Expert, Phases of Knowledge Engineering, Tools for Knowledge Engineering

Unit 4 **[7 hrs]**

Neural network applications, artificial neural network models, NN applications in Cellular manufacturing and other areas of mechanical Engg.**]**

Unit 5 **[7 hrs]**

Fundamentals of OOP (Object oriented programming), creating structures and objects, object operations, invoking procedures, programming applications, Object oriented expert systems.

Unit 6 **[8 hrs]**

Semantic nets, ruled systems for semantic nets, certainty factors, automated learning;

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Designing Knowledge Based System	1985	Addis, T.R	Prentice Hall
2	Principles of Artificial Intelligence and Expert Systems Development	1988.	Rolston, D.W	McGraw Hill
3	Handbook of Expert Systems in Manufacturing	1991	Maus, R. and Keyes	McGraw Hill
4	A comprehensive guide to artificial intelligence and expert systems	1990	Robert Levine	McGraw-Hill, 1990
5	Artificial Intelligence	1991	Elain Rich	McGraw-Hill, 1991
6	Rule based expert systems	1990	Sasikumar, Ramani	
7	Design for Knowledge Based Systems	1978	Graham Winstanley	Galgotia Publications
8	Artificial Neural Networks	1992	Zurada	West, 1992
9	Neural Networks and Fuzzy Logic		V.B. Rao and H.V. Rao, "C^{++} :	BPB Publications

VII Semester
ME2447– PE IV : Maintenance Management

Objective	Course Outcome
To Study (1) Functions of maintenance dept. (2) Types of maintenance policies (3) Various failures modes and their diagnosis (4) Various conditioned monitoring technique (5) Various types of maintenance costs & their estimation (6) Various techniques for measurement of maintenance work **(7)** Plan for maintenance of machines	The student will be able to, (I) understand the maintenance function, its importance, types and organize the maintenance department. (II) analyze the failure of a machine and plan the condition monitoring program for a machine .] (III) Estimate repair and maintenance cost and evaluate maintenance performance.] (IV) Understand the maintenance needs of basic electrical and mechanical devices.

Unit I **[8 Hrs]**

Objectives, scope, structure of maintenance organization and operating policies to guide management, policies with respect to work allocation, work force, intra and inter plant relation, material, finance and control.

Concept of life cycle maintenance, optimization of total maintenance, analysis of productivity ,Reliability ,Maintainability, and Availability,

Unit II **[7 Hrs]**

Maintenance policies, Preventive maintenance program, corrective maintenance guidelines, replacement policies-cyclic replacement, group replacement, standbys, economics of machine replacement, TPM, RCM and CMMS.

Unit III **[7 Hrs]**

Failure analysis:

General practice, failure classification , data collection, failure pattern recognition ,determination of replacement period, time between preventive maintenance checks. Use of various modern techniques to monitor the condition of machine to facilitate maintenance

Unit IV **[8 Hrs]**

Work measurement for maintenance:

Need for Work measurement ,various techniques for work measurement of direct and indirect labour. Work force requirement, location and size.

Unit V **[8 Hrs]**

Control and estimation of maintenance cost:

Job classification, various estimating techniques and its use.

Maintenance manual, plant performance improvement, Maintenance training program, Maintenance control indices and factor affecting them .Lubrication system-need ,design and implementation.

Unit VI **[7 Hrs]**

Maintenance of various mechanical and electrical equipments.

.**Reference books:**

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Maintenance engineering handbooks	2008	Mobley and Higgins	Mc-graw Hill
2	Guide to Complete Maintenance	1988.	Rolston, D.W	Heintzelment
3	Maintainability and maintenance management	1991	J. Patton	Maus, R. and Keyes
4	Operation research in Maintenance	--	Jarding	--
5	Introduction to reliability and maintainability Engineering.	--	Thomos Ebelling	Mc-graw Hill
6	Advanced operations management		R.P.Mohanty and S.G.Deshmukh	Pearson Education
7	Maintenance engineering and management		R.C.Mishra and K.Pathak	PHI Publications
8	Industrial Maintenance management		S.K.Shrivastava	S.Chand

VII Semester
ME2448– PE IV : Total Quality Management

COURSE OBJECTIVES	COURSE OUTCOMES
• The course aims to build an overall capability to understand Quality and its relevance in today's dynamic market. • Various Quality Improvement tools and technique shall be introduced and practiced so as to develop skills and knowledge to function as a good quality professional in the Engineering Profession.	1. Develop an understanding on quality management philosophies and frameworks. 2. Develop in-depth knowledge on various tools and techniques of quality management. 3. To Evaluate the applications of quality tools and techniques in both manufacturing and service industry 4. Ability to use quality management methods analyzing and solving problems of organization.

Unit 1	**[7 hrs]**
Principles of Quality Management, Pioneers of TQM, Quality costs, Quality system Customer Orientation, Benchmarking, Re-engineering	
Unit 2	**[7 hrs]**
Leadership, Organizational Structure, Team Building, Information Systems and Documentation – Quality Auditing, ISO 9000 - QS 9000.QMS, Quality awards.	
Unit3	**[8 hrs]**
Single Vendor Concept, J.I.T., Quality Function deployment, Quality Circles, KAIZEN, SGA POKA -YOKE, Taguchi Methods. SMED, Kanban system. Cost of quality. Robust design	
Unit4	**[8 hrs]**
Methods and Philosophy of Statistical Process Control, Control Charts for Variables and Attributes	
Unit5	**[8 hrs]**
Cumulative sum and exponentially weighted moving average control charts, Others SPC Techniques – Process Capability Analysis. Acceptance Sampling Problem, Single Sampling Plans for attributes, double, multiple and sequential sampling,]	
Unit6	**[7 hrs]**
Six sigma manufacturing concepts. Six-sigma philosophy Quality strategy and policy. Motivation and leadership theories. Continuous vs. breakthrough improvements. Management of change, DMAIC Methodology. Lean manufacturing	

Reference books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Total Quality Management for Engineers	1991	Mohamed Zairi	Woodhead Publishing Limited 1991
2	Production and Operations mangament - Total Quality and Responsiveness	1995	Harvid Noori and Russel	McGraw-Hill Inc, 1995
3	Managing for Total Quality	1998	N.Logothetis	Prentice Hall of India Pvt .Ltd,1998
4	The Essence of Total Quality Management	1995	John Bank	Prentice Hall of India Pvt.Ltd., 1995.
5	Introduction to Statistical Quality Control	1991	Douglus C. Montgomery	2nd Edition, John Wiley and Sons, 1991.
6	Statistical Quality Control	1984	Grant E.L and Leavensworth	McGraw-Hill, 1984.

VII Semester
ME2449– PE IV : Project Evaluation & Management

Objective	Course Outcome
The course focuses on developing complete understanding of formulating a problem/project and finding possible solutions against the given constraints. The overall learning shall resolve project identification evaluating its technical and economical feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details	The students will be able 1. To apply the concepts of monitoring and evaluation, appraise 2. To analyze the best monitoring methods, appreciate evaluation in the context of developmental project work 3. To perform problem analysis, determine relevant indicators and data necessary for evaluation, 4. Implement a monitoring and evaluation process, establish baselines and targets..

Unit1 **[7 hrs]**

Project Identification considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project demand forecasting, secondary data, accuracy, confidence level, uncertainty.

Unit2 **[7 hrs]**

Technical feasibility: Process selection, Level of automation, plant capacity, acquiring technology, Appropriate technology plant location, Equipment selection & procurement, Govt. policies. Value analysis and project evaluation.

Unit3 **[9 hrs]**

Economic feasibility: Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Break even point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes.

Unit 4 **[7 hrs]**

Project Planning and Control: Work break down structure and network development. Basic Scheduling, Critical Path and four kinds of floats. Scheduling under probabilistic durations, Time Cost tradeoffs, CPM, PERT, Optimum project duration, resource allocation, updating.

Unit 5 **[7 hrs]**

Project report: Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital

Unit6 **[8 hrs]**

Initial review, performance analysis , ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost,

Organizational aspects, Computer packages and Project Completion environ-mental & social aspects.

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Projects	Seventh edition 2007	Prasanna chandra	Tata mc graw Hill publishing company Ltd.
2	CPM & PERT		L. S. Srinath	East West publisher
3	Projects	1963	P.K. Joy	Macmillon
4	Engineering Economy	Fifth edition	H. G Thuesen, W J Fabricky, G,J, Thuersen	Prentice-Hall
5	Finance series 'Project management' , Vol-I1 and Vol-III	2009	ICFAI	ICFAI,Press Hyderabad
6	Finance Management	Sixth edition 2010	M.Y.Khan	Tata McGraw hill
7	Financial Management	Fourth edition	Chandra, Prasanna	Tata McGraw-Hill Education, 1997
8	Engineering Economics	Eighth edition	G. J. Thuesen, Wolter J. Fabrycky	Prentice Hall, 1993

VII Semester
ME2461– PE V : Stress Analysis

Objective	Course Outcome
To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply to its solution a few, well understood basic principles of stress analysis.[c,e]	(Students will be able to: 1. Analyze the stresses and strains in simple problems in Cartesian co-ordinate. 2. Analyze the stresses and strains in simple problems in Polar co-ordinate. 3. Analyze the stresses and strains using whole field method. 4. Analyze the stresses and strains using strain gauges, carryout of analysis for fracture and fatigue; design a proper stress analysis system for as per system requirements.

Unit 1 **[7 hrs]**

Two Dimensional Problems in. Cartesian Coordinate system -Fundamentals of stress & strain, stress-strain relationship, Elastic constant, plane stress, plane strain., differential equation of equilibrium Boundary conditions, Saint Venant's principle, compatibility equation.

Unit 2 **[7 hrs]**

Airys stress function. Stress analysis of cantilever subjected to concentrated load at its end and simply supported beam subjected to uniformly distributed load.

Two dimensional problems in polar coordinate systems -General equations of equilibrium in polar coordinate compatibility equation.

Unit 3 **[7 hrs]**

Stress distribution about symmetric. axis, stress analysis of cylinder subjected to ~ internal & external pressure, Pure bending of curved beams, effect of hole on the stress distribution in plates, Stress analysis of rotating circular disk.

Unit 4 **[8 hrs]**

Introduction to various methods of stress analysis like grid techniques, brittle coating method, Moire fringe method etc.

Two Dimensional Photo elasticity - Introduction to basic optics related to photo elasticity, stress optic law, plane & circular polariscope arrangements, diffusion and lens type polariscope .Effect of stressed model in plane & circular polariscope, Isoclinic & Isochromatics, stress trajectories, calibration of photo elastic material (determination of fringe constant). Various photoelastic materials and their properties, Casting of photo elastic models, Tardy's and other compensation technique. Separation techniques like, shear difference, oblique incidence & electrical analogy.

Unit 5	**[8 hrs]**
Strain gage technique for stress & strain analysis -Introduction to electrical resistance strain gages, gage . factor, bridge circuit, bridge balance, output voltage of Wheatstone bridge, balancing of bridge, temperature compensation, various bridge configurations, bonding of strain gages to the specimen, determination of principle strains & stresses using strain rosettes. Environmental effects on performance of strain gages, Strain gages response to dynamic strains, Effect of lead wires. Introduction to Strain measurement on rotating components, Static & Dynamic Strain Measurement introduction to semiconductor gages, high temperature strain gages & self-temperature compensated gages. Introduction to Commercial strain indicators.	
Unit 6	**[7 hrs]**
Introduction to fatigue and fracture mechanics.	

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Theory of Elasticity	2nd edition	Timoshenko S.P;	Tata McGraw-Hill Education, 1951
2	Experimental Stress Analysis	3rd edition	Dally ;Riley	McGraw-Hill, 1991
3	Experimental Stress Analysis	1982	Ray T.K.	S. Chand,
4	Experimental Stress Analysis	1984	Srinath L.S	Tata McGraw-Hill Publishing Company Limited, 1984
5	Vol - I and Vol – II."Theory of photoelasticity	2009	Max Mark Frocht	Pergamon Press, 1969
6	Applied elasicity	--	Chi The Wang	Amazon

VII Semester
ME2462– PE V : Product Design and Development

Objective	Course Outcome
To understand the Product Life Cycle. Study different design techniques, product development phases, process selection, material selection and costs associated with PDD	Students will be able to: (1) Evaluate the product life cycle (2) Analyze and select the materials and manufacturing processes for designed product. (3) Evaluate the product for different design criteria like Value engineering/ analysis, robust design, benchmarking, DFX,etc and estimate the product costing. (4) Explain the various prototyping methods and its economics.

UNIT 1	**Introduction** Importance of product design, types of design, product definition, product specification, Phases of product development: conceptual, embodiment and detailed design, product and technology development cycle, concept generation and evaluation methods.	**[7 hrs]**
UNIT 2	**Material and Process selection** Material selection – Importance, classification, material performance characteristic, Selection criteria, Ashby Material selection chart. Process selection – Importance types of manufacturing processes and their classification, sources of information, selection criteria, Material and Process selection Methods- Expert systems, Computer Database Approach, Performance indices, decision matrix, AHP and fuzzy approach, introduction to material and process selection software	**[7 hrs]**
UNIT 4	**Benchmarking** Benchmarking – DFM, DFA, DFX, Early supplier involvement, robust design, QFD and concurrent engineering.	**[8 hrs]**
UNIT 5	**Product Costing** Mathematics of Time Value of Money, Cost Comparison, Depreciation, Taxes, Inflation, Profitability of Investment and Investment Decision Analysis Sensitivity Analysis. Methods of Cost Estimates. Creative thinking, Ergonomics in Design.	**[8 hrs]**
UNIT 6	**Rapid Prototyping** Product Development Cycle and Importance of Prototyping, Types of Prototypes, Principle and Advantages & Different Type of Generative Manufacturing Process, Viz, Stereolithography, FDM, SLS etc. Factors Concerning to RP: Consideration for Adoptions, Advantages, Accuracy and Economic Considerations	**[7 hrs]**

Book for reference:

1. Dieter George E. "Engineering Design", McGraw Hill Pub. Company, 2000
2. Ulirich Karl T. and Eppinger Steven D., "Product Design and Development" McGraw Hill Pub. Company, 1995.
3. Bralla, James G., "Handbook of Product Design for Manufacturing" McGraw Hill Pub. Company, 1986
4. HARRY NYSTROM, " Creativity and innovation", John Wiley & Sons, 1979.
5. BRAIN TWISS, " Managing technological innovation", Pitman Publishing Ltd., 1992.
6. HARRY B.WATTON, " New Product Planning ", Prentice Hall Inc. 1992.
7. P.N.KHANDWALLA - " Fourth Eye (Excellence through Creativity) – Wheeler Publishing ",Allahabad, 1992.
8. I.P.R. Bulletins, TIFAC, New Delhi,A.K. Chitale and R. C. Gupta, Product Design and

VII Semester
ME2463– PE V : Power Plant Engineering

Objective	Course Outcome
1. To study the basics of power generations systems. 2. To study conventional & non-conventional power plants. 3. To study the combined operations of different power plants. 4. To study Power load analysis & Economic analysis of power generations systems.	(I) Student will be able to understand the various systems of thermal power plant (Steam and Gas) (II) Student will be able to understand hydraulic power plants.] (III) Student will be able to undertake power load analysis & Economic analysis of power generations systems. (IV) Student will be able to understand nuclear power plat and safety aspect.

Unit1 **[7 Hrs]**

THERMAL POWER PLANT- I

Introduction to thermal power plants and power plant layouts.
Fuel characteristics, handling, storage, preparation & firing methods. Ash & dust collection and handling.
Boiler: classification, general arrangement, details of different components and system like draught system, steam turbine systems, condenser, cooling towers, water treatment, Waste Disposal-Present practices, environmental hazards and other social aspects**.**

Unit2 **[8 Hrs]**

THERMAL POWER PLANT- II

Gas Turbine Power Plant: -Introduction, power plant layouts, Open cycle, close cycle power plants. Various components and systems. Methods to improve efficiency. Reheat and Regeneration cycle and their combinations
Diesel Electric Power Plant: - Introduction, Outline, type of engines, different components, performance, plant layout.
Comparison with other power plant. Introduction to captive power plant.(To study the practical aspect ot power plant,the visit to nearby power plant shall be arrange for the students) **.**

Unit 3 **[7 Hrs]**

HYDROELECTRIC POWER PLANT.

Hydrology: - Rainfall, Runoff, Hydro graph, flow duration curve, mass curve.
Hydroelectric power plant: - Site selection, classification of hydroelectric power plant, general arrangement, details of different components, turbine selection, models & model testing, governing.
Comparison with other power plant.

Unit 4 **[8 Hrs]**

POWER PLANT ECONOMICS

Load Analysis - Fluctuating Load on power plants, Load curves, various terms & definition, peak load, effect of fluctuating load.

Economic Analysis: - Cost of electric energy, load division, and. Tariff methods for Electrical Energy.

Unit 5 **[8 Hrs]**

NUCLEAR POWER PLANT

Introduction to Nuclear Engineering, Global scenario, prominent installations worldwide, present & proposed nuclear plant in India.

Nuclear Reactors: - Types of reactors, PWR, BWR, CANDU, Gas cooled, liquid metal cooled, Breeder reactor. Operational requirements and difficulties, site selection for location of a nuclear power station Nuclear Waste Disposal-Present practices, environmental hazards and other social aspects.

Comparison with other power plant.

Unit 6 **[7 Hrs]**

COMBINED OPERATION OF DIFFERENT POWER PLANTS

Combined operation: - Need division, combination of different plant & their coordination, advantages.

NON CONVENTIONAL POWER GENERATION SYSTEMS

Introduction to Non Conventional power Generation Systems

Geo-Thermal Power Plant, Tidal Power Plant, Wind Power Plant, Solar Power Plant

Global scenario, prominent installations worldwide present & proposed plant locations.

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Power Plant Engineering	2002	Domkundwar.	Dhanpat Rai & Co.

Reference books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Power Plant Engineering	2007	Vopal & Slortzki	
2	Power Plant Engineering	1984	M.M. Wakil	TATA Mc-Graw Hill.
3	Power Plant Engineering	2008	P. K. Nag	TATA Mc-Graw Hill.
4	Power Plant Engineering	2005	R. K. Rajput	TATA Mc-Graw Hill.

VII Semester
ME2464– PE V : Value Engineering

Objective	Course Outcome
To familiarize students with : 1. Philosophy of Value Analysis / Value Engineering , its importance and application 2. The various steps involved in systematic implementation of Value Analysis / Value Engineering	Students will be able to: 1. Explain the various typs of Values and functions. 2. Evaluate the product life cycle. 3. Analyze the project selection and estimate life cycle costs. 4. Evaluate and improve value of product/system by designing and critically analyzing the VE job plans and othe VE/VA techniques.

Unit 1 **[7 hrs]**

Introduction to Value Engineering (V.E.) and Value Analysis, Quantitative definition of Value, Use Value and Prestige Value, Estimation of product quality/performance, Types of Functions.

Unit 2 **[7 hrs]**

Life Cycle of a Product, Product life cycle Management, Methodology of V.E.,

Unit 3 **[8 hrs]**

Relationship between Use Functions and Esteem Functions in product design, Functional Cost and Functional Worth, Effect of value improvement on profitability, Aims of VE systematic Approach

Unit 4 **[8 hrs]**

Introduction to V.E. Job plan / Functional Approach to Value Improvement, Various phases and techniques of the job plan

Unit 5 **[8 hrs]**

Factors governing project selection, Life Cycle Costing for managing the Total Value, Concepts in LCC, Present Value concept, Annuity concept, Net Present Value, Pay Back period, Internal rate of return on investment (IRR), Examples and illustrations

Unit 6 **[7 hrs]**

Creative thinking and creative judgment, False material, labor and overhead saving, System Reliability, Reliability elements in series and parallel, Decision matrix, Estimation of weights and efficiencies, Sensitivity analysis, Utility functions, Fast diagramming, Critical path of functions, DARSIRI method of value analysis, Purchase price analysis.

Reference Books				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Value Engineering	1962	L.D.Miles	Materials Management International,
2	Getting more at less cost	1995	Jagannathan	Tata McGraw-Hill Publishing Company Limited,
3	Value Engineering		Tufly	
4	Value Engineering	3rd edition	Donald Parker	
5	Value Engineering	4th edition	Zimmerman	City of Tulsa, 1984

VII Semester
ME2465– PE V : Design of Experiments and Taguchi Methods

Objective	Course Outcome
The course aims to develop the engineering - analysis capability for engg-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course.	Students will be able to 1) Calculate and represent Frequency Distribution, Histograms and Probability distribution 2) Design the experiments 3) Distinguish and analyze the different optimization techniques. 4) Analyze the variance in observation data.

Unit 1 **[7 Hrs]**

Frequency Distribution & Histograms, Probability & its Distribution, Measures of Central Tendency & Distribution, Presentation of Statistical Data. Importance and significance of statistics in an engineering industry.

Unit 2 **[8 Hrs]**

Confidence intervals, Hypothesis Testing, Correlation, Liner & Multiple Repression Analysis, Signification Testing, Introduction to minitav

Unit 3 **[7 Hrs]**

Full & fractional factorial experiments, analysis of variance, Latin squares, response surface methology,

Unit 4 **[7 Hrs]**

Group Method of Data Handling, shainin variable search technique, Regression equation in matrix form.

Unit 5 **[8 Hrs]**

Taguchi techniques, concept of six sigma, DoE and six sigma, Six sigma implementation.

Unit 6 **[8 Hrs]**

Industrial application of Taguchi technique, orthogonal arrays, OA selection, DoE with Taguchi and comparison with conventional DoE

Text books:				
S.N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Experimental Design	1950	Cochran & Cox	Wiley,
2	Taguchi Techniques in Quality Engineering	2nd edition	Phillip J. Ross	McGraw-Hill, 1996
3	Statistical Analysis for Engineers and Scientist	2010	Barnes	McGraw-Hill, 1994
4	Introduction to Probability and Statistics	4th edition 2003	Milton	McGraw-Hill,
5	Engineering Statistics	2nd edition	Bowker & Liberman	Prentice-Hall, 1972

VII Semester
ME2466– PE V : Industrial Safety

Objective	Course Outcome
•To understand the need and importance of safety. Study different types of accidents and its preventions. Also study the various safety equipments and their applications. •Learn how to get higher operating plant and equipment reliability that lifts efficiency and output of operating assets, stops equipment failures and creates higher plant and equipment reliability, with this subject.	(I) Student will be able to understand the risk management (II) Student will be able to handle the accidental situation in plant (III) Student will be able to understand the operations of different type of safety instruments. (IV) Student will be able to arrange the training for employees on Safety.

Unit 1 **[7Hrs]**

Introduction

Introduction to occupational safety & health, need for occupational safety, Safety Organization, Safety Policy, Safety Committee, Safety Officer, Medical Officer, Labour welfare Officer, Safety manual, Disaster management plan, Government & other autonomous occupational safety & health organizations. Introduction to OHSAS 18000.

Unit 2 **[8Hrs]**

Occupational Accidents

Accident, causes of accident, cost of accident, unsafe conditions, unsafe actions, unsafe personal factors, Accident causations models, accident reporting, accident investigation & analysis, Application of remedial measures, result monitoring, Personal Protective Equipments(ppe), Types of ppe, legal provisions of accident reporting, safety performance measurement, Frequency Rate, Severity Rate, Incidence Rate, Introduction to IS:3786.

Unit 3 **[7Hrs]**

Risk Identification & Risk management

Plant safety inspection, Job safety analysis, Hazards identification & Risk analysis **(HIRA)**, Fault tree analysis **(FTA)**, Hazards & operability Study **(HAZOP)**, Failure mode & Effect analysis**(FMEA)**, Failure mode, criticality & effect analysis **(FMCEA)**, Safety audits, Safety Integrity Level **(SIL)**, Level of Protection Analysis **(LOPA)**.

Unit 4 **[7Hrs]**

Safety & The Law

Introduction to various Laws & Rules pertaining to Safety, Health & Welfare of Indian work-force. Provisions of Factories Acts' 1948 pertaining to Safety only.

Unit 5 **[8Hrs]**

Safety with Machines

Safety in design, Plant layout & housekeeping, Machine maintenance, Machine guarding, types of machine guards, special tools for enhancing safety, safety in use of compressed gas cylinder, safety around grinding wheel, safety in drill machines, safety in use of hand tools, safety in press machines, handling and disposal of

hazardous chemicals, electrical safety, fire safety

Unit 6 **[7Hrs]**

Safety Training & Awareness

Safety training and safety education, safety awareness methods viz safety competitions, safety posters and hording, safety magazine, safety pamphlets, safety campaign, Tool-Box talk, Employees participation in promoting safety**.**

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Industrial Safety	3rd editiion	Roland Patton Blake	Prentice-Hall, 1963
2	Industrial Safety	1977	Jack W. Boley	Gulf Publishing Company, Book Division,

VII Semester
ME2467– PE V : Control System Engineering

Objective	**Course Outcome :-** Students will be able to
• To develop an ability to define transfer function. • To analyze the performance of control system in time domain and frequency domain	(I) Describe the mathematical representation of various control system components and determine the transfer function of mechanical, electrical, thermal and fluid system. (II) Analyse the construction and working of various control system components and electrical motors. (III) Evaluate the performance of control system using time response analysis and stability analysis. (IV) Analyze the performance of control system on the basis of frequency response and design suitable compensation for the control system.

Unit 1 **[7hrs]**
Introduction, System concept Open and Closed loop control systems. Transfer function, Mathematical Modeling of Physical System and system representation through Block Diagram. Transfer function through Block Diagram Simplification. Signal Flow Graph, Masons Gain Formula Block diagrams of various control systems.

Unit 2 **[7 hrs]**
Representation of Control components: Mechanical and Electrical components; Analogous systems; Thermal and Fluid systems.

Unit3 **[8 hrs]**
Electrical systems: - ac/dc servomotors; field controlled and armature controlled servomotors; positional servomechanisms; stepper motors.
Hydraulic systems: - Hydraulic pumps (gear; vane; and reciprocating piston) Cylinders, Direction control valves (2, 3, 4 way) Flow control valve; Relief valve Hydraulic servomotor.

Unit4 **[8 hrs]**
Transient and steady state response of first and second order systems Concept of stability; relative stability; Routh stability criteria.

Unit5 **[8 hrs]**
Frequency response and its characteristics; Bode plots; Nyquist plots. Gain margin and phase margin. Identification of system transfer function.

Unit6 **[7 hrs]**
Basic control actions; Proportional Integral and Derivative control actions and their effect on system performance. Root locus technique. Introduction to control system design log load compensation Feed Back Compensation and Pole -Zero placements.

Text books:				
1	Modern Control Engineering	3rd Edition (2009	Ogata	Prentice Hall
2	Control system Engineering	4th Edition (2007)	Nise	John Wiley & Sons
3	Control system	4th Edition (2009)	Nagrath & Gopal	New Age International
4	Modern Control System	12th Edition (2009)	Dorf	pearson

VII Semester
ME2468– PE V : Tribology

Objective	Course Outcome
Tribology deals with design of fluid containment systems like seals and gasket, Lubrication of surfaces in relative motion to achieve reduced friction and wear. The structure of the bearing and the nature of fluid flow determine the loads that can be supported. Modeling systems as hydrostatic squeeze film and Elasto-hydrodynamic lubrication will be studied as infinite and later finite structures. Gas (air) lubricated and rolling contact type motions with deformation at contact will be studied as special systems.	

UNIT-1: Introduction Introduction to tribology, History of tribology, Interdisciplinary Approach, Economic Benefits.
UNIT-2: Friction Causes of Friction, Adhesion Theory, Abrasive Theory, Junction Growth Theory, Laws of Rolling Friction, Friction Instability.
UNIT-3: Wear Wear Mechanisms, Adhesive Wear, Abrasive Wear, Corrosive Wear, Fretting Wear, Wear Analysis
UNIT-4: Lubrication and Lubricants Importance of Lubrication, Boundary Lubrication , Mixed Lubrication , Full Fluid Film Lubrication ; Hydrodynamic, Elastohydrodynamic lubrication , Types & Properties of Lubricants, Lubricants Additives.
UNIT-5: Fluid film lubrication Fluid mechanics concepts, Equation of Continuity & Motion,Generalised Reynolds Equation with Compressible & Incompressible Lubricants
UNIT-6: Application Tribology Introduction, Rolling Contact Bearings, Gears, Journal Bearings - Finite Bearings.

Reference Books:

1. Dowson D, History of Tribology, Longman London, 1979.
2. Stachowiak G N, Batchelor A W and Stachowick G B "Experimental methods in Tribology", Tribology Series 44, Editor D Dowson, 2004.
3. Michael M Khonsari, Applied Tribology (Bearing Design and Lubrication),John Wiley & Sons, 2001.
4. Jost H P, Lubrication (Tribology) : A Report on the present position and industry`s needs, Her Majesty`s Stationary Office, London, 1966.
5. J Halling, Principles of Tribology, The Macmillan Press Ltd, London, 1975.
6. Archard J F and Hirst W, The Wear of Metals under Unlubricated Conditions, Proc. R. Soc., London, A 236, 397-410, 1956.
7. Ludema K C, Friction, Wear, Lubrication: A textbook in Tribology, CRC Press, 2010.

VII Semester
ME2469– PE V : Turbines

Objective	Course Outcome
Students should apply the fundamentals of fluid dynamics and thermodynamics to turbine. The student shall learn about equipment employed for converting water energy to electrical energy and different types of turbines and also understand steam turbine and gas turbine and its application.	**CO:1** The student will be able to describe and analyze the working of impulse water turbines.[a,e,k] **CO:2** The student will be able to describe and analyze the working Centrifugal Pumps .[a,e,k] **CO:3** The student will be able to define evaluate Steam nozzles and; describe and analyze the impulse steam turbines, reaction steam turbines.[a,e,k] **CO:4** The student will be able to describe and analyze the working of Gas turbines.[a,e,k]

Unit No.	Contents	Max. Hrs.
Unit 1	Impulse Water Turbines: Momentum Principle and its Application , Classification of water turbines, Pelton wheel, its construction and working, velocity triangles, efficiency, power, work done, Pelton wheel design, Governing of Pelton wheel **[CO:1]**	**[6 hrs]**
Unit 2	Reaction Water Turbines Principle of operation, Construction and working of Francis and Kaplan Turbine, Effect of modification of velocity triangles on runner shape, Draft tube, Cavitations calculation of various efficiencies, Power, Discharge, Blade angles, Runner dimensions etc. governing of Francis and Kaplan turbine, Draft tube types and analysis [**CO:2]**	**[7 hrs]**
Unit 3	Steam nozzles: Compressible fluid flow, Static and Stagnation properties, Isentropic flow, Flow of fluid through nozzles, Continuity equation, Variation of velocity, area and specific volume, Mass of discharge, Maximum discharge, Critical pressure ratio, Choking, Effect of friction, Nozzles and Diffusers efficiency, Back pressure effect, Super saturated flow. [**CO:3]**	**[7 hrs]**
Unit 4	Impulse Steam turbines : Types of turbines, Compounding, Velocity diagrams, Performance analysis, Reheat factor, Stage efficiency, Governing, and Losses in turbines. [**CO:3]**	**[6 hrs]**
Unit 5	Reaction Steam turbines: Types of turbines, Compounding, Velocity diagrams, Performance analysis, Reheat factor, Stage efficiency, Governing, and Losses in turbines. [**CO:3]**	**[6 hrs]**
Unit 6	Gas turbines: Classification of gas turbines, Analysis, Regeneration, Inter-cooling, Reheating, Applications, Types of jet engines, Construction and working; propulsive efficiency [**CO:4]**	**[7 hrs]**

Text books:			
S.N.	**Title of the book**	**Author(s)**	**Publisher**
1	Fluid Mechanics: Fundamentals and Applications	Yunus A. Cengel and John M. Cimbala	McGraw-Hill
2	Engineering Fluid Mechanics	K. L. Kumar	S. Chand & Company Ltd.
3	Fluid Mechanics & Fluid Power Engineering	D. S. Kumar	S. K. Kataria Publication
4	Thermal Engineering	P.L.Ballaney	Khanna Publication
5	Thermal Engineering and heat engines	R.Yadav	Central Publishing house
6	Heat power engg	Kumar & Vasandani	Metro Politon Publisher
7	Gas Turbine	Dubey & Khajuria	Dhanpat Rai Publications
8	Thermal Engineering	R.K.Rajput	Laxmi Publication

VIII Semester
ME2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	On successful completion of the course students will be able to: 1. Demonstrate a sound technical knowledge of their selected project topic. 2. Undertake problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Communicate effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 **PSO** : i,ii,iii	

The group of students will continue to work for the project allotted previously and will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

VIII Semester
ME2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
1. To expose to culture and tradition. 2. To provide opportunity for student to perform and present their hidden talent, still and art. 3. To nurture hobbies. 4. To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits. 5. To develop creative talent, self-confidence, sense of achievement. 6. To be able to design process on environmental, social, political, ethical, health and safety. 7. To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	1. An ability to work initially as well as part of team to achieve set goals. 2. An ability to work to serve society and for betterment of society. 3. An ability to communicate with people at large.
Mapped Program Outcomes : 5,6,7,9,10,11	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2018
3rd to 8th Semester
Electrical Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EL-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
TOTAL FIRST & SECOND SEM										47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	EL2201	Analog Electronics	T	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	EL2202	Lab. : Electronics Engineering Workshop	P	0	0	2	2	1		60	40	
4	3	PC	EL2203	Electrical Machines	T	4	0	0	4	4	30	20	50	3 Hours
5	3	PC	EL2204	Lab.:Electrical Machines	P	0	0	2	2	1		60	40	
6	3	PC	EL2205	Network Analysis	T	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	EL2206	Lab.:Computer Programming	P	0	0	2	2	1		60	40	
8	3	PC	EL2207	Electrical Measurement & Instrumentation	T	3	0	0	3	3	30	20	50	3 Hours
9	3	PC	EL2208	Lab.:Electrical Measurement & Instrumentation	P	0	0	2	2	1		60	40	
				TOTAL		**16**	**0**	**8**	**24**	**20**				
Fourth Semster														
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	EL2251	Electrical Machines in Power System	T	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	EL2252	Lab.:Electrical Machines in Power System	P	0	0	2	2	1		60	40	
4	4	PC	EL2253	Electrical Energy Generation System	T	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	EL2254	Lab.:Renewable Energy System	P	0	0	2	2	1		60	40	
6	4	PC	EL2255	Electric & Magnetic Fields	T	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	EL2256	Lab.:Electrical Engineering Workshop	P	0	0	2	2	1		60	40	
8	4	PC	EL2257	Microprocessor	T	3	0	0	3	3	30	20	50	3 Hours
9	4	PC	EL2258	Lab.:Microprocessor	P	0	0	2	2	1		60	40	
10	4	PC	EL2259	Signals & Systems	T	4	0	0	4	4	30	20	50	3 Hours
				TOTAL		**19**	**0**	**8**	**27**	**23**				
List of Audit Courses														
1	3	HS	GE2121	Env Studies for 3 Sem. EL,ET,CT	A	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2125	YCCE Communication Aptitude Preparation (YCAP4.2) for EL,EE,ET	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05
Chairperson	Dean (Acad. Matters)	Date of Release	Version

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EL-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	EL2301	Power Electronics	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	EL2302	Lab.:Power Electronics	**P**	0	0	2	2	1		60	40	
4	5	PC	EL2303	Fundamentals of Power System	**T**	3	0	0	3	3	30	20	50	3 Hours
5	5	PC	EL2304	Electrical Drives	**T**	3	0	0	3	3	30	20	50	3 Hours
6	5	PC	EL2305	Lab.:Electrical Drives	**P**	0	0	2	2	1		60	40	
7		OE		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3 Hours
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3 Hours
				TOTAL		**18**	**0**	**4**	**22**	**20**				
Audit Courses														
1	5	HS	AU2127	YCCE Communication Aptitude Preparation (YCAP5.2) for EL,EE,ET	**A**	3	0	0	3	0				

Open Electives -I

1	5	OE	EL2311	OEI:Renewable Energy Generation System
2	5	OE	EL2312	OEI:Electrical Machines and their Applications
3	5	OE	EL2313	OEI:Testing and Maintenance of Electrical Machines
4	5	OE	EL2314	OEI: Solar power plant design and Installation

Open Electives -II

4	5	OE	EL2321	OEII:Electrical Energy Audit and Safety
5	5	OE	EL2322	OEII:Utilization of Electrical Energy
6	5	OE	EL2323	OEII:Power System Engineering

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EL-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	EL2351	Control System	**T**	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	EL2352	Lab.:Control System	**P**	0	0	2	2	1		60	40	
4	6	PC	EL2353	Power System Analysis	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PE		**Professional Elective I**	**T**	3	0	0	3	3	30	20	50	3 Hours
6	6	PE	EL2354	**Lab.**:Simulation of Power Electronics & Power System	**P**	0	0	2	2	1		60	40	
7	6	OE		**Open Elective III ***	**T**	3	0	0	3	3	30	20	50	3 Hours
8	6	OE		**Open Elective IV ***	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	PC	EL2355	Lab.:Substation Design	**P**	0	0	2	2	1		60	40	
10	5/6	STR	EL2360	**Industry Visit and its report**	**P**	0	0	0	0	1		60	40	
					TOTAL	**18**	**0**	**6**	**24**	**22**				

Professional Electives -I

1	6	PE	EL2361	**PEI:**Advanced Power Electronics
2	6	PE	EL2362	**PEI**:Electrical Distribution in Power System
3	6	PE	EL2363	**PEI:**Illumination Engineering (MOOC)
4	6	PE	EL2364	**PEI:**Electric Vehicles
5	6	PE	EL2365	**PEI**:Electric Power Utilization
6	6	PE	EL2366	**PEI:** Grid Integration of Renewable Energy
7	6	PE	EL2367	**PEI:** Switched Mode Power Supply
8	6	PE	EL2368	**PEI:** Programming in C for beginners

Open Electives -III

9	6	OE	EL2371	**OEIII**:Renewable Energy Generation System
10	6	OE	EL2372	**OEIII**:Electrical Machines and their Applications
11	6	OE	EL2373	**OEIII**:Testing and Maintenance of Electrical Machines
12	6	OE	EL2374	**OEIII**:Solar power plant design and Installation

Open Electives -IV

13	6	OE	EL2381	**OEIV:**Electrical Energy Audit and Safety
14	6	OE	EL2382	**OEIV**:Utilization of Electrical Energy
15	6	OE	EL2383	**OEIV**:Power System Engineering
16	6	OE	EL2384	**OEIV**: Electrical Wiring: Estimation and Costing

Audit Courses											
1	6	HS	AU2128	YCCE Communication Aptitude Preparation (YCAP6.1) for CV,EL	**A**	3	0	0	3	0	

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TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
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SoE No. EL-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	EL2401	Switchgear & Protection	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	EL2402	Lab.:Switchgear & Protection	**P**	0	0	2	2	1		60	40	
3	7	PC	EL2403	High Voltage Engineering	T	3	0	0	3	3	30	20	50	3 Hours
4	7	PC	EL2404	Lab.:High Voltage Engineering	**P**	0	0	2	2	1		60	40	
5	7	PE		**Professional Elective II**	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		**Professional Elective III**	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		**Professional Elective IV**	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	EL2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	EL2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -II

1	7	PE	EL2411	**PEII:** Fundamentals of Power Quality
2	7	PE	EL2412	**PEII:**Electrical Installation Design
3	7	PE	EL2413	**PEII:**Electrical Machine Design
4	7	PE	EL2421	**PEII:** Power System Operation and Control
5	7	PE	EL2422	**PEII:** Sensors and Actuators

Professional Electives -III

5	7	PE	EL2422	**PEIII**:FACTS Devices
6	7	PE	EL2423	**PEIII**: Electrical Energy Management and Audit
7	7	PE	EL2424	**PEIII:**Advanced Control System
8	7	PE	EL2425	**PEIII:**Artificial Intelligence Based System

Professional Electives -IV

9	7	PE	EL2431	**PEIV:**Advanced Electrical Drives
10	7	PE	EL2432	**PEIV**:Fundamentals of Smart Grid
11	7	PE	EL2433	**PEIV**:Computer Methods in Power System
12	7	PE	EL2434	**PEIV**:EHVAC-HVDC Transmission

Coursera Electives				
1	6	PE	EL2366	**PEI**:Energy Production, Distribution and Safety
1	7	PE	EL2435	**PEIV**: Power Electronics Specialization

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TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.04**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2020-21 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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SoE No. EL-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	EL2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	EL2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**86**	**0**	**46**	**132**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

3rd Semester

Electrical Engineering

28 June 2019

III Semester

GE2201 - Engineering Mathematics III

Objectives	Outcomes
1. Able to find numerical solution of various mathematical equations 2. Give knowledge of Laplace transform, Z transform, Fourier transform 3. Define the periodic functions in the form of Fourier series 4. Solve partial differential equations	The student will be able to: 1. Estimate the Calculus of Numerical Function. 2. Determine transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations. 3. Discuss the nature of periodic function and express it in terms of series. 4. Use appropriate method/s to solve partial differential equations.

Unit I: Finite Differences

Difference table; Operators E and Δ, Central differences, Factorials notation, Numerical differentiation and integration, Difference equations with constant coefficients. **(6 hours)**

Unit II: Laplace Transform

Laplace Transforms: Laplace transforms and their simple properties, Unit step function, inverse of Laplace transform, convolution theorem, Applications of Laplace transform to solve ordinary differential equations .**(7 hours)**

Unit III: Z-transform

Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant co-efficient. **(6 hours)**

Unit IV: Fourier Series

Periodic Functions and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions **(7 hours)**

Unit V: Partial Differential Equation

Partial Differential Equations of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve first and second order partial differential equations. **(7 hours)**

Unit VI : Fourier Transform : Definition: Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem**.** **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John Wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John Wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan
5	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	Laxmi Prakashan

III Semester
EL2201 - Analog Electronics

Course Objective	Course Outcomes
After taking this course, the student should be able to analyze, simulate, and design single and multistage amplifiers. Design of single, multistage, and op-amp amplifier are covered in detail including analysis of biasing techniques, frequency response compensation, feedback, stability, noise and nonlinearity	The student will be able: 1. To identify the basic structure, characteristics and various operating modes of BJT 2. To Explain and Describe the various small signal parameters and its applications 3. To demonstrate the knowledge to develop various power amplifier and oscillator circuit. 4. To analyse and evaluate the basic concept of Op-Amp circuit and its various applications.

UNIT-1: Bipolar Junction Transistors (BJT)
BJT, Theory of operation, characteristics, Biasing arrangements (CB, CE, CC modes), operating modes , Stability factor, Transistor as a switch.

UNIT-2: Small Signal Analysis
Small signal analysis of CE, CB, CCmodes and their comparison, AC equivalent circuit, transistor equivalent circuit-CE, Hybrid equivalent model, Analysis of a transistor using h-parameter, emitter follower, RC coupled amplifier, low frequency response of an RC coupled stage

UNIT-3 :Power & Feedback Amplifier
Introduction to Power Transistors, Power amplifiers- classification as A,B, AB, C, Push pull amplifiers, Cross over distortion, Positive and Negative amplifiers- classification, feedback amplifiers, advantages and applications.

UNIT-4:Oscillator Circuits
Basic principle of sinusoidal oscillator, R-C Phase Shift and Wein Bridge oscillators, Tuned oscillators- Collpits and Hartley; Crystal oscillator

UNIT-5 : Operational Amplifier (OA)
Simple linear circuit: Inverting, non-inverting , buffer amplifier, summer integrator , differentiator, log, antilog, Multiplier, instrumentation amplifier, grounding and shielding problem in instrumentation amplifier. Precision rectifier, RMS to DC conversion, constant current and voltage sources, Sinusoidal oscillator with frequency and amplitude stabilization elementary , idea of active filter with Butterworth second order filter design procedure.

UNIT-6: Applications of Operational Amplifier
Applications of Operational amplifier for clipping, clamping, comparator circuit with non-linear components, Multiplexers, Demultiplexer, Astable, Mononstable, Bistable multivibrator circuits using OpAmp, sample/ hold circuits,D/A and A/D conversion circuits.

III Semester
EL2201 - Analog Electronics

Text Books:

SNo.	Title	Authors	Publisher
1	Electronic Principles,	A.P. Malvino,	Tata Mcgraw Hill Publications
2	Electronics : Analog & Digital	I. J. Nagrath	PHI Publication
3	Linear Application Handbook	National Semiconductors	
4	Operational Amplifiers	Dailey	Tata McGraw Hill
5	Introduction to Operational Amp	Wait	Tata McGraw Hill
6	Designing with Op- Amps	France	Tata McGraw Hill

Reference Books:

SNo.	Title	Authors	Publisher
1	Electronic devices and circuits	Jacob Millman, and C.C. Halkias	TMH Publications
2	Introduction to Semiconductor	M. S. Tyagi	John Wiley & Sons Inc
3	Materials and Devices		
4	Solid State Electronic Devices	Ben G. Streetman,	PHI, 5th Ed, 2001

III Semester
EL2202 - Lab. : Electronics Engineering workshop w

Course Objective	Course Outcomes
To expose printed circuit board (PCB) design, fixing of components on PCB, testing of components and circuits	1. This course gives the basic introduction of electronic hardware systems. 2. It provides hands-on training with familiarization, identification, testing, assembling, dismantling of various components. 3. Student can identify the active and passive electronic components 4. Testing of electronics components like Resistor, Capacitor, Diode, Transistor, UJT and JFET using multimeter. 5. PCB fabrication and repairing such systems by making use of the various tools and instruments available in the Electronics Workshop.

Mapped program outcomes							

Practical based on following topics :-

Minimum eight practical based on following are to be set up :-

Expt. No.	Experiments based on
01	Design and fabrication of PCB
02	Design of voltage regulators
03	Design of different timers using operational amplifiers.
04	Study and testing of diodes
05	Study and testing of transistors
06	Study and testing of MOSFET, IGBT
07	Study and testing of Thyristor, power diodes
08	Study and testing of power transistors
09	Study and testing of operational amplifiers, LEDs.ICs etc

III Semester
EL2203 - Electrical Machines w

Course Objective	Course Outcomes
The course objective is to impart knowledge of • The basic principle of transfer of electrical power, operation, construction of 3-phase transformers, their classification, connections and phasor diagrams. • The basic principle, construction, operation, Performance characteristics, steady state analysis and applications of electrical motors andinduction generator.	Students will be able to 1. Demonstrate the knowledge of Operation of single phase and auto-transformer. Develop, analyse and evaluate vector diagrams and performance indices of single phase transformer. 2. Explain Construction, vector grouping, testing and examine the need of parallel operation of three phase transformers 3. Explain and examine principle, construction, types, operation, speed control, characteristic and applications of DC machines and evaluate performance parameters of d.c.machines 4. .Explain and examine principle, construction, operation, starting, speed control ,applications and evaluate the performance indices of induction motors.
Mapped program outcomes:1,2,3	

UNIT 1: ELECTRO MAGNETISM: (6)
Magnetic Field, Magnetic Flux, Magnetic Flux Density, Permeability, Relation between magnetic flux density and field intensity, magnetic field due to current carrying conductor and a coil, Right hand grip rule, Force on a current carrying conductor placed in a magnetic field, Flemings Left hand Rule, Magnetomotive Force, Magnetic Field Strength, Reluctance, Magnetization curves of magnetic materials, Magnetic hysteresis and hysteresis loss, Eddy current and loss, leakage flux and fringing, Faraday's laws of electromagnetic induction, Lenz's Law, Flemings's Right hand rule, Types of induced EMF.

UNIT-2: SINGLE PHASE TRANSFORMER (10)
Phasor diagram of transformer on no load and on load, Load Test, Open circuit and short circuit test on 1 phase transformer, equivalent circuit of transformer, Efficiency and condition for maximum efficiency, Regulation and Efficiency using O.C. & S.C. data, Autotransformer operation, kVA rating of autotransformer.

UNIT-3: THREE PHASE TRANSFORMER (08)
Types of 3 phase transformers, Construction, Labelling of terminals, Vector Groups, Polarity marking & Test, Transformer connections and their comparative features, Open Delta Connection, parallel operation of single and three phase transformers, All day efficiency

UNIT-4 D.C. GENERATOR: (08)
Construction, Magnetic structure, Field and Armature systems, Field and Armature windings (Both Lap and Wave Types),EMF Equation, Characteristics and applications of different types of D.C. Generators, Building of Emf in D.C. Shunt generator, Armature reaction, commutation, straight line commutation, inter-poles, compensating winding.

III Semester
EL2203 - Electrical Machines w

UNIT 5: D.C. MOTOR: **(08)**

Principle, Torque Equation, Characteristics and applications of various types of D.C. Motors, Starting of D.C. Motors, Speed control of Series and Shunt motors, Power flow in DC machines, Losses and Efficiency in D.C. machines,

UNIT 6 :THREE PHASE INDUCTION MOTOR **(10)**

Equivalent circuit, No load and blocked rotor tests and determination of parameters of equivalent circuit, Losses and efficiency. Starting, Speed control, Crawling and cogging, Double cage induction motor: principle, construction, torque slip characteristics. Induction Generator: principle, isolated operation, double fed induction generator, applications

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Electrical Machines	2nd -1993	Dr. P. K. Mukherjee and S. Chakravarti	Dhanpat Rai Publications (P) Ltd
2	Electrical Machines	3rd -2010	I.J.Nagrath and Dr. D.P.Kothari	Tata McGraw Hill
3	Electric Machines		Ashfaq Husain	Dhanpat Rai Publications (P) Ltd.

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	D.C. Machines		Langsdorf	
2	Electrical Machines and Transformers		Nasser Syed	
3	Laboratory manual for Electrical machines		Dr. D.P. Kothari and Prof. Umre	.S. S.CHAND

III Semester
EL2204 - Lab.: Electrical Machines w

Course Objective	Course Outcomes
	The student will be able to understand the 1. Circuit connections, selections of measuring instruments and their position in the circuit to determine the circuit quantities 2. Evaluation of performance indices, equivalent circuit parameters and variation of the performance on loading of single phase and three phase transformance, induction motors and DC shunt motors 3. Magnetizing characteristics of the DC Generator, Critical Field resistance and speed of the machine 4. Various methods of speed control of DC shunt motor and three phase wound rotor induction motor

Mapped program outcomes	a	b	c	f	g	h	j

Minimum Eight Practical are to be performed out of the following :-

Expt. No.	Experiments based on
01	To perform load test on 1-phase transformer to determine its efficiency and voltage regulation.
02	To perform Open Circuit and Short Circuit tests on a 1-phase transformer to evaluate efficiency and voltage regulation.
03	To perform back to back test on two identical 1-phase transformers.
04	To study conversion of a 2-winding transformer into an autotransformer.
05	To study phasing out and polarity marking of a 3-phase transformer.
06	To study voltage and current relations in a 3-phase, Delta-Star connected transformer.
07	To perform Open Circuit and Short Circuit test on a 3-phase transformer.
08	To plot magnetization characteristic of a DC generator.
09	To study speed control of a DC shunt motor by varying – (a) field excitation and (b) armature voltage
10	To perform load test on a DC shunt motor.
11	To study measurement of slip of a 3-phase induction motor by different method.
12	To study control of a 3-phase slip-ring induction motor by – (a) variation of a rotor resistance and (b) varying supply voltage
13	To perform load test on a 3-phase induction motor by indirect loading.
14	To perform load test on a 3-phase induction motor by direct loading.
15	To perform No-Load and Blocked rotor tests on a 3-phase induction motor.
16	To perform No-Load and Blocked rotor tests on a 1-phase induction motor.
17	To study Induction generator operation.

III Semester
EL2205 - Network Analysis

Course Objective	Course Outcomes
The basic objective of this course is to introduce students to the fundamental theory and mathematics for the analysis of electrical circuits. Through the material presented in this course, students will learn: • The fundamental principles of electrical circuit analysis and to be able to extend these principles into a way of thinking for problem solving in mathematics, science, and engineering • To become adept at using various methods of circuit analysis, including simplified methods such as series-parallel reductions, voltage and current dividers, and the mesh - node method. • To appreciate the consequences of linearity, in particular the principle of superposition and Thevenin - Norton equivalent circuits. • To analyze analog circuits that include energy storage elements. • To utilize Laplace transforms for circuit analysis. • To analyze four terminal networks using two-port parameters.	Upon successful completion of this course, students should be able to: 1) Define basic concepts related to the course of network analysis. 2) 2) Select best possible method of circuit analysis for a given situation. 3) Apply a variety of circuit analysis methods including theorems and Laplace transform. 4) Design circuits for a given voltage, power, as well as for critical frequencies and two port parameters

Mapped program outcomes							

UNIT 6 :THREE PHASE INDUCTION MOTOR (10)

Equivalent circuit, No load and blocked rotor tests and determination of parameters of equivalent circuit, Losses and efficiency. Starting, Speed control, Crawling and cogging, Double cage induction motor: principle, construction, torque slip characteristics. Induction Generator: principle, isolated operation, double fed induction generator, applications

UNIT-1: NODAL ANALYSIS OF ELECTRIC CIRCUITS

Basics of electric circuits, circuit elements and their voltage – current relationship, classification of circuit elements, sources - their types and characteristics, concept of equivalent sources, source transformation, concept of supernode and V – shift, nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-2: : MESH ANALYSIS OF ELECTRIC CIRCUITS

Concept of supermesh and I – shift, mutual inductance, coefficient of coupling, dot convention, dot marking in coupled coils, mesh analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-3 :NETWORK THEOREM

Superposition Theorem, Thevenin"s Theorem, Norton"s Theorem, Maximum Power Transfer Theorem.

III Semester
EL2205 - Network Analysis

UNIT-4: INITIAL AND FINAL CONDITIONS, IMPEDANCE FUNCTIONS AND CIRCUIT ANALYSIS WITH LAPLACE TRANSFORM

Concept of initial and final conditions, behavior of resistor, inductor and capacitor at t = 0- and at t = 0+, procedure for evaluating initial and final conditions, analytical treatment.

Review of Laplace Transform, concept of complex frequency, transform impedance and admittance, s – domain impedance and admittance models for resistor, inductor and capacitor, series and parallel combinations of elements. Transformed network on loop and mesh basis, mesh and node equations for transformed networks, time response of electrical network with and without initial conditions by Laplace transform.

UNIT-5:TRANSFORMS OF OTHER SIGNAL WAVEFORMS, NETWORK FUNCTIONS, POLES AND ZEROS OF NETWORK FUNCTIONS

Unit step, ramp and impulse functions with and without time delay, their Laplace transform, waveform synthesis and its application to electrical networks.

Terminal pairs or ports, network functions for one port and two port networks, definition and physical interpretation of poles and zeros, pole-zero plot for network functions, restrictions on pole and zero locations for driving point and transfer functions, time domain behavior from the pole – zero plot, network synthesis using pole – zero plot.

UNIT-6: TWO PORT PARAMETERS

Standard reference directions for the voltages and currents of a two – port network, defining equations for open circuit impedance, short circuit admittance, transmission, inverse transmission, hybrid and inverse hybrid parameters, relationships between parameter sets, conditions for reciprocity and electrical symmetry in terms of two – port parameters, interconnections of two - port networks.

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Network Analysis	3rd Edition	M. E. Van Valkenburg	PHI Learning Private Limited
2	Engineering Circuit Analysis	8th Edition	William H. Hayt, Jack E. Kemmerly, Steven M. Durbin	McGraw – Hill
3	Linear Circuit Analysis	2nd Edition	Decarlo, Lin	Oxford Univ. Press

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Schaum"s 3000 Solved Problems In Electric Circuits Book 1 & 2	1st Edition	Syed A. Nasar	McGraw - Hill
2	Schaum"s Outline Series: Theory and Problems of Electric Circuits	5th Edition	Joseph A. Edminister	McGraw - Hill
3	Basic Circuit Theory	3rd Edition	Lawrence P. Huelsman	PHI Learning Private Limited

III Semester
EL2206 - Lab.: Computer Programming

Course Objective	Course Outcomes
To make the student familiar with the application of MATLAB using programming and simulink.	1) The inbuilt functions, keywords, concepts of drawing and using the various toolbars in SCILAB programming. 2) To design the matrix operation and mesh analysis which generally using in mathematical operation. 3) The various conditions like for loop, while loop and if else loop which are used in decision making statement. 4) The RL series circuit which is the basic concept in basic engineering. 5) The differential equations used in mathematical operation. 6) The design of 2-D and 3-D plots.

Mapped program outcomes								

Minimum Eight Practical are to be performed from the following :-

Expt. No.	List of Experiments
01	Program to demonstrate the script file and elementary matrix manipulations
02	Program to demonstrate indexing of matrices.
03	Program to create function and calling functions
04	Program to solve linear differential equations
05	Write a function that returns the two roots of a quadratic equation, given the three arguments a, b and c. Test the function from the command line
06	Write a function that returns the mean and standard deviation of a vector of numbers (input vector). While Matlab supplies the mean() and std() functions, try just using the sum() and length() functions.
07	Write a function that reverses the order of letters in a string, and returns the new string.
08	Use the eval() Matlab function to evaluate strings such as: exp1 = „5*6 + 7"; Note this, and feval(), is very useful for dynamic programming
09	Use a cell array to store a list of expressions, stored as strings. Then use eval() and a for loop to iterate over the expressions and evaluate them.
10	Create the vector 0:pi/20:2*pi and use it to sample the sin() function. Plot the results and edit the figure window to put labels on the figure. Save the figure (.fig) and export a .jpg file.
11	Use the meshgrid() function to sample a 2 dimensional input space between 0 and 2p, then use the data to sample the function $\sin(x_1)*\cos(x_2)$. Plot the results using the mesh() function.
12	Create a GUI that prompts the user for a number and then displays double that number next to the entered value.
13	Start Simulink and using a sin() **source** and a **scope sink**, view the signal over 10 seconds.
14	Change the frequency of the sin() source and again compare the results. Next change the simulation length.
15	Build the first order system H(s) = 1/(1+3s) in the model and pass a sin() signal through the system. Make sure you run the simulation for a long enough time for the transients to die down and the system to settle. Replace the first order system with the second order system, what is the difference when the system settles down H(s) = 1/(1+2s+s^2).
16	We need to simulate the resonant circuit and display the current waveform as we change the frequency dynamically

III Semester
EL2207 - Electrical Measurement & Instrumentation

Course Objective	Course Outcomes
Students will be able to understand the operation of different electrical instrument used for measurement of electrical and non-electrical parameters and measurement of resistance, inductance or capacitance using various bridges. CT and PT applications	Upon successful completion of this course, Students should be able to: 1) Explain the working of Electrical instruments and compute the value of Resistances, inductance and capacitance by using bridges. 2) Evaluate electrical power and energy in single phase and three phase circuits. 3) Explain and illustrate the concept of instrumentation system with different Transducers and Sensors. 4) Explain the construction, working principle and applications of Transducers. 5) Evaluate Power calculations and applications of Transducers.

UNIT - I: MEASURING INSTRUMENTS

Electrical Measurement :

Classification of Instruments , Deflection and null type instruments ,forces acting in Indicating instruments , PMMC and MI type instruments (Construction and working principle)

Measurement of Resistance :

Classification of Resistance, Wheatstone bridge , Kelvin's Double Bridge , Loss of charge method.

Megger (Construction and Operating principle, Measurement of Earth Resistance.

UNIT – II: POTENTIOMETERS AND AC BRIDGES

D.C. Potentiometer:

Basic Potentiometer circuit, Lab.Type Potentiometer voltage ratio box.

A.C. Potentiometer:--

Standardization of AC Potentiometer, Drysdale Polar potentiometer, Gall-Tinsley (Co-ordinate type) Potentiometer.

AC Bridges:

General equation of AC bridge balance, measurement of Inductance by Maxwell Inductance-capacitance Bridge, detectors used in AC Bridges, Measurement of Capacitance By High voltage Schering bridge , Measurement of Relative Permittivity by Schering bridge, Measurement of frequency By Wien's Bridge.

UNIT – III: MEASUREMENT OF POWER AND ENERGY

Wattmeter :

Electrodynamometer type wattmeter (construction and operation) , LPF Wattmeter, Measurement of power using instrument transformer, Blondal's Theorem , Measurement of three phase power By single wattmeter , Two wattmeter , and three wattmeter method , measurement of Reactive power for Balanced load using single wattmeter method.

Energy Measurement :

Induction type Energy meter (construction and operating principle)Errors and their compensation , Two element energy meter , maximum demand energy meter , phantom Loading (Merz – price).

Power factor Meter : Three phase Electrodynamometer type power factor meter.

III Semester
EL2207 - Electrical Measurement & Instrumentation

UNIT – IV: INSTRUMENT TRANSFORMERS

Instrument Transformer :

Use of instrument transformer , ratios in instrument transformer , burden , characteristics of CT , Effect of secondary open in CT.

Potential transformer : Difference between CT and PT , Errors in PT , Reduction of errors in PT , characteristics of PT

UNIT – V: DIGITAL INSTRUMENTS AND TRANSDUCERS

Digital Voltmeters, Digital Ammeters:

Ramp type digital Voltmeter and Ammeter, Integrating type digital voltmeter and ammeter.

Digital Frequency Meter: Basic circuit, Time base , start and stop Gate circuit for measurement of frequency. Electrical resonance type frequency meter , Weston frequency meter

Transducers: Introduction , Types (Piezoelectric Transducer , Active , Passive transducers)

UNIT – VI: ANALOG TRANSDUCERS

Transducers :

Transducers required for the measurement of (Non electrical quantities)

Linear displacement ,(LVDT), Strain , (Strain gauge, Un bounded metal Strain gauge, semi conductor Strain gauge),Pressure , (Bourden Tube,Bellows, Pirani Gauge),Torque ,

Linear velocity, Angular Velocity, Temperature,(Thermocouples ,First and Second Law of Thermocouple, Thermistors , Bimetallic Thermocouples), Flow (Electromagnetic Flow meter), Acceleration : LVDT Accelerometer.

Digital Encoding transducers – Contacting or Brush type, Shaft encoder.

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Electrical Measurement And Instrumentation	Eighteenth Revised and Enlarged Edition , 2007)	A.K.Sawhney	
2	Electrical Measurement :		J. Singh	
3	Electrical Measurement and Measuring Instrument.			Tata McGraw Hills

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Electrical And Electronics Measurement	19th Edition	A.K.Sawhney	

III Semester
EL2208 - Lab :Electrical Measurement & Instrumentation

Course Objective	Course Outcomes
	The student will be able to understand 1) Measure resistance, capacitance, and inductance using AC and DC bridges 2) Calibrate single phase energy meter 3) Determined the characteristics of RTD,themistor,pressure and transducer 4) Measure the active and reactive power using different types of method

Mapped program outcomes	a	b	c	f	g	h	j

Minimum Eight Practical are to be performed out of the following :-

Expt. No.	Experiments based on
01	To measure high resistance using loss of charge method.
02	To measure low resistance using Kelvins" double bridge.
03	To measure inductance using Maxwell"s inductance capacitance bridge.
04	To measure inductance using Anderson"s bridge.
05	To measure three phase power using two wattmeter method
06	To measure electrical energy using electromechanical energy meter.
07	Determination of self inductance using Owen"s bridge.
08	Testing of single phase induction type energy meter.
09	Measurement of reactive power in balanced three phase ac circuit using single wattmeter.
10	Study of Pressure gauge.
11	Study of Strain gauge.
12	To measure Torque using sensors.
13	To study first order response of filters- (i) High pass filters (ii) Low pass filters (iii) Notch filter.
14	Study of an instrumentation amplifier.
15	Study of Cathode Ray Oscilloscope.
16	Draw the characteristics of LVDT.
17	Measurement of distance by ultrasonic transducers.
18	Draw the characteristics of RTD, Thermo couple and Thermistor.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

4th Semester

Electrical Engineering

28 June 2019

IV Semester
GE2204 - Advanced Mathematical Techniques

Objective	Outcomes Students will be able to
• To introduce various Numerical Methods to solve algebraic and differential equations • To understand the concept of Probability distribution • To introduce the concept of Fuzzy Set theory and functions • To make aware of different optimization techniques	• Utilize numerical techniques to obtain approximate solutions of mathematical equations • Measure the Statistical parameters for random variables • Explain the basic concept of fuzzy sets, Relations and fuzzy logic. • Design and determine the solution of linear programming problems

Unit I:
Numerical Methods for Algebraic And Transcendental Equations: Errors in numerical calculation, Errors in series approximation, Rounding of error solutions of algebraic and transcendental equations, Iteration method, Bisection method, False position method, Newton Raphson method and their convergence
Numerical Methods System of Algebraic Equations: Solution of System of linear equations, Gauss- Seidel method, Crouts method**.** **(7 hours)**

Unit II:
Numerical Methods for Differential Equations: Numerical solution of ordinary differential equation by Taylor's series method, Picard's method, Runge's second and third order method, Runge-Kutta 4^{th} order method, Euler's method, Euler's modified method, Milne's Predictor and Corrector method. **(6 hours)**

Unit III:
Random Variables and Probability Distribution: Discrete and continuous random variables, probability density function of one and two variables, Probability distribution function of one and two variables, Joint distributions and conditional distributions. **(6 hours)**

UNIT IV:
Mathematical Expectation: Definition of mathematical expectation, functions of one and two random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis. **(7 hours)**

UNIT V:
Fuzzy Sets And Fuzzy Logic: Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations. **(7 hours)**

Unit VI:
OPTIMIZATION TECHNIQUES: Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method. **(6 hours)**

IV Semester
GE2204 - Advanced Mathematical Techniques

Text Books:

SN	Title	Edition	Authors	Publisher
1	Computer based Numerical and Statistical Techniques	Paperback Firstedition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	Fourth Edition (2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	Year-2009.First Edition	C.Mohan and Kasum Deep	New Age International Publication

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers
6	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	LaxmiPrakashan

IV Semester
EL2251 - Electrical Machines in Power System

Course Objective	Course Outcomes
To make student aware about • The basic principle, construction, operation, performance characteristics and steady state and transient analysis of synchronous machines. • The principle, construction, operation, control and applications of special electric motors.	The student will be able to understand : 1) Explain constructional features, develop phasor diagram and winding layout, examine steady state performance of synchronous machines and determine induced emf and voltage regulation of synchronous alternator 2) Illustrate the need and method of parallel operation of alternators, analyse and evaluate the behaviour of synchronous machine connected to infinite bus. 3) Interpret behaviour & determine time constant and equivalent circuit parameters under transient conditions of synchronous machines 4) Explain the principle, construction and operation of special machines and identify their applications

UNIT-1: Three Phase Synchronous Generator **(07)**

Introduction, Constructional features of cylindrical and salient pole rotor machines, Full pitch coil, short pitched coil, Coil span factor, concentrated winding, distributed winding, distribution factor, introduction to armature winding and field winding, MMF of armature winding, induced EMF with and without harmonics.

UNIT-2: Steady State Operation of Three phase synchronous generators **(07)**

Effect of loading on terminal voltage, Armature reaction, Effect of load power factor on armature reaction, concept of synchronous reactance, Phasor diagram on load, regulation by Direct loading, Emf method, Load characteristics, External Characteristic, Zero power factor characteristics (ZPFC), construction of Potier triangle.

UNIT-3: Parallel Operation **(06)**

Conditions of synchronization of generator with another generator and or Infinite busbars, Parallel operation, Load sharing between parallel connected generators. Effect of variable excitation and power input on generator operation.

UNIT-4: Synchronous Motor **(06)**

Principle of operation, Methods of starting, phasor diagram, expression for torque, Excitation Emf, load/torque angle, Effect of variable excitation and load on motor operation, V and inverted V curves, Concept of synchronous condenser,
Introduction to Reluctance and Hysteresis motor

UNIT 5: Synchronous Machine Connected to Infinite Bus **(08)**

Power Angle Characteristic of Synchronous machines with and without armature resistance. Expression for electrical and electromechanical power developed, losses and efficiency in synchronous machines.

UNIT-6: Transient Behaviour **(06)**

Short circuit ratio, unbalanced Loading, Sequence Component, Sudden 3-phase short circuit, Constant flux linkage theorem, Transient and sub–transient reactances, Time constants and equivalent circuit diagram, role of damper winding in both generator and motor operation. Experimental determination of steady state & transient parameters

IV Semester
EL2251 - Electrical Machines in Power System

Text Books:

SN	Title	Edition	Authors	Publisher
1	Electrical Machines	2nd -1993	Dr. P. K. Mukherjee and S. Chakravarti	Dhanpat Rai Publications (P) Ltd
2	Electrical Machines	3rd -2010	I.J.Nagrath and Dr. D.P.Kothari	Tata McGraw Hill
3	Alternating Current Machines	1st -1983	M.G. Say	CBS Publishers
4	Electrical Machinery	7TH -2008	P.S.Bhimbra	
5	Electrical Machinery	1ST-1985	A.E.Fitzgerald, C.Kingsley, S.D.Umens	Mc Graw Hill
6	Electric Machines	2nd -2008	Ashfaq Husain	Dhanpat Rai Publications (P) Ltd.

IV Semester
EL2252 - Lab. Electrical Machines in Power System

Course Objective	Course Outcomes
To make student aware about The basic principle, construction, operation, performance characteristics and steady state and transient analysis of synchronous machines. The principle, construction, operation, control and applications of special electric motors	The student will be able to understand : 1) Explain constructional features, develop phasor diagram and winding layout, examine steady state performance of synchronous machines and determine induced emf and voltage regulation of synchronous alternator 2) Illustrate the need and method of parallel operation of alternators, analyse and evaluate the behaviour of synchronous machine connected to infinite bus. 3) Interpret behaviour & determine time constant and equivalent circuit parameters under transient conditions of synchronous machines. 4) Explain the principle, construction and operation of special machines and identify their applications

Mapped program outcomes	1	2	3				

Minimum Eight Practical are to be performed out of the following :-

Expt. No.	Experiments based on
01	To determine voltage regulation of an alternator by direct loading.
02	To determine voltage regulation of an alternator by synchronous impedance method.
03	To plot external characteristics of synchronous generator at different power factor loads.
04	To perform slip test on a 3-phase synchronous machine.
05	To study synchronization of a 3-phase alternator with infinite bus-bars.
06	To determine sub-transient reactances of synchronous machine.
07	To determine negative sequence reactance of a 3-phase synchronous machine.
08	To determine zero sequence reactance of a 3-phase synchronous machine.
09	To observe armature voltage and current waveforms of a 3-phase alternator during slip-test on C.R.O.
10	To plot V and inverted V curves of a 3-phase synchronous motor.

IV Semester
EL2253 - Electrical Energy Generation System

Course Objective	Course Outcomes

Unit I: Introduction to generation systems **(7)**

Importance of Electrical Energy, Generation of Electrical Energy, Relationships among Energy units, Calorific value of fuels.

Sources of Electrical energy- Coal, oil and natural gas, hydro, solar, wind and nuclear energy.

Different factors associated with a generating station : connected load, maximum demand, demand factor, load factor, diversity factor, plant capacity and utilization factor, load curve and load duration curveload survey, base load and peak load station, advantages of interconnection.

Tariff-: Definition, Objective, Characteristics of tariff, Types of Tariff (Numerical), economical choice of tariff.

Unit II: Solar Energy **(7)**

Solar radiation & its Measurement: - Solar constant, Solar radiation at earth's surface, Solar radiation geometry, Solar radiation on tilted surfaces, Solar radiation measurement, Solar Energy Collectors: - Physical principles of the conversion of solar radiation into heat, flat plate collectors. Applications of Solar energy: Solar Dryer, Solar Still, Solar cooker

Solar Photovoltaic Cell: Principle of solar photovoltaic energy conversion, Equivalent circuit of solar cell,

Unit III: Wind Energy **(7)**

Principle of wind energy conversion, Power in the wind, Cut In, Cut Off Wind Speed ,Site selection considerations, Basic components of wind energy conversion systems(WECS),Classification of WEC systems, Advantages and Limitations of WECS,,Types of wind Machines(HAWT and VAWT), Application of wind energy.

Unit IV: Hydro Power Station **(6 or7)**

Schematic arrangement of Hydroelectric Power Station, Constituents of Hydroelectric power plant, Advantages and Limitations of Hydro-electric Plants ,Hydrology, stream flow, flow duration curve, power duration curve, mass curve, reservoir capacity, Water Power equation (Numerical), type of hydro power plants and their field of use, pumped storage plant and their utility, surge tanks. General study of Hydro Turbine, Introduction to Small hydro plants.

Unit V: Thermal Power Station **(7)**

Introduction, Site selection, size and number of units, general layout, major equipment, auxiliaries, electric supply to auxiliary, cost of generation ,effect of different factors on costs.

General study of steam Turbine.

Condenser: Different types of condensers. Construction and Working principle of Condenser

Unit VI: Nuclear Power Plant and Biomass Energy **(7)**

A)Site selection for nuclear power plant, introduction to nuclear physics, chain reaction, Working Principle of nuclear Power Plant, Components of a nuclear reactor, types of nuclear reactor, material for moderator and control rods, control of nuclear reactors, , economics of nuclear power generation.

B)Biogas production from waste biomass, classification of biogas plants, operational parameters, availability of raw material and gas yield.

IV Semester
EL2253 - Electrical Energy Generation System

Course Objective	Course Outcomes

Text Books:

SN	Title	Edition	Authors	Publisher
1	A Textbook on Power System Engineering	2nd edition 2014	M.L.Soni,P.V.Gupta,U.S.Bhatnagar	Dhanpat Rai and Co.
2	Principles of Power System	2nd edition 2008	V.K.Mehta, Rohit Mehta	S.Chand
3	Generation of Electrical Energy	5th edition 2007	B.R.Gupta	S.Chand
4	Non-Conventional Energy Sources	5th edition 2011	G. D. Rai	Khanna

Text Books:

SN	Title	Edition	Authors	Publisher
1	Power System Analysis	1st edition 2007	T.K. Nagsarkar, M.S. Sukhija	Oxford
2	Electrical Power System	5th edition 2007	Ashfaque Hussain	CBS
3	Non-Conventional Energy Resources	2nd edition 2010	B. H. Khan	Tata McGraw-Hill

IV Semester
EL2254 - Lab. Renewable Energy Sources

Course Objective	Course Outcomes
To make student aware about The basic principle, construction, operation, performance characteristics and steady state and transient analysis of synchronous machines. The principle, construction, operation, control and applications of special electric motors	The student will be able to understand : 1) Explain constructional features, develop phasor diagram and winding layout, examine steady state performance of synchronous machines and determine induced emf and voltage regulation of synchronous alternator 2) Illustrate the need and method of parallel operation of alternators, analyse and evaluate the behaviour of synchronous machine connected to infinite bus. 3) Interpret behaviour & determine time constant and equivalent circuit parameters under transient conditions of synchronous machines. 4) Explain the principle, construction and operation of special machines and identify their applications

Minimum Eight practical are to be performed based on the following :-

Expt. No.	Experiments based on
01	To plot V-I characteristics of a single PV module.
02	To plot V-I characteristics of a series connected PV modules.
03	To plot V-I characteristics of a parallel connected PV modules
04	To study the effect of tilt angle on power output of module.
05	To study the effect of shadow on power output of solar PV module.
06	To study the solar based battery charger
07	To study the wind based battery charger
08	To study the hybrid wind and solar based charger
09	To study the biogas generation plant model set up at YCCE Campus
10	To study the box type solar cooker
11	To study solar water heater in natural convection and force convection mode
12	Study of Hydroelectric Power Plant
13	To design home solar PV system.
14	To study Parabolic Solar Cooker

IV Semester
EL2255 - Electric and Magnetic Fields

Course Objective	Course Outcomes
To educate the student in static electric and magnetic fields. To make them aware about various laws of electromagnetic & electrostatic fields.	The student will be able to : 1. Remember, Understand and Analyze the properties of electrostatic field. 2. Apply electrostatics on different mediums and analyze the boundary characteristics. 3. Remember and Understand and Apply the properties of electromagnetic field. 4. Understand the electromagnetic waves and analyze them over different medium.

UNIT-1:Vector Analysis
Scalars and vectors, vector algebra, the Cartesian coordinate system , the scalar and vector field, the dot product, the cross product, Cylindrical coordinate system, Spherical coordinate system.

UNIT-2:Coulomb's Law and Electric Field Intensity: Electric Flux Density, Gauss's Law, and Divergence
Coulomb"s Law, electric field intensity, types of charge distributions, electric field due to line charge density, surface charge density, and volume charge density, streamlines and sketches of fields. Concept of electric flux, electric flux density, Gauss"s Law, application of Gauss"s Law to symmetrical charge distributions, application of Gauss"s law to differential volume element, divergence, Maxwell"s first equation in electrostatics, the vector operator □and the Divergence theorem.

UNIT-3Energy and Potential: Conductors, Dielectrics, and Capacitance
Energy expended in moving a point charge in an electric field, potential difference and potential, the potential field of a point charge, line charge density and surface charge density, the potential field of a system of charges, potential gradient, the dipole, energy density in the electrostatic field, Current and current density, continuity of current, metallic conductors, conductor properties and boundary conditions, the method of images, semiconductors, the nature of dielectric materials, boundary conditions for perfect dielectric materials, capacitance, several capacitance examples.

UNIT-4:Poisson's and Laplace's Equations
Poisson"s and Laplace"s equations, Uniqueness theorem, examples of the solution of Laplace"s equation (involving one variable only).

UNIT-5 Steady Magnetic Field: Magnetic Forces, Materials, and Inductance
Biot – Savart law, magnetic field due to infinitely long current filament, finite length current filament, Ampere"s circuital law, magnetic field due to coaxial cable, uniform sheet of surface current, solenoid, toroid, curl and its physical interpretation, Stoke"s theorem, magnetic flux and magnetic flux density, scalar and vector magnetic potentials, Force on a moving charge, force on a differential current element, force between differential current elements, force and torque on a closed circuit, nature of magnetic materials, magnetization and permeability, magnetic boundary conditions, potential energy and forces on magnetic materials, inductance and mutual inductance.

IV Semester
EL2255 - Electric and Magnetic Fields

Course Objective	Course Outcomes
To educate the student in static electric and magnetic fields. To make them aware about various laws of electromagnetic & electrostatic fields.	The student will be able to : 1. Remember, Understand and Analyze the properties of electrostatic field. 2. Apply electrostatics on different mediums and analyze the boundary characteristics. 3. Remember and Understand and Apply the properties of electromagnetic field. 4. Understand the electromagnetic waves and analyze them over different medium.

UNIT-6: Time-Varying Fields and Maxwell's Equations, Uniform Plane Wave

Faraday"s Law, derivation of Maxwell"s equations in point form and integral form, displacement current and its physical interpretation, concept of retarded potentials, Maxwell"s equations in phasor form, wave equations, uniform plane waves, solution of wave equation in free space, perfect dielectric, lossy dielectrics and good conductor, skin effect and skin depth, Poynting vector.

Text Books:

SN	Title	Edition	Authors	Publisher
1	Engineering Electromagnetics	7th Edition	W.H. Hayt J. A. Buck	McGraw Hill Publication.
2	Schaum"s Outline Series Theory and Problems of Electromagnetics	2nd Edition	Joseph A. Edminister	Schaum"s outline Series of Engineering
3	Principles of Electromagnetics	4th-2007	Matthew N.O.Sadiku	Oxford University Press

Reference books:

SN	Title	Edition	Authors	Publisher
1	Applied Electromagnetic	1978	Plonus M. A.	MGH
2	Electromagnetics	1998	Kraus J. D.	MGH
3	Fundamentals of Electromagnetics with MATLAB	2nd Edition	Karl E. Lonngren, Sava V. Savov, Randy J. Jost	Scitech Publishing Inc.

IV Semester
EL2256- Lab.: Electrical Engineering Workshp

Course Objective	Course Outcomes
This practical will allow to handle different electrical daily use equipment used by electrical engineer. Concept of illumination from design point is also studied. House wiring concept will also be understood by student.	The student will be able to 1. Describe the basic concept of various electrical components. 2. Demonstrate, formulate and solve the basic maintenance and troubleshooting of household equipments, energy saving etc. 3. Outline the fundamentals of major electrical devices and actual operation of devices like induction motor.

Mapped Program Outcomes	1	2	3	4	5	6	12

Practical based on following topics :-

Expt. No.	Experiments based on
01	a. To set up a staircase wiring using given lamp, controlledby switches. b. To set godown wiring using given lamp, controlled by switches.
02	Determination of polarity marking of single phase transformer.
03	To make connections of a fluorescent lamp wiring and to study accessories of the same.
04	To implement residential house wiring using switches, fuse, indicator, lamp and energy meter.
05	Study of 11 KV sub-station at YCCE.
06	Testing of DC Compound Motor
07	To study internal and external parts of ceiling fan.
08	To measure earth resistance by Earth Tester.
09	Study of Power Cables.
10	Study of line insulators.

IV Semester
EL2257- Microprocessors

Course Objective	Course Outcomes
1) To learn the microprocessor applications in electrical engineering 2) To understand principle of microprocessor chip working. 3) To study Interfacing with memory and other peripherals	The students will be able to: CO1: List, select and explain types of memory devices and architecture of 8085 microprocessor CO2: Recall, experiment with and make use of assembly language instructions of 8085. CO3: Demonstrate and test microprocessors and its interfacing devices. CO4: Illustrate and make use of DMA controller and timer.

Mapped Program Outcomes	1	2	3	12

UNIT-1: **Memory devices**
Memory devices, RAM, ROM, Introduction to Intel"s 8085 Architecture, Flag register, Instruction set, Addressing modes, assemblers, hand coding (7 Hours)

UNIT-2: Programming Instructions
Branching instruction, Simple programmes, stack, PUSH, POP Instructions, CALL/RETURN instruction & Subroutines- simple & nested programmes, Programmes using Subroutines. (8 Hours)

UNIT-3: Timing Diagrams
Timing Diagrams, Timing Diagram of instruction. Delay programmes, Serial data transfer, Interrupts - concept and structure in 8085 Interrupt service routine, advanced instructions & Programming of 8085A. (7 Hours)

UNIT-4: Interfacing of Microprocessor
Complete signal description of 8085, interfacing memory devices interfacing I/O devices. Methods of data transfer-serial, parallel synchronous and asynchronous. IN/OUT instructions. Hardware considerations bus contention, slow memory interfacing. (8 Hours)

UNIT-5: Hardware interfacing and Handshaking
Simple hardware interface to 8085 of standard latches & buffers as I/O ports. Architecture and interface of 8255 & 8085. Handshaking concepts. Interfacing of multiplexed keyboard/ display interface and assembler directives. Interfacing of ADC & DAC, stepper motor Interface with 8085. (8 Hours)

UNIT-6: Architecture and Interface
Architecture and interface of 8253 with & 8085, Different modes of 8253. Architecture and interface of 8257 with & 8085, Different modes of operation of 8257, Application of microcontroller. (7 Hours)

Text Books:

SN	Title	Edition	Authors	Publisher
1	Programming and Interfacing 8085		Gaonkar	
2	Programming of 8085		D.V. Hall	

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Microprocessor & Interfacing Manual , Intel Perpheral		Barry Brey	

		June 2022	1.06	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV Semester
EL2258-Lab. : Microprocessors

Course Objective	Course Outcomes
1) To learn the microprocessor applications in electrical engineering 2) To understand principle of microprocessor chip working. 3) To study Interfacing with memory and other peripherals	The students will be able to: CO1: List, select and explain types of memory devices and architecture of 8085 microprocessor CO2: Recall, experiment with and make use of assembly language instructions of 8085. CO3: Demonstrate and test microprocessors and its interfacing devices. CO4: Illustrate and make use of DMA controller and timer.

Mapped Program Outcomes	1	2	3	12

Practical based on following topics :-

Expt. No.	Experiments based on
01	Write Assembly Language Program (ALP) to add 16 bit numbers 1324 H & 4532 H.
02	Write Assembly Language Program (ALP) to add two 08 bit BCD numbers 78 + 45 & store result in memory 2150 H.
03	Write Assembly Language Program (ALP) to subtract two 08 bit BCD numbers78 – 45 store result in memory 215 H.
04	X & Y are two 32 bit numbers present in memory from address 2150 H & 2300 H. Write ALP to add these two 32 bit binary numbers & store result in memory from address 2710 H.
05	Ten 8 bit binary number are present in memory from address 2340 H. Write ALP to transfer this number to destination memory from address 2400 H.
06	Twelve 8 bit binary numbers are present in memory from address 2540 H. Write ALP to transfer this number to destination memory from address 2548 H.
07	Ten 8 bit binary nos. are present in memory from address 2200 H. Write ALP to transfer this number to destination memory from address 2190 H in reverse order.
08	Fifteen 8 bit binary numbers are present in memory from address 2200 H. Write ALP to transfer this number to destination memory from address 2190 H in reverse order.
09	Fifteen 8 bit binary numbers are present in memory from address 2340 H. Write ALP to find greatest number in data block & store result in memory at the end of data block.
10	Ten 8 bit binary numbers are present in memory from address 2345 H. Write ALP to find smallest number in a data block & store result in memory at end of block.
11	Write ALP to convert 8 bit BCD to binary number.
12	Write ALP to convert 8 bit binary number to BCD number.

IV Semester
EL2259- Signals & Systems

Course Objective	Course Outcomes
To make the student conversant with the analysis of the signal and how to represents the periodic and non-periodic signals.	The student will be able : 1) To classify signals and systems and analyze continuous and discrete time signals. To understand the properties of LTI system 2) To Interpret periodic signals and representing them by using Fourier series.ToInterpret continuous and discrete time signals in frequency domain and to summaries properties of Fourier transform. 3) To do the time and frequency characterization of signals and systems. 4) to understand the Laplace and Z-transform

Mapped Program Outcomes	1	2	3	12

UNIT-1: Signals and Systems
Continuous-Time and Discrete-Time Signals. Transformations of the Independent Variable. Exponential and Sinusoidal Signals. The Unit Impulse and Unit Step Functions. Continuous-Time and Discrete-Time Systems. Basic System Properties.

Linear Time - Invariant Systems
Discrete-Time LTI Systems: The Convolution Sum. Continuous-Time LTI Systems: The Convolution Integral. Properties of Linear Time-Invariant Systems. Causal LTI Systems Described by Differential and Difference Equations. Singularity Functions.

UNIT-2: Fourier Series Representation of Periodic Signals
The Response of LTI Systems to Complex Exponentials. Fourier Series Representation of Continuous-Time Periodic Signals. Convergence of the Fourier Series. Properties of Continuous-Time Fourier Series. Fourier Series Representation of Discrete-Time Periodic Signals. Properties of Discrete-Time Fourier Series. Fourier Series and LTI Systems. Filtering. Examples of Continuous-Time Filters Described by Differential Equations. Examples of Discrete- Time Filters Described by Difference Equations.

UNIT-3 : The Continuous-Time Fourier Transform
Representation of Aperiodic Signals: The Continuous-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Continuous-Time Fourier Transform. The Convolution Property. The Multiplication Property. Systems Characterized by Linear Constant-Coefficient Differential Equations.
The Discrete-Time Fourier Transform
Representation of Aperiodic Signals: The Discrete-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Discrete-Time Fourier Transform. The Convolution Property. The Multiplication Property. Duality. Systems Characterized by Linear Constant-Coefficient Difference Equations.
:

UNIT-4: Time & Frequency Characterization of Signals and Systems
The Magnitude-Phase Representation of the Fourier Transform. The Magnitude-Phase Representation of the Frequency Response of LTI Systems. Time-Domain Properties of Ideal Frequency-Selective Filters. Time-Domain and Frequency-Domain Aspects of Non - ideal Filters. First-Order and Second-Order Continuous-Time and Discrete- Time Systems.

IV Semester
EL2259- Signals & Systems

Sampling
Representation of a Continuous-Time Signal by Its Samples: The Sampling Theorem. Reconstruction of a Signal from Its Samples Using Interpolation. The Effect of Under - sampling : Aliasing. Discrete-Time Processing of Continuous- Time Signals. Sampling of Discrete - Time Signals.

UNIT-5 : The Laplace Transform
The Laplace Transform. The Region of Convergence for Laplace Transforms. The Inverse Laplace Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the Laplace Transform. Analysis and Characterization of LTI Systems Using the Laplace Transform. System Function Algebra and Block Diagram Representations. The Unilateral Laplace Transform.

UNIT-6: The Z-Transform
The z-Transform. The Region of Convergence for the z-Transform. The Inverse z-Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the z-Transform. Analysis and

Characterization of LTI Systems Using z-Transforms. System Function Algebra and Block Diagram Representations. The Unilateral z-Transform.

Text Books:

SN	Title	Edition	Authors	Publisher
1	Signals and Systems	2nd Edition, 2013	Alan V. Oppenheim, Alan S. Willsky, with S. Hamid	PHI Learning Private Limited.

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Signals & Systems	2nd Edition., 2005	Simon Haykin and Van Veen	Wiley
2	Signals, Systems and Transforms	3rd Edition, 2004	C. L. Philips, J.M.Parr and Eve A.Riskin	Pearson education
3	Schaum's Outlines of Signals and Systems	3rd Edition, 2002	Hwei P. Hsu	McGraw Hill
4	Linear Systems and Signals	2nd Edition	B.P. Lathi	Oxford University Press

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

5th Semester

Electrical Engineering

28 June 2019

V Semester

GE 2312 - Fundamental of Economics

Objectives	Outcome (Students will be able to)
Recognizes consumer's behavior and pricing.	Relate their buyer behaviour to particular product and the pricing in the market.
Extrapolates an operations in market with productions constrain.	Examine and classify various market structure and factors of production and its role in production process.
Describes the national income accounting and public finance.	Analyse the national income accounting and the various issues related to banking, taxation, and inflation.
Interprets international trade and institutions.	Elaborate about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institutions.

UNIT-1: Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, exceptions to law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, exception to law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. **(8 Hours)**

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation. **(6 Hours)**

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination. **(7 Hours)**

UNIT-4: National income accounting:
Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation. **(5 Hours)**

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (GST, Import duties), Revenue and capital expenditure.

(7 Hours)

V Semester
GE 2312 - Fundamental of Economics

UNIT-6: International Trade and Institutions

Definitions of closed vs. open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions. **(5 Hours)**

Text Books

SN	Title	Edition	Authors	Publisher
1	Modern Economics	13th Edition	H. L. Ahuja	S. Chand Publisher, 2009.
2	Modern Economic Theory	3rd edition	K. K. Devett	S. Chand Publisher, 2007

Reference Books

SN	Title	Edition	Authors	Publisher
1	Advance Economic Theory	17th Edition	H. L. Ahuja	S. Chand Publisher, 2009
2	International Trade	12th edition	M. L. Zingan	Vindra Publication, 2007
3	Macro Economics	11th Edition	M. L. Zingan	Vindra Publication, 2007
4	Economics: Samuelson,			
5	Monitory Economics	11th Edition	M. L. Sheth	Vindra Publication, 2007
6	Economics of Development and Planning	12th Edition	S. K. Misra and V. K. Puri	Himalaya Publishing House, 2006.

V Semester

EL2301 - Power Electronics

Objective	Course Outcome
The student should be able to) understand the basics of power electronics. 2)understand SCR"s, MOSFET, UJT, IGBT, Concept of rectification, inversion and commutation .	**On completion of this course, the student will be able to** 1) Demonstrate the learnings of various power semiconductor devices with their protection and apply them for various applications. 2) Analyse different Power Electronics Converter circuits and choose them for suitable applications. 3) Demonstrate the knowledge of chopper circuits, analyse and utilise them for different applications. 4) Analyse inverter circuits with different modulation techniques and identify their applications.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Demonstrate the learnings of various power semiconductor devices with their protection and apply them for various applications.	1											1	1	
CO2	Analyse different Power Electronics Converter circuits and choose them for suitable applications.	1	3	2									1	1	
CO3	Demonstrate the knowledge of chopper circuits, analyse and utilise them for different applications.	1	3	2									1	2	
CO4	Examine inverter circuits with different modulation techniques and identify their applications	1	3	2									1	2	
CO5	Develop practical aspects of power semiconductor devices, converters, inverters and chopper circuits.	1	1	2									1	2	

V Semester
EL2301 - Power Electronics

Unit No.	Contents	Max. Hrs.
1	**Power Semiconductor Devices** SCR and its characteristics, Gate characteristics, SCR turn off, ratings, Triggering circuits and opto-couplers	6
2	**Single Phase Line Commutated Converters** Series and parallel connections of SCRs, Single phase line commutated converters, single pulse converter, two pulse mid-point converter, single phase bridge converter, effect of source inductance, effect of freewheeling diode, single phase half controlled rectifier cyclo converter (single phase)	5
3	Three **Phase Line Commutated Converters** Three phase three pulse converter, three phase bridge converter, speed control of dc motors (with single phase rectifier).	5
4	**Forced Commutated Semiconductor Devices and Protection** Characteristic and working of MOSFET, Gate turn off thyristor and insulated gate bipolar transistor, protection of SCR, gate circuit protection, over voltage and over current protection, snubber circuit design.	5
5	**D.C. Choppers** Principles of step down chopper, step up chopper classification, Control strategies, time ratio control and current limit control Impulse commutated and resonant pulse choppers, Multiphase choppers, Application of choppers.	6
6	**Single Phase and Three Phase Bridge Inverters** Single phase and three phase bridge inverters, Output voltage control, Harmonics in output voltage waveforms, Harmonic attenuation by filters, Harmonic reduction by pulse width modulation techniques, analysis of single pulse width modulation, working of current source inverters, applications.	6

V Semester
EL2301 - Power Electronics

Text books:				
S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics Circuit"s Devices and Applications	3rd Edition,2004	M.H.Rashid	Prentice Hall Limited
2	Power Electronics		D.Y.Shingare	Electrotech Publication Engineering Series
Reference books:				
S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics	1981	C.W.Lander	McGraw Hill
2	Thyristors and their Applications	2nd Edition 2002	Dr.M.Ramamoorty	East West Press
3	Thyristors and their Applications		Dr.G.K.Dubey, Doralda Sinha and Joshi	New Age International
4	Power Electronics	1989	Ned Mohan, T.M.Undeland, and W.P.Robbins	John Wiley and Sons

V Semester

EL2302 - Power Electronics Lab

S.N	TITLE
1	To show V-I characteristics of SCR and measure holding and latching current of SCR.
2	To estimate sensitivity of four modes operation of TRIAC
3	To evaluate average dc voltage of single phase half wave rectifier with Resistive load.
4	To show transfer and output characteristics of Power MOSFET.
5	To show speed control of DC Shunt Motor with Semi Converter.
6	To demonstrate single phase step down Cycloconverter with Resistive load.
7	To demonstrate Forced Commutation methods of SCR.
8	To evaluate RMS AC Voltage of single phase MOSFET based full Bridge inverter.

V Semester

EL2303 - Fundamentals of Power System

Objective	Course Outcome
The student should be able to Calculate the basic parameters of transmission line of power systems. To know the power flow through transmission lines under different circumstances.	**On completion of this course, the student will be able to** 1) Define and explain basic components of power system and representation of its elements in terms of per unit. 2) Analyze and evaluate the transmission line parameters which limits the transmission capacity of a line. 3) Classify, evaluate and determine the performance of distribution and transmission system. 4) Choose, Compare and select the type of insulators and underground cables and improve the performance of system.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Define and explain basic components of power system and representation of its elements in terms of per unit.	2	2											1	
CO2	Analyze and evaluate the transmission line parameters which limits the transmission capacity of a line.	2	2	2										2	
CO3	Classify, evaluate and determine the performance of distribution and transmission system.	2	3	2	2								1	2	
CO4	Choose, Compare and select the type of insulators and underground cables and improve the performance of system.	2	2	2										1	

V Semester
EL2303 - Fundamentals of Power System

Unit No.	Contents	Max. Hrs.
1	**Introduction to power system** Structure of Electrical Power System, use of high voltage, idea about substation, classification, Indoor, outdoor substation, symbols for equipment used in substation, concept of real, reactive and complex power. Per unit system: Representation of power system elements, models and parameters of generator, transformer and transmission lines, Numericals.	6
2	**Inductance of transmission line** Constants of transmission line, flux linkages, inductance of single phase two wire line, inductance of 3 phase overhead line, self GMD and mutual GMD,Numericals	5
3	**Capacitance of transmission line** Electric Potential, Capacitance of single phase 2 wire line, capacitance of 3 phase overhead line, Symmetrical and unsymmetrical spacing, Numericals.	5
4	**Distribution system and Load flow analysis** Types of distribution system, comparison, Feeders and distributors, Numericals on DC and AC distribution Y Bus formation, Illustration of active and reactive power transmission, Introduction to load flow studies in multi bus system (SLFE).	5
5	**Insulators and Cables** Types, Potential distribution over suspension insulator string, String efficiency, Numericals on string efficiency. CABLES: Construction, classification, insulation resistance, capacitance, Dielectric stress, economical size, Grading of cables, Numericals.	6
6	**Transmission Systems** Short, medium (Nominal T and Nominal Π method) and Long line, Voltage regulation & efficiency of power transmission lines using simple series equivalent representation, ABCD parameters of transmission lines.	6

V Semester

EL2303 - Fundamentals of Power System

Text books:				
1	Power System		S.Chand	V.K.Mehta
2	Electrical Power Systems	5th edition	CBS	Ashfaq Hussain
3	Modern Power System Analysis	3rd -2008	Tata McGraw Hill	I. J. Nagrath and D.P. Kothari

Reference books:				
1	Elements of Power system analysis	4th - 1982	MGH	W. D. Stevenson
2	Electrical Power system	3rd -2005	New Age International	C.L Wadhwa

V Semester

EL2304 - Electrical Drives

Objective	Course Outcome
The student should be able to After studying Electrical machines this subject elaborates applications of different machines in industry. Characteristics under starting, running braking and speed control of different motors are explained. Programmable logic controller, contactors, tractions is also explained.	**On completion of this course, the student will be able to** 1) Classify and compare characteristics of AC and DC motors to interpret application of motors in electrical drives. 2) Apply Selection criteria for electrical drives by adapting electrical and mechanical characteristics of motor. 3) Categorize and compare contactors and relays for application of control circuit. 4) Explain the applications of PLCs in electrical drives and compare and assess control of electrical drive. 5) Estimate and adapt different motors for traction work.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify and compare characteristics of AC and DC motors to interpret application of motors in electrical drives.	3	3												
CO2	Apply Selection criteria for electrical drives by adapting electrical and mechanical characteristics of motor	3	3												
CO3	: Categorize and compare contactors and relays for application of control circuit.	3												1	
CO4	Explain the applications of PLCs in electrical drives and compare and assess control of electrical drive.	3				3							1		1
CO5	Estimate and adapt different motors for traction work	3	3										1		

		June 2022	1.06	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
EL2304 - Electrical Drives

Unit No.	Contents	Max. Hrs.
1	**Introduction to Drives and Speed Control** Definition of a Drive, Classification of Drives, Brief idea about drives commonly used in industries, Speed-torque characteristics of common drive motors (DC and AC), Characteristics of Drives under starting and running, Types of braking, Speed Control of AC and DC motors.	6
2	**Selection of motors** Selection of motors and bearings of motor: Power capacity for continuous and intermittent periodic duties, Flywheel effect, Duty cycles of motor, transmission, enclosure systems for drives.	5
3	**AC and DC contactor and relays** AC and DC contactor and relays: Limit Switches, Lock out contactor, magnetic structure, operation, arc interruption, Contactor rating, H.V. Contactor, control circuit for automatic starting and braking of DC motor and three phase induction motor, Control panel design for Motor Control Centre(MCC).	5
4	**Programmable Logic Controllers** Programmable Logic Controllers (PLC), programming methods, Ladder programming with few examples, Applications of PLC"s in electrical drives.	5
5	**Traction motors** Traction motors: Motors use in AC/DC traction and their performance and desirable characteristics, requirement and suitability of motor for traction duty, Speed time characteristics of train, Traction motor control. Series parallel control with numerical method, Starting and braking of traction motor.	6
6	**Digital speed control of Electric motors** Digital speed control of Electric motors, comparison with Analog method of speed control, Block Diagram arrangement for microprocessor based speed control of AC/DC motor, Flowcharts and algorithms for speed control and speed reversal of motor. Digital signal processors (DSP"s) for drive control.Variable frequency Drive(VFD)	6

V Semester
EL2304 - Electrical Drives

Text Books:				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	A Course in Electrical Power	**1st-2005**	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Magnetic control of motors	Industrial New York 1947	Heumann	Chapman and Hall
3	Introduction to Programmable Logic Controllers	3rd Edition, 2008.	Gary Dunning	Cengage Learning

Reference books:				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Modern Electric Traction	**4th -2005**	H. Pratap	Dhanpat Rai and Company
2	Modern utilization of traction motor	2003	J.B. Gupta	
3	A Textbook of Electrical Technology Volume III Transmission, Distribution, Utilization		B.L.Theraja, A.K.Theraja	S.Chand

V Semester
EL2305 - Electrical Drives Lab

S.N	TITLE
1	To evaluate and explain the control circuit of star delta starter
2	To evaluate and explain control circuit of direct online starter (DOL)
3	To explain function of side rotary limit switch.
4	To categorize different types contactors
5	To classify and explain programming logic control (PLC) M-1200, M-1400 and LOGO PLC.
6	To make use of operating limit switch to turn ON contactor (output device).
7	To design ladder programming in PLC to control lamp.
8	To design ladder programming using LOGO PLC to control lamp.
9	To explain Implementation of timer using LOGO PLC
10	To design ladder programming in PLC to Control of lamps in pre defined sequence
11	To design a program for Reversal of synchronous motor using PLC
12	To make use of limit switch, and sensors to turn ON contactor motor, lamp .

V Semester

EL2311 - OE I : Renewable Energy Generation Systems

Objective	Course Outcome
This subject introduce the different renewable energy sources to the students. Students get knowledge of Electric Power generation by wind, solar, small hydro.	**On completion of this course, the student will be able to** 1) Summarize, classify and compare types of renewable energy sources, outline as per Global and Indian context. 2) Utilize solar energy for various applications, estimate solar radiation geometry and classify types of wind turbine generator. 3) Demonstrate, Classify and utilize geothermal and biomass energy. 4) Compare, classify and apply energy from ocean, tide, wave and hydro for power generation, explain storage methods for renewable energy sources.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Summarize, classify and compare types of renewable energy sources, outline as per Global and Indian context.	1		1			1	1							
CO2	Utilize solar energy for various applications, estimate solar radiation geometry and classify types of wind turbine generator.	1	2	1	1	1		2	1			1			
CO3	Demonstrate, Classify and utilize geothermal and biomass energy.	1		1		1	1	2	1			1			1
CO4	Compare, classify and apply energy from ocean, tide, wave and hydro for power generation, explain storage methods for renewable energy sources.	1		1		1		1				1		1	1

V Semester

EL2311 - OE I : Renewable Energy Generation Systems

Unit No.	Contents	Max. Hrs.
1	**Introduction** Fundamentals of Renewable / Non-renewable Energy Sources, Renewable Energy sources, Renewable Energy Potential in India, Renewable Energy Sources and their sustainable development. Storage methods for renewable energy sources.	6
2	Solar Energy Principles, scope and applications, solar radiation, its measurement & prediction, flat plate collectors-design & theory, solar water heating, solar dryers, solar stills, solar cooling and refrigeration. Solar cells, thermal storage, street lighting, solar power generation.	5
3	Wind Energy Introduction, Historical development, Wind energy resources, sites identification, blade element theory, aero-foil design, component of wind energy conversion system, wind turbine generator classification, and windmill and wind electrical generator, Advantages, disadvantages, economics and present status of wind energy generation systems, grid connection of wind energy.	5
4	Geothermal Energy and Biomass Energy Introduction, history of geothermal resources, basics of geological process, dry rock and hot aquifer analysis, geothermal exploration, geothermal well drilling and fluid extraction, utilization of geothermal resources, geothermal heat pump, site of geothermal energy in India. Biomass energy resources and conversion processes, urban waste to energy conversion.	5
5	Mini & Micro hydro-plants Introduction, Classification of water turbines, hydroelectric system, essential components of hydroelectric system, system efficiency, advantages and disadvantages of hydroelectric system, present Indian power scenario of mini- micro hydro.	6
6	Ocean Energy Ocean thermal energy conversion (OTEC), Open cycle and closed cycle OTEC, Ocean wave energy conversion, tidal energy conversion. Introduction of Fuel cells.	6

V Semester

EL2311 - OE I : Renewable Energy Generation Systems

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Non Conventional Sources of Energy	**4th edition**	G.D.Rai	Khanna Publisher
2	Energy Technology:Nonconventional Renewable and Conventional	,	S. Rao and B.B Parulekar	Khanna Publisher New Delhi

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Solar Energy : Principles of Thermal collection and storage	**3rd edition,1994**	S.P.Sukhatme,J.K.Nayak	Tata McGraw Hill
2	Wind and Solar Power System		M. R. Patel	CRC Press, New York
3	Renewable Energy Sources Basic Principles and Applications		G. N. Tiwari and M. K. Ghoshal	Narosa Publishing House,New Delhi

V Semester

EL2312 - OE I : Electrical Machines and their Applications

Objective	Course Outcome
The student should be able to This subject introduce the applications of different machines and commonly used drives	**On completion of this course, the student will be able to** 1) To explain speed-torque characteristics, need for starters, starting methods and braking of AC and DC motors. 2) To build/apply criterion for selection of motors, duty cycle, enclosures, transmission system and insulation classes. 3) To illustrate/interpret/explain the principle, operation and construction of 1-phase and 3-phase transformers and autotransformers. 4) To show/define the principle. Construction, types, characteristics and performance of special machines like BLDC, Stepper motor and Universal motor

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	To explain speed-torque characteristics, need for starters, starting methods and braking of AC and DC motors	3													1
CO2	To build/apply criterion for selection of motors, duty cycle, enclosures, transmission system and insulation classes	3	1					1							1
CO3	To illustrate/interpret/explain the principle, operation and construction of 1-phase and 3-phase transformers and autotransformers	2	1												2
CO4	To show/define the principle. Construction, types, characteristics and performance of special machines like BLDC, Stepper motor and Universal motor	3													1

V Semester

EL2312 - OE I : Electrical Machines and their Applications

Unit No.	Contents	Max. Hrs.
1	Introduction to Drives and Speed Control: Classification of Drives, brief idea about commonly used drives (AC and DC) drives in industry, speed- torque characteristics of different drive motors, their behaviour under starting and running conditions.	6
2	Need of starter, Starting methods, Braking and Speed Control of AC and DC motors.	5
3	Selection Criterion for Drive Motors: Criterion for selection of motors, Duty Cycle, Power Rating for Continuous and Intermittent Duty Cycles, Environment and Enclosures, Transmission System, Insulation Classes.	5
4	Single Phase transformer Review of Principle, constant flux machine, losses, efficiency etc., Operation on load (Phasor diagrams), Voltage regulation, effect of load power factor on regulation, Application of Single phase transformer in Electronic circuitry, autotransformer, welding transformer, furnace transformer.	5
5	Three Phase Transformer. Concept of three phase transformer, Comparison between unit and bank of single phase transformer, connections, All Day Efficiency, application in power system.	6
6	Special Machines: Brushless DC motor: - Principle, construction , operation, converter for BLDC, rotor position sensor (Hall Sensor), Stepper motor: types, slewing, torque-speed characteristics, stepper motor converter, Universal motor, applications Applications of three phase and single phase induction motors in cement industry, steel rolling mill, textile mill, etc.	6

V Semester
EL2312 - OE I : Electrical Machines and their Applications

Text books				
S.N	**Title**	**Year/Edition**	**Author**	**Publisher**
1	A Course in Electrical Power	First-2005	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Fundamentals of Electric Drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

Reference Books:

Sr. No.	Title	Year/Edition	Author	Publisher
1	A Course in Electrical Power	First-2005	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Fundamentals of Electric drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

V Semester

EL2313 - OE I : Testing and Maintenance of Electrical Equipment's

Objective	Course Outcome
The student should be able to To adopt various testing and maintenance procedures for electrical equipments by providing effective insulation to enhance their life and working condition	**On completion of this course, the student will be able to** 1) Classify, the causes of hazards, accidents, shock and the remedial action taken against the electrical shock. 2) Demonstrate, apply and evaluate different types of tests and the various maintenance techniques to be employed on various electrical machines and it installation. 3) Demonstrate, apply and estimate the factors affecting the life of insulation, its testing and maintenance. 4) Explain, develop and determine the various tests to be conducted on distribution transformer, I. S. Standards.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify, the causes of hazards, accidents, shock and the remedial action taken against the electrical shock.	1					2	1	3				3		1
CO2	Demonstrate, apply and evaluate different types of tests and the various maintenance techniques to be employed on various electrical machines and it installation	1					2		1				1	2	
CO3	Demonstrate, apply and estimate the factors affecting the life of insulation, its testing and maintenance.	1					2								
CO4	Explain, develop and determine the various tests to be conducted on distribution transformer, I. S. Standards.	1					1		1				1	2	

V Semester

EL2313 - OE I : Testing and Maintenance of Electrical Equipment's

Unit No.	Contents	Max. Hrs.
1	Safety & Prevention of Accidents Definition of terminology used in safety; safety, hazards, accident, major accident hazard, responsibility, authority, accountability, monitoring, I.E. Act & statutory regulations for safety of persons & equipments working with electrical installation, Dos & don"ts for substation operators as listed in IS Meaning & causes of electrical accidents factors on which severity of shock depends, Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration, Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers.	6
2	General Introduction Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests, Methods of testing a) Direct, b) Indirect, c) Regenerative. Concept of routine, preventive & breakdown maintenance, advantages of preventive maintenance, procedure for developing preventive maintenance schedule, Factors affecting preventive maintenance schedule. Introduction to total productive maintenance.	5
3	Testing & maintenance of rotating machines Type tests, routine tests & special tests of 1 & 3 phase Induction motors, Routine, Preventive, & breakdown maintenance of 1 & 3 phase Induction motors as per IS 9001:1992. Parallel operation of alternators, Maintenance schedule of alternators & synchronous machines as per IS 4884-1968. Brake test on DC Series motor.	5
4	**Testing & maintenance of Insulation** Classification of insulating materials as per I.S. 8504(part III) 1994, factors affecting life of insulating materials, measurement of insulation resistance & interpretation of condition of insulating. Methods of measuring temperature of internal parts of windings/machines & applying the correction factor when the machine is hot.	5
5	**Testing & maintenance of Transformer** Listing type test, routine test & special test as per I.S. 2026-1981. Procedure for conducting following tests: Measurement of winding resistance, no load losses, & no load current, Impedance voltage, load losses, Insulation resistance, Induced over voltage withstand test, separate source voltage withstand test, Impulse voltage withstand test, Temperature rise test of oil & winding, Different methods of determining temp rise- back to back test, short circuit test, open delta (delta – delta) test. Preventive maintenance & routine maintenance of distribution transformer as per I.S. 10028 (part-III): 1981, Periodic checks for replacement of oil, silica gel, parallel operation of 1 & 3 phase transformer, load sharing calculations (numerical).	6
6	**Installation** Factors involved in designing the machine foundation, Requirement of different dimension of foundation for static & rotating machines procedure for levelling & alignment of two shafts of directly & indirectly coupled drives, effects of misalignment. Installation of rotating machines as per I.S. 900-1992. Use of various devices & tools in loading & unloading, lifting, carrying heavy equipment.	6

V Semester

EL2313 - OE I : Testing and Maintenance of Electrical Equipment‟s

Text Books:			
S. N.	**Author**	**Title**	**Publisher**
01.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol – I	Media Promotors & Publisher Ltd. Mumbai
02.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol – II	Media Promotors & Publisher Ltd. Mumbai

Reference Books:			
S. N.	**Author**	**Title**	**Publisher**
01.	B. L. Theraja	Electrical Technology Vol I to IV	S. Chand & Co., New Delhi
02.	C. J. Hubert	Preventive Maintenance Hand Books & Journals	----------

V Semester
EL2314 – Solar power plant design and Installation

Course Objectives	Course Outcomes
This Course is aimed at training candidates for the job of a "Solar PV System Installation Engineer", in the "Energy" Sector/Industry and aims at building the following key competencies amongst the learner.	The students will be able to: CO1: Assess customer's PV system requirement. CO2: Plan and arrange for installation. CO3 Coordinate with colleagues at workplace CO4:Ensure safety at workplace

UNIT-1 Solar Power Plant
How solar is beneficial to Industry and Residences, Types of Solar Power Plant, Grid Connected solar Power Plant, Net Metering Solar Power Plant, Behind the meter, Gross meter, Off-Grid / Hybrid solar power plant, Schemes of solar power plant PV module structure inter row spacing calculation, Pitch analysis, Selection of PV module tilt angle, Near shading object calculation, Site survey and plant assessment, selection of site and shadow analysis, selection of site and shadow analysis, Selection of PV module technology.
UNIT-2 Selection of PV module technology and Sizing
Types Crystalline module cells, Manufacturing process of PV cells, Comparison between mono crystalline, Selection of PV cells, Selection of front and rear sheet Selection of PV module glass, Selection of EVA sheet , Bus bar and frame.
UNIT-3 Inverters Selection and Sizing
Types of solar inverter, Selection of string /central / off grid inverter, Selection of power conditioning unit (PCU), Sizing of solar inverter for roof top and grid connected projects, Selection and sizing of string inverter, Selection and sizing of central inverter.
UNIT-4 Selection and sizing of AC and DC Cable, Earthing and Lightning Arrestor
Sizing of solar cable /DC cable, Sizing of String cable, Derating factor of cables Sizing of AC cable (Inverter to ACDB ,ACDB to MDB), Sizing of DC cable (Module to SMB , SMB to Inverter), Solar Plant resistance calculation Preparation AC /DC earthing layout, Selection of lightening protection device Selection of ESE type Lightening Protection.
UNIT-5 Plant Installation and Government policies
IEC Standards, Equipment Installation, Monitoring Equipment, Commissioning System Installation & Pre-Commissioning Checklist, Commissioning Test Sheets. Introduction to State & Central policies, Net meter policy of Maharashtra state, Various scheme of Solar net metering. Case Study KUSUM & Ultra Mega solar power projects. Introduction to Solar PV Design and Simulation software like HOMER Pro, PV F-Chart, pvPlanner, PVsyst, RETscreen, System Advisor Model (SAM), Solar Pro
UNIT-6 Maintenance And Troubleshooting
Preparation of checklist for maintenance as per OEM recommendation for: Module, Inverter, DC cabling & SMB, AC Cabling ACDB, MDB, Checking functionality and protection system, Measurement of earthing resistance, Efficiency measurement of plant. Monitoring Equipment, Commissioning System Installation & Pre-Commissioning Checklist, Commissioning Test Sheets, Staff Management

Text books:				
S.N.	**Title of the book**	**Edition)**	**Author(s)**	**Publisher**
1	Solar Photovoltaic Technology And Systems	1st 2013	Chetan Singh Solanki	PHI Learning Delhi
2	Implementation of Solar Thermal and Photovoltaic Systems		Covrig Claudiu	• LAP Lambert Academic Publishing
3	Photovoltaics for Professionals - Solar Electric Systems- Marketing, Design and Installation		Falk Antony	Taylor & Francis Ltd
Reference books:				
1	The Solar Electricity Handbook: 2019 Edition 2019: A simple, practical guide to solar energy - designing and installing solar photovoltaic systems.	2019	Michael Boxwell	Greenstream Publishing

V Semester

EL2321 - OE II: Electrical Energy Audit and Safety

Objectives	Course Outcomes
The student should be able to Understand various operating characteristics of electrical equipments,its monitoring, tools used in comprehensive energy audit and its procedure to save the electricity with and without investment, calculation of energy saving and its global impact	**On completion of this course, the student will be able to** 1) Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003. 2) Demonstrate, apply and evaluate different forms of electrical and thermal energy. 3) Demonstrate, apply and estimate the Energy Management, Energy Audit, Energy Monitoring and Targeting. 4) Explain, develop and determine the various Global Environmental Concerns and Electrical safety procedures.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003	1							1				1		
CO2	Demonstrate, apply and evaluate different forms of electrical and thermal energy.		1										1	1	
CO3	Demonstrate, apply and estimate the Energy Management, Energy Audit, Energy Monitoring and Targeting.		2			1	1	2					1		1
CO4	Explain, develop and determine the various Global Environmental Concerns and Electrical safety procedures.	1									1		1		1

V Semester

EL2321 - OE II: Electrical Energy Audit and Safety

Unit No.	Contents	Max. Hrs.
1	Energy Scenario Commercial and Non-commercial energy, primary energy sources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance. Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features, Salient Features of Electricity Act 2003.	6
2	Basics of Energy and its various forms Electricity basics- DC & AC currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.	5
3	Energy Management & Audit Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.	5
4	Energy Monitoring and Targeting Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM).	5
5	Global environmental concerns United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).	6
6	Electrical Safety Primary hazards associated with electricity. Control measures and safety-related work practices to minimize the risk associated with electrical hazards. Response procedures in the event of electrical shock or fire.	6

V Semester

EL2321 - OE II: Electrical Energy Audit and Safety

Text Books:			
S. N.	**Author**	**Title**	**Publisher**
01	Archie,W Culp	Principles of Energy Conversion	McGraw Hill
02	Wayne C Turner	Energy Management Handbook Bureau	John Willey and Sons
03		Bureau of Energy Efficiency Study Material for Energy Managersand Auditors Examination	Bureau of Energy Efficiency www.beeindia.in

Reference Books:			
S. N.	**Author**	**Title**	**Publisher**
01.	Amit Kumar Tyagi	Handbook on Energy Audit and Management	TERI

V Semester

EL2322 - OE II: Utilization of Electrical Energy

Objectives	Course Outcomes
The student should be able to To understand the basic principle of electrical heating, welding, illumination, refrigeration and air conditioning, fans, pumps, compressors and digi sets.	**On completion of this course, the student will be able to** 1) Demonstrate and utilize electrical energy for various purposes including heating and traction system. Students will also be able to classify illumination, its types and purpose. 2) Demonstrate and apply electric energy to different types of welding 3) Explain how refrigeration system and air condition system works. 4) Analyse, determine and estimate proper economic generation.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Demonstrate and utilize electrical energy for various purposes including heating and traction system. Students will also be able to classify illumination, its types and purpose	3	2	2					2	1	1				1
CO2	Demonstrate and apply electric energy to different types of welding			1		1			1						
CO3	Explain how refrigeration system and air condition system works	1		1	1				1						
CO4	Analyse,determine and estimate proper economic generation	3	2	2	1		1		2	2	3	1		3	1

V Semester
EL2322 - OE II: Utilization of Electrical Energy

Unit No.	Contents	Max. Hrs.
1	**Electric Heating:** i) Electric Heating : Types and methods of electrical heating, advantages of electrically produced heat Types & application of electric heating equipment"s, transfer of heat. ii) Resistance Ovens: General constructions, design of heating elements, efficiency & losses, radiant heating. iii) Induction heating: Core type & core less induction furnace, indirect induction oven, medium and high frequency eddy - current heating. iv) Dielectric heating: Principle and application. v) Arc furnace: Direct & indirect arc furnace, power supply, characteristics & control.	6
2	**Electric Welding*:*** i) Importance, Advantages & Disadvantages of welding, classification of welding processes. ii) Resistance welding, Butt welding, Spot welding, Projection welding, Seam welding. iii) Electric arc welding: carbon arc welding, metal arc welding, submerged arc welding, Welding positions, Types of welding electrodes iv) Ultrasonic welding, electron beam welding, laser beam welding.	5
3	**Illumination*:*** Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), types of lamps, luminaries, Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.	5
4	**Refrigeration & Air conditioning:** Terminology, refrigeration cycle, refrigeration systems (Vapour compression, vapour absorption), domestic refrigerator, water cooler, desert cooler. Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.	5
5	**Electric Traction** Traction system, requirement of an ideal traction system, different systems for traction, system of railway electrification, comparison between AC and DC systems, power supply for electric traction system, overhead equipments (collector gear for overhead equipments, conductor-rail equipment)Speed- Time curve for train movement, crest speed, average speed and schedule speed, simplified speed-time curve	6
6	Economics of Power Generation, Electric Power Supply and Utilization Terms and Definitions, base load and peak load, selection of power plant equipment (boilers, prime-movers, size and number of generating units), economics in plant selection, economics of hydroelectric power plant, economics of combined hydro and steam power plant, performance and operating characteristics of power plants, power plant useful life, tariff for electrical energy, objective and requirements of tariff, general tariff forms, comparison between private generating plant and public supply.	6

V Semester

EL2322 - OE II: Utilization of Electrical Energy

Text books:				
S. N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLISHER**
1	Utilization of Electric Power & Electric Traction		J.B. Gupta	Kataria & Sons
2	Art and Science of Utilization of Electrical Energy		H Pratap	Dhanpat Rai & Sons, Delhi
3	Utilization of Electrical Power		R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:				
	TITLE	**EDITION**	**AUTHOR**	**PUBLISHER**
1	Guide book for National Certification Examination for Energy Managers and Energy Auditors			Bureau of Energy Efficiency
2	Utilization of Electrical Power		Dr N. Suryanarayana V.	Wiley Eastern Ltd, Age International New
3	Utilization of Electrical Energy		E.Openshaw Taylor	Orient Longman

V Semester

EL2323- OE II: Power System Engineering

Objective	Course Outcome
The student should be able to :- (1) To comprehend the different issues related to overhead lines and underground cables. (2) To train the students with a solid foundation in power system concepts required to solve engineering problems. (3) To provide the knowledge about the system transients, sag and various issues related to cables and transmission lines. (4) To introduce the students to the general structure of the network for transferring power from generating stations to the consumers. (5) To expose the students to the different electrical & mechanical aspects of the power network along with its environmental and safety constraints	On completion of this course, the student will be able to (1) Articulate types of load and power system concepts required to engineering problems. (2) Develop the ability to implement the appropriate safety equipments for design of electrical power system with enhancing the efficiency of the transmission and distribution system with environment friendly technology. (3) Formulate A.C and D.C distribution networks for necessary variable calculation. (4) Ability to design and analyze switchgear protection system with respect to various electrical parameters which is required in substation.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Articulate types of load and power system concepts required to engineering problems.	2				1		1			1			1	
CO2	Develop the ability to implement the appropriate safety equipments for design of electrical power system with enhancing the efficiency of the transmission and distribution system with environment friendly technology.	1	2	1				1				1	1	2	
CO3	Formulate A.C and D.C distribution networks for necessary variable calculation.	2	1					1						2	
CO4	Ability to design and analyze switchgear protection system with respect to various electrical parameters which is required in substation.	1	1	2				1			1			1	

		June 2022	1.06	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
EL2323- OE II: Power System Engineering

Unit No.	Contents	Max. Hrs.
1	**Introduction to Power System** Restructuring of power sector, Constituents of present day power system, sources of electrical energy, types and characteristics of generating stations: Thermal, hydro, nuclear , solar ,wind and other renewable, salient features of electricity act 2003.	6
2	**Load on Power Stations** Load, Important terms and factors, and Units generated per annum , Load duration curve , Types of loads, Load demand and diversity factors, Load curves and selection of generating units, Base load and peak load on Power station, Method of meeting the load ,Interconnected grid system.	5
3	**Transmission System I** Electric supply system, A.C power supply scheme, D.C transmission scheme, Comparison of AC and DC transmission system, advantages of A.C. transmission system, Comparison of various transmission system (Two wire dc system, Single phase two wire A.C system, Single phase three wire system , three phase three wire system, Three phase four wire system) Elements of transmission line, Economic choice of transmission voltage, requirements of satisfactory electric supply, Concept of HVDC transmission.	5
4	**Transmission System II** Line support insulators, types of insulators (pin type, suspension type, strain type, shackle type), Commonly used conductor material, concept of corona, factor affecting corona, advantages and disadvantages of corona, methods of reducing corona effect, Sag and its effects, Constants of transmission line (R, L and C) , Resistance of transmission line, skin effect , Classification of overhead transmission line and voltage regulation .	5
5	**Distribution System** Classification of distribution system, Types of distribution AC and DC, Overhead verses underground system, Requirements of distribution system, Design consideration of distribution system, AC distribution types, Voltage drop calculations in different distribution system , importance of voltage control, location of voltage control equipment and its methods, Tap changing transformer , Concept of tariff, desirable characteristics of tariff, types of tariff.	6
6	**Introduction to Switchgear** Essential features of switchgear, switchgear equipment's, switches, fuses, circuit breakers, relays, HRC fuses, Bus Bar arrangement (single bus system, One and half feeder ,Main and transfer bus system) , MCB, MCCB, ELCB Introduction to Instrument transformer Current Transformer (CT) and Potential transformer (PT).	6

V Semester

EL2323- OE II: Power System Engineering

Text books:				
	Title	Edition	Author	Publication
1.	Power System Analysis	1st edition 2007	T.K. Nagsarkar, M.S. Sukhija	Oxford
2.	Principles of Power System	2nd edition 2005	V.K.Mehta, Rohit Mehta	S.Chand
3.	Electrical Power System	5th edition 2007	Ashfaque Hussain	CBS

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

6th Semester

Electrical Engineering

28 June 2019

VI Semester
GE2311 - Fundamentals of Management

Objective	Outcomes Students will be able to
To introduce the fundamentals and legal provision of Management	Explain the Legal provision and Functions of Management.
To introduce the Human Resource and Financial practice of organization	Analyze the role of Human Resource and Financial Management in the organization.
To Introduce the Project Management	Analyze the project life cycles.
To provide knowledge of Marketing Activities of Management	Identify tools and techniques for the marketing of goods and services.

Unit – 1 - Principle of Management
Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership

UNIT-2: Legal Aspects of Management
The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company

UNIT-3: Human Resource Management
Human Resource Management-Meaning and Scope, Principles of HRD, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Grievance Redressal Procedure .

UNIT-4: Project Management
Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Tools and Techniques of Project Management, Network techniques - Introduction and Use of CPM &PERT for planning, SWOT Analysis, Project Risk Analysis, Project Control.

UNIT-5: Marketing Management
Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

VI Semester
GE2311 - Fundamentals of Management

UNIT-6: Financial Management

Definition & Functions of Finance department, Sources of finance, Types of capital, Profit maximization vs. Wealth Maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

Text book and Reference

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

VI Semester
EL2351- Control System

Course Learning Objectives	Course Outcomes
This is a first course in feedback control of dynamic systems. The main goal is to introduce and familiarize students with dynamic systems modeling and analysis techniques that can be employed on a large variety of engineering systems. Being an interdisciplinary course, students will learn: 1 the role of a control engineer in multi- disciplinary teams. 2 to apply the knowledge gained in basic mathematics, physical sciences and engineering courses to derive mathematical models of typical engineering processes. 3 to use transfer function and state space models for control system analysis in time and frequency domain. 4 the basic concepts of proportional, integral, and derivative (PID) control. 5 the importance of stability in control systems and the various methods to determine it. 6 to construct root locus plot and frequency response plots such as polar plot, Bode plot, Nyquist plot etc.	The students will be able to: CO1: Classify, select types of control systems, interpret transfer function of the system and compare and evaluate electrical and mechanical systems. CO2: Illustrate the time response, develop and evaluate the controller. CO3: Demonstrate, apply and evaluate stability using transfer function and state variable approach. CO4: Demonstrate, construct and select design parameters using root locus and frequency domain methods Mapped program outcomes:1,2,3,12

UNIT I : Introduction to Control Systems: History of control system, Basic Components of Control System, Open loop control and close loop control with examples, classification of control systems.

Transfer Function, Block Diagram and Signal Flow Graph : Transfer function and gain, Order of a system, block diagram algebra & reduction techniques, signal flow graph, its constructions and Mason"s gain formula.

Mathematical Modelling of physical systems: Mathematical modelling of physical system such as – electrical, mechanical, electro-mechanical, thermal, hydraulic, pneumatic etc., Analogous systems.

UNIT II: Characteristics of Feedback Control Systems : Effect of negative feedback compared to open loop system such as – sensitivity to parameter variation, speed of time response, bandwidth, disturbance rejection and linearizing effect, Effect of positive feedback.

UNIT III:Time Domain Analysis of Control Systems: Concept of transient response, Steady state response and time response, standard test signals, Time response of first order systems, Transfer function of second order system, Time response of second order system, Time response specifications of second order system, steady state error (e_{ss}) analysis, static error constants and system type, dominant poles, Approximation of high order systems by low order systems, Relation between roots of characteristic equation, damping ratio and transient response, effect of proportional(P), Integral (I) and derivative (D) controllers on the time response concept of transportation lag.

VI Semester
EL2351- Control System

UNIT IV: **Stability of Linear Control Systems :** Concept of stability, stable, unstable and marginally stable system, Absolutely stable and conditionally stable system, Necessary conditions for stability, method to determine stability, Routh-Hurwitz stability criterion with special cases, relative stability analysis.

State Variable Analysis : Concept of state, state variables and state model, state model of linear systems, state model using physical variables, phase variables and canonical variables, state model from differential equations, block diagram and signal flow graph, transfer function from state model, stability of systems modeled in state variable form, solution of state equations, state transition matrix, its properties and computation.

UNIT V: Root LocusTechnique : Definition, magnitude and angle criteria, properties of root locus, construction rules for root locus plot of negative feedback systems, determining the gain from root locus plot, effect of addition of poles and zeros of G(s)H(s).

UNIT VI: Frequency domain analysis of control systems: Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, correlation between time and frequency response, polar plot, inverse polar plot, bode plot, all pass and minimum – phase system, experimental determination of transfer function, log magnitude versus phase plot.

Stability in Frequency domain : Principle of argument, Nyquist stability criterion, Assessment of relative stability using Nyquist criterion, concept of gain margin and phase margin and its computation using polar plot and log magnitude versus phase plot. Constant M and constant N circles, Nicholas chart.

Text books:

1	Control system Engineering	5TH Edition	I. J. Nagrath & M. Gopal	New Age International
2	Automatic control systems	7th Edition	B. C. Kuo	PHI Learning Private Limited

Reference Books:

1	Sigma Series: Control Systems	1st Edition	Ashok Kumar	McGraw - Hill
2	Control systems :Principles and Design	4th Edition	M. Gopal	McGraw - Hill
3	Modern Control Engineering	5th Edition	Katsuhiko Ogata	PHI Learning Private Limited

VI Semester
EL2352- Lab.: Control System

Practical based on above syllabus are to be covered.

	TITLE
1	To study transient response of a second order system.
2	Study of Stepper Motor
3	Study of Potentiometer as an Error Detector.
4	To study the Speed Torque Characteristic of AC Servo Motor
5	To study the Frequency Response of RLC network
6	To study the Synchros a)To plot the characteristic of synchro transmitter. b)To plot the characteristic of synchro receiver
7	Study of synchro as an error detector
8	Study of DC Position Servo Mechanism
9	Verification of Root Locus using MATLAB
10	Verification of Bode Plot using MATLAB
11	To Study Effect of Type of System on Steady State Error
12	PID Controller

VI Semester
EL2353- Power System Analysis

Course Objective	Course Outcomes
After learning basic concepts of power system this subject explain functioning of power system with balance, unbalanced condition. Concept of faults, stability, grounding and economics of power system is also explained.	The student will be able to understand the 1) Symmetrical component transformation and sequence networks. 2) Symmetrical fault analysis with various faults with and without pre fault load currents. 3) Unsymmetrical fault analysis with and without fault impedance for various faults using symmetrical components. 4) Steady state and transient stability analysis of power system. 5) Economic operation of power system and representation of transmission loss using loss formula co-efficient. 6) Concept of Neutral grounding, shunt and series compensation of power system.
Mapped Program Outcomes:a,b,c,d,e,f,g,l,j	

UNIT-I: Symmetrical Fault Analysis

Define fault & its causes, effect of fault on power system, purpose of fault analysis, assumptions made for fault analysis, transient in a series R-L circuit, short circuit analysis on synchronous machine at no-load & loaded condition, selection of circuit breaker & its short circuit MVA calculation, current limiting reactors.

UNIT-II: Symmetrical Component:-

Introduction, α-operator, symmetrical components of an unbalanced Three phase system, symmetrical components of voltage & current phasors, zero sequence components of voltage & current, power in terms of symmetrical components, phase shift in star-delta transformers, sequence network for fault calculation, sequence impedances of transmission line & synchronous machines, zero sequence networks of transformers, assembly of sequence networks of power system.

UNIT-III: Unsymmetrical Fault Analysis

Assumptions made for unsymmetrical fault analysis, sequence voltages of a generator, sequence voltages at a fault point, general procedure for analysis of various fault with and without fault impedance for Line to Ground (L-G), L-L-G, L-L, Open conductors faults analysis using symmetrical components.

UNIT-IV: Power System Stability

Stability of power system:-Steady state, Dynamic and Transient stability definition, Dynamics of synchronous machine, swing equation, swing equation for machines swinging coherently and Non-Coherently. Power angle equation, Steady state stability studies.

VI Semester
EL2353- Power System Analysis

Transient stability studies: - Swing curve, Equal Area criterion for transient stability, Application of equal area criterion for different disturbances. Solutions of swing equation by point by point method. Methods of improving transient stability.

UNIT-V: Economic operation of power system

Introduction, incremental fuel cost, economic dispatch neglecting transmission losses, transmission loss as a function of plant generation, general loss formula, and optimum load dispatch considering transmission losses

UNIT-VI: System Neutral Grounding & Reactive Power Compensation

Neutral Grounding: - Introduction to neutral grounding, methods of neutral grounding, peterson coil grounding. Compensation: - Series & shunt compensation, location of series capacitors, protective schemes for series capacitors, problem associated with series capacitors, Static VAR system with its different schemes.

Text Books				
	TITLE	**EDITION**	**AUTHOR**	**PUBLICATION**
	Electrical Power System	**5TH edition 2007**	Ashfaque Hussain	**CBS**

Reference books				
	TITLE	**EDITION**	**AUTHOR**	**PUBLICATION**
	Elements of Power System Analysis	4th-1984	W. D. Stevenson	Tata McGraw Hill
	Modern Power System analysis	4th-2011	I. J. Nagrath & D. P. Kothari	Tata McGraw Hill
	Electrical Power System	3rd - 2005	C. L. Wadhawa	NEW AGE INTERNATIONAL

VI Semester
EL2354- Lab.: Simulation of Power Electronics & Power System

Course Objective	Course Outcomes
To understand Power electronics and Drives through various software available for power electronics.	Students shall be able to understand practically the 1) Use of semiconductor devices for realizing uncontrolled and controlled rectifiers. 2) The implementations of inverters without and with PWMs 3) The working and implementation of multilevel inverter and the modulation control 4) The inverter fed AC drive with open loop control.

Expt.No.	Name of Experiment
1	To study half wave uncontrolled rectifier
2	To study half wave controlled rectifier
3	To study full wave controlled rectifier
4	To study single phase H-bridge inverter(withoutPWM)
5	To study three phase bridge inverter(180 degree mode)
6	To study sinusoidal pulse width modulation(APOD,POD and IPD)
7	To study single phase H-bridge inverter using SPWM
8	Introduction to multilevel inverter and implementation of 3 and 5 level inverter
9	To study voltage sag on distribution system using symmetrical fault
10	To study inverter fed induction motor

VI Semester
EL2355- Lab. Substation Design

Course Objectives	Course Outcomes
The student will understand different aspects of substation design that is layout drawing, earthing Drawing, lighting drawing and cable wiring.	The students will be able to: CO1: Illustrate and Explain, single line diagram of substation with rating of different equipment's, types of relays required and their settings CO2: Construct plan of equipment's and panels mounted in a substation. CO3: Design earthing system of a substation.

Mapped Program Outcomes				4	

Practical based on following topics may be performed.

1) One Line diagram
2) Switchyard and control panel layout for 132 and 11 kV substation.
3) Lighting layout of substation and switchyard.
4) Substation earthing.

Text books:				
1	Handbook of Electrical Power Distribution	2nd Edition	Gorti Ramamurthy	University Press
2	Electric Power Distribution	4th edition, 1997	A.S. Pabla	Tata Mc Graw-Hill Publishing Company

VI Semester
EL2361- PE-I: Advanced Power Electronics

Course Objective	Outcomes
To study soft switching and various soft switched converters, Multilevel inverters, Pulse Width modulation with different modulation strategies are covered.	1) To gain the knowledge of semi conductor devices regarding their structure and operation. 2) Concept of converters which uses the special switching techniques 3) Operation of different multilevel and hybrid multilevel inverter topologies. 4) Various types of modulation techniques, their significance, implementation and applications. 5) Causes, effects and remedies of different power quality problems 6) Various types of harmonics, their measuring indices and elimination methods.
Mapped Program Outcomes: a,b,c,d,f,j	

UNIT-1: Power Semiconductor Devices

Power Semiconductor Devices: Metal Oxide Turn off thyristor (MTO), Metal oxide Controlled Thyristor (MCT), Emitter Turn off Thyristor (ETO), Static Induction Thyristor (SIT). Injection enhanced gate transistors (IEGT), integrated gate commutated thyristor (IGCT).

UNIT-2: Hard Switched and Soft Switched Converters

Hard Switched and Soft Switched Converters: Load Resonant Converters, Series, Parallel & Hybrid Loaded Converters, Resonant Switch Converter, Zero Current, Zero Voltage switched Resonant Converter, DC-DC Resonant link inverters, Hybrid resonant link inverters.

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UNIT-3: Multilevel Inverters

Multilevel Inverters: Diode Clamped Inverters, Flying Capacitor Inverters, Cascaded multilevel Inverters and Hybrid Cascaded Inverter. Introduction to latest multilevel inverter topologies.

UNIT-4: Modulation Techniques

Modulation Techniques: Pulse Width Modulation, Selective Harmonic Elimination (SHE) Space Vector Pulse Width Modulation (SVPWM), Random PWM.

UNIT 5: Harmonics

Harmonics: Effects within power system, Interference with Communication Harmonic Measurements and.Harmonic Indices

Unit 6:Harmonics Mitigation Techniques

Passive Filter ,Active Power Filter-Series and Shunt(Open Loop and Closed Loop Control).

VI Semester

EL2361- PE-I: Advanced Power Electronics

Text Books				
S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Electronics:Converters,Application and Design	2007	Ned Mohan, T.M. Undeland and W.P. Robbins	Wiley Publication(Wiley Student Edition)
2	Power Electronics;Principles and Applications	2017	Joseph Vithayathil	Tata McGraw Hill Publication (Indian Edition)
3	Power Electronics and AC Drives	2003	B.K. Bose	Pearson Education
Reference Books				
1	Power Semiconductor Circuits	1984	S.B. Dewan and Straughen	John Wiley and Sons, Inc

VI Semester
EL2362- PEI: Electrical Distribution in Power System

Course Objectives	Course Outcomes
Student will be able to understand the various Aspects of distribution system **Mapped Program Outcomes: a,b,d,f,j**	The student will be able to understand the 1) The factors which affect the performance of distribution system, nature of load, its growth and forecasting. 2) Types of feeders, its loading, causes of unbalance, fault isolation, System restoration. 3) Distribution line parameter, supports and the causes and effects of voltage drop in distribution line 4) Different method Reactive power compensation Benefits of power factor improvement. 5) To decide optimal location of substation 6) Problems with existing distribution systems and function of substation automation system

UNIT-1: Load Forecasting
Introduction, Explanation of basic terms like demand factor, utilization factor, load factor, plant factor, diversity factor, coincidence factor, contribution factor and loss factor, load & load characteristics, load and load duration curve, relation between load and loss factor, load curve and diversified demand, load modeling,load growth and forecasting.

UNIT-2: Distribution Feeders:
Introduction, Primary and secondary distribution, Radial and loop types, Distribution substation location and planning, Feeder loading and voltage drop considerations, Voltage drop in feeder with different loading, Engineering considerations for voltage levels and loading, causes of unbalance and unequal drops, common faults in feeders, fault location, fault isolation, restoration.

UNIT-3: Overhead lines and Cables
Introduction, Line parameters, Overhead lines, insulators and supports, cables, Insulation resistance, Voltage drop and power loss in conductors, voltage drop in ac single phase distribution system, voltage drop computation based on load density, voltage drop in underground cable distribution.

UNIT-4: Reactive power compensation and applications of capacitors
Introduction, advantages and benefits of power factor improvement, power factor improvement using capacitors: mathematical calculations, location of capacitors, application of capacitor banks for power factor improvement, sub harmonic oscillations and ferro resonance due to capacitor banks, optimum power factor for distribution system.

UNIT-5: Substation & Metering, instrumentation & Tariffs
Introduction, substation types, substation components, equipment and layouts, substation location and size, Grounding, earth connection and earthing system, measurement of power, measurement of energy, maximum demand and trivector meter, automatic meter reading (AMR), AMR systems, substation instrumentation, tariffs and billing.

VI Semester
EL2362- PEI: Electrical Distribution in Power System

UNIT-6: Distribution automation (DA) & SCADA
Problems with existing distribution systems, need for distribution automation, distribution automation, feeder automation, communication requirements for DA. Remote terminal unit (RTU), Block diagram of SCADA, Components of SCADA, Functions of SCADA, SCADA applied to distribution automation, Advantages of DA through SCADA,DA integration mechanisms, Functions of substations automation systems, state and trends of substation automation.

Text books				
1	Electrical Power Distribution Systems	2009	V. Kama Raju	Tata Mcgraw Hill Education Private Ltd., New Delhi
2	A Text Book of Electric Power Distribution Automation	1st Edition, 2010	Dr. M. K. Khedkar And Dr. G. M. Dhole,.	University Science Press

Reference books:				
1	Electric Power Distribution	4th edition, 1997	A.S.Pabla	Tata Mc Graw-Hill Publishing Company
2	Electrical Distribution System	1st Edition,2013	Dr.H.P.Inamdar	Electrotech Publication

VI Semester
EL2363- PEI: Illumination Engineering (MOOC)

Unit I:
Radiation & Colour
Eye & Vision
Different entities of illuminating systems

Unit II:
Light sources: daylight, incandescent, electric discharge, fluorescent, arc lamps and lasers
Luminaries, wiring, switching & control circuits

Unit III:
Laws of illumination; illumination from point, line and surface sources
Photometry and spectrophotometry; photocells
Environment and glare

Unit IV:
General illumination design
Interior lighting – industrial, residential, office departmental stores, indoor stadium, theatre and hospitals

Unit V:
Exterior lighting- flood, street, aviation and transport lighting, lighting for displays and signalling- neon signs, LED-LCD displays beacons and lighting for surveillance Utility services for large building/office complex & layout of different meters and protection units

Unit VI:
Different type of loads and their individual protections
Selection of cable/wire sizes; potential sources of fire hazards and precautions. Emergency supply stand by& UPS
A specific design problem on this aspect

VI Semester
EL2364- PEI: Electric Vehicles

Unit 1:- Introduction to Electric Vehicles & Vehicle mechanism

EV System, Components of an EV, History of EV, EV Advantages, EV Market, Vehicle Mechanics:- Roadway Fundamentals, laws of Motion, Dynamics of Vehicle motion (Numerical), Propulsion power, Velocity and acceleration, Propulsion system design.

Unit 2:- Battery and other alternative Energy Sources

Battery basics, lead acid battery, alternative batteries, battery parameters (Numerical), technical characteristics of battery, targets and properties of batteries, battery modeling.

Fuel cells- Basic Operation, Fuel Cell model and cell voltage, No-Load and Load voltage of a PEM(Numerical), Basic Operation of super capacitorsand ultra-capacitors, Basic Operation of flywheels.

Unit 3:- Electric Machines

Motor and engine ratings, EV and HEV motor requirements, dc and three phase ac machines, space vector representation, dq modeling, induction machine dq model, power and electromagnetic torque, permanent magnet machines, switched reluctance machines, BLDC machines(Numerical).

Unit 4:- Power Electronics and motor Drives

Electric drive components, dc drives, operating point analysis, ac drives, Buck Converter in Continuous Conduction Mode (CCM) (Numerical), Boundary Conduction Mode (BCM) (Numerical), Discontinuous Conduction Mode (DCM),PM synchronous motor drives, Switched Reluctance motor drives, design of current and speed controller.

Unit 5: Drive Train

EV transmission configuration, transmission components, gears, automobile differential, clutch, brakes, ideal gear box, EV motor sizing(Numerical).

Unit 6: Hybrid Electric Vehicle

Types of Hybrids, series and parallel HEVs, IC engines, reciprocity engines, various air cycles, design of HEV, hybrid drive train, sizing of components, rated vehicle velocity, initial acceleration, maximum velocity and maximum gradeability

Text Book: -

1) Iqbal Husain, "**Electric and Hybrid Vehicles: Design Fundamentals**", CRC Press, 2005.

2) John G. Hayes, John G. Hayes,"**Electric Powertrain- Energy Systems, Power Electronics and Drives for Hybrid, Electric and Fuel Cell Vehicles**", John Wiley & Sons, 2018

VI Semester
EL2365- PEI: Electric Power Utilization

Course Objectives	Course Outcomes
Student will understand. The knowledge about energy utilization .The application of electrical energy such as lightning, heating welding, fans and pumps.	The student on completion will be able to understand 1) Types of electric heating techniques, their field of application, relative advantages and limitations. 2) Types of electric welding techniques, their field of application, relative advantages and limitations, defects in welding, new advancements in welding technology. 3) Basic concepts of illumination, various types of lamps along with their light characteristic and field of application. They will be able to design illumination system for various criterions. 4) Basic refrigeration cycle, VCRS and VARS, various types of air conditioning systems and its use as per requirement. 5) Difference between fans and blowers with respect to its characteristics , various energy saving methods to be used. They can classify pumps with respect to its characteristic and field of application. 6) Classification of compressors, application of compressors as per requirement of compressed air. They will understand basics of DG system, its major components, working under different conditions and energy saving opportunities in DG system

UNIT-1: **Electric Heating**

Introduction, Advantages of electric heating, modes of heat transfer, methods of electric heating, resistance heating, arc heating, arc furnaces, induction heating, dielectric heating, infrared and radiant heating.

UNIT-2: **Electric Welding:**

Definition, welding process, resistance electric welding, electric arc welding, submerged arc welding, MIG welding, Ultrasonic welding, laser beam welding, welding of various metals, underwater welding, defects in welding, testing of welding joints.

UNIT-3: Illumination :

Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), types of lamps, luminaries, Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.

VI Semester
EL2365- PEI: Electric Power Utilization

UNIT-4: Refrigeration & Air conditioning:

Terminology, refrigeration cycle, refrigeration systems (Vapor compression, vapor absorption), domestic refrigerator, water cooler, desert cooler.

Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective Temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.

UNIT-5: Fans & Pumps:

Fans and Blowers: Fan types, fan performance evaluation & efficient system operation, fan design & selection criteria, flow control strategies, fan performance assessment, energy saving opportunities.

Pumps: Pump types, system characteristics. Pump curves, factors affecting pump performance, efficient pumping system operation, flow control strategies, energy conservation opportunities in pumping system.

UNIT-6: Compressors and DG Sets:

Compressors: Compressor types, Compressor efficiency, Compressed air system components.

Diesel Generating Systems: Introduction, selection and installation factors, operational factors, energy performance assessment in DG sets, energy saving measures for DG sets.

Text books:

1	Utilization of Electric Energy		E. Openshaw Taylor	Orient Longman
2	Utilization of Electric Power & Electric Traction		J.B. Gupta	Kataria & Sons
3	Art and Science of Utilization of Electrical Energy		H Partap	Dhanpat Rai & Sons, Delhi
4	Utilisation of Electrical power	1st Edition, 2006	R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:

	Guide book for National Certification Examination for Energy Managers and Energy Auditors			Bureau of Energy Efficiency
	Utilization of Electrical Power		Dr N. V. Suryanarayana	Wiley Eastern Ltd, New Age International

VI Semester
EL2366 – PEI: Grid Integration of Renewable Energy

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Analyse the need of integrating large renewable energy sources in the existing power system.
2. Assess renewable energy applications in the context of grid integration.
3. Enhance the understanding of renewable energy policy environment.
4. Explain the impacts of renewable energy integration on grid and environment.

Unit:1	**Introduction**	**6 Hours**
Concept of nano/micro/mini grid. Need of integrating large renewable energy sources, Concept of Virtual Power Plant (VPP).		
Unit:2	**Grid Integrated Solar PV System**	**7 Hours**
Basics of solar photovoltaics: cell, modules and arrays. Structure and components required for grid connected PVsystem, it's working. Introduction to energy storage for PV application.		
Unit:3	**Grid Integrated Wind Energy Conversion System**	**6 Hours**
Structure and components required for grid connected Wind Energy Conversion System, types of wind turbines, it's working.		
Unit:4	**Policies and various schemes for Renewable Energy in India**	**7 Hours**
Introduction to Indian Energy Policy, Grid Code, Green Corridor, policy and regulatory framework for rural electrification: Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY), Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM), various other schemes (eg. JNNSM etc.)		
Unit:5	**Impact of Renewable Energy Generation on Environment**	**7 Hours**
Environmental impacts of wind power, solar power, biomass, hydroelectric power, geothermal power, Carbon credits, National action plan on climate change: 1. National Solar Mission 2. National Mission for Enhanced Energy Efficiency 3. National Water Mission 4. National Mission for a Green India 5. National Mission for Sustainable Agriculture		
Unit :6	**Impact of Renewable Energy Generation on Grid**	**7 Hours**
Importance of power quality and corresponding standards, THD, voltage regulation. Voltage rise, voltage unbalance, frequency change and its effects, system protection.		
	Total Lecture Hours	**39 Hours**

Text book	
1	Grid integration of solar photovoltaic systems, Majid Jamil, M. Rizwan, D.P.Kothari, CRC Press (Taylor & Francis group), 2017.
Reference Books	
1	Renewable Energy Grid Integration, Marco H. Balderas, Nova Science Publishers, New York, 2009.
2	Wind Power Integration connection and system operational aspects, B. Fox, D. Flynn L. Bryans, N. Jenkins, M. O' Malley, R. Watson and D. Milborrow, IET Power and Energy Series 50 (IETdigital library), 2007.
3	Integration of Alternative sources of Energy, Felix A. Farret and M. Godoy Simoes, IEEE Press –Wiley-Interscience publication, 2006.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	Vijay Vittal, Raja Ayyanar, Grid Integration and Dynamic Impact of Wind Energyhttp://link.springer.com/openurl?genre=book&isbn=978-1-4419-9322-9
2	Francis McGowan, European Energy Policies in a Changing Environment http://link.springer.com/openurl?genre=book&isbn=978-3-7908-0951-0
MOOCs Links and additional reading, learning, video material	
1	P R Krithika and Siddha Mahajan, Background paper: Governance of renewable energy in India: Issues and challenges http://www.gpgl.in/assets/governance-of-renewable-energy-in-india-issues-challenges.pdf
2	ÇSE Presentation: Renewable Energy in India: Growth and Targets http://cseindia.org/docs/photogallery/ifs/Renewable%20Energy%20in%20India%20Growth%20and%20Targets.pdf
3	Charles K Ebinger, India's Energy and Climate Policy Can India Meet the Challenge of Industrialization and ClimateChange? https://www.brookings.edu/wp-content/uploads/2016/07/india_energy_climate_policy_ebinger.pdf
4	Guidelines Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY), Scheme of Government of India for rural electrification.https://www.ddugjy.gov.in/assets/uploads/1548234273fykio.pdf
5	Gisele Schmid, The development of renewable energy power in India: which policies have been effective? https://unige.ch/gsem/iee/files/3313/9574/8551/11103_v2.pdf
6	Impact of wind power on the power system imbalances in Finland, A. Helander1, H. Holttinen, J. Paatero, IET Renew.Power Generation., Vol. 4, No. 1, pp. 75–84, 2010.
7	Impact of widespread photovoltaic generation on distribution systems, M. Thomson and D.G. Infield, IET Renew. PowerGeneration, Vol. 1, No.1, pp. 33–40, 2007.
8	A. Rahman, S. Agrawal, A. Jain, "Powering Agriculture in India: Strategies to Boost Components A & C under PM-KUSUM Scheme", Council on Energy, Environment and Water (CEEW), New Delhi, India, 2021.

VI Semester
EL2367 – PEI: Switched Mode Power Supply

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Outline the basic working principle and operation of DC-DC converter 2. Design the Closed Loop Control of Power Converter 3. Describe the operation of Soft Switching Converters 4. Describe the basic working of Unity Power Factor Rectifiers

Unit:1	**DC-TO-DC Converter**	**6 Hours**
Introduction, DC-DC Converter, Switched Mode Power Converter, Versatile power converter, Isolated DC-DC Converter.		
Unit:2	**Dynamic Analysis of DC-DC Converters**	**7 Hours**
Formulation of dynamic equation of buck and boost converters, averaged circuit models, linearization technique, small-signal model and converter transfer functions		
Unit:3	**Controller Design:**	**7 Hours**
Review of frequency-domain analysis of linear time-invariant systems, concept of bode plot, phase and gain margins, bandwidth, controller specifications, proportional (P), proportional integral (PI), proportional derivative (PD) proportional integral derivative controller (PID), selection of controller parameters.		
Unit:4	**Closed Loop Control of Power Converter**	**7 Hours**
Closed loop control, closed loop performance function, Effect of Input filter on the converter performance, Design criteria for selection of Input filter.		
Unit:5	**Soft Switching Converters**	**7 Hours**
Resonant Load Converters, SMPS Using Resonant Circuit, Resonant Switch Converters: Concept of Zero voltage switching, principle of operation, analysis of M-type and L-type Buck or boost Converters. Concept of Zero current switching.		
Unit:6	**Unity Power Factor Rectifiers**	**5 Hours**
Power Circuit of UPF Rectifiers, Average Current Mode Control, Voltage Feedforward Controller, Resistor Emulator UPF Rectifiers, Non-linear Carrier Control.		
	Total Lecture Hours	**39 Hours**

Text book	
1	Course Material on Switched Mode Power Conversion Department of Electrical Engineering Indian Institute of Science Bangalore 560012 V. Ramanarayanan January 15, 2008
2	Muhammad H. Rashid, Power Electronics – Circuits, Devices and Applications, Pearson Education
3	Benjamin kuo, "Automatic Control Systems" 2008
4	R. A. Barapate, "feedback control systems" Tech Max 2009
Reference Books	
1	Robert Ericson, Fundamentals of Power Electronics, Chapman & Hall, 2004.
2	V. Ramanarayanan, Switched Mode Power Conversion, 2007.
3	Umanand.L, Power Electrionics: Essentials and Applications, Wiley India, 2009.
4	B. Jayant Baliga, Power Semiconductor Devices; PWS 1996.
5	B. S. Manke, Control System Design, 2010
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4471-4548-6
2	http://link.springer.com/openurl?genre=book&isbn=978-0-85729-915-4
MOOCs Links and additional reading, learning, video material	
1	https://www.youtube.com/watch?v=P0MK7sWfs9k&list=PLbMVogVj5nJRY--U9E7dvmqgB9RhGuymk
2	https://www.youtube.com/watch?v=P0MK7sWfs9k&list=PLuv3GM6-gsE3onbCZCZLY2sTozcFF71xL
3	https://www.youtube.com/watch?v=HcwJKKG_LYY&list=PLwdnzlV3ogoWVgA9fHBV36L_bxWZlpa7X

VI Semester
EL2368 – PEI: Programming in C for beginners

Course Outcome
Upon successful completion of the course the students will be able to 1.Write algorithms, flowcharts and programs. 2.Implement different programming constructs and decomposition of problems into functions. 3.Use and implement data structures like arrays and structures to obtain solutions. 4.Define and use of pointers with simple applications.

UNIT I: Introduction to C Programming

Introduction to Computing: Introduction, Art of Programming throughAlgorithms and Flowcharts

Overview of C: History and importance of C, Basic structure of C program, executing a C program.

Constants, Variable and Data Types: Introduction, Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Assigning Values to Variables, Defining Symbolic Constants.

Managing Input and Output Operations: Reading a Character, Writing a Character, Formatted Input, Formatted Output.

Operators and Expressions: Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Type Conversions in Expressions, Operator Precedence and Associativity.

UNIT II: Control Structures

Decision Making and Branching: Introduction, Decision Making with IF Statement, Simple IF Statement, the IF-ELSE Statement, Nesting of If-ElseStatements, The Else If Ladder, The Switch statement, Operator, The goto statement.

Decision Making and Looping: Introduction, The while Statement, The do statement, The For statement, Jumps in LOOPS.

UNIT III: Introduction to Arrays and Strings

Arrays: One-dimensional Arrays, Declaration of One-dimensional Arrays, Initialization of One-dimensional Arrays, Example programs- Bubble sort, Selection sort, Linear search, Binary search, Two-dimensional Arrays, Declaration of Two-dimensional Arrays, Initialization of Two-dimensional Arrays, Example programs-Matrix Multiplication, Transpose of a matrix.

Character Arrays and Strings: Declaring and Initializing String Variables, Reading Strings from Terminal, Writing Strings to Screen, Arithmetic Operations on Characters, String-handling Functions, Example Programs.

UNIT IV : FUNCTIONS
User-defined Functions: Need for functions, Elements of User-definedFunctions, Definition of Functions, Return Values and their Types, FunctionCalls, Function Declaration, Category of Functions, No Arguments and noReturn Values, Arguments but no Return values, Arguments with ReturnValues, No Arguments but Returns a Value, Passing Arrays to Functions,Recursion, The Scope, Visibility and Lifetime of variables.
UNIT V: POINTERS AND STRUCTURES
Pointers: Introduction, Declaring Pointer Variables, Initialization of Pointervariables, accessing a Variable through its Pointer, Pointer Expressions, Pointer Increments and Scale Factor. **Structures:** Introduction, Defining a structure, declaring structure variables,accessing structure members, structure initialization, array of structures.
UNIT VI: FILE MANAGEMENT
File Management in C: Introduction, Defining and opening a file, closing a file, Input/output and Error Handling on Files.

Text Books:				
Sr.No.	**Title**	**Edition**	**Author**	**Publisher**
1	"Programming in C"	8th Edition	E. Balaguruswamy	McGraw Hill Education
Reference Book:				
	Title	**Edition**	**Author**	**Publisher**
1	Programming in C	2nd Edition	Pradip Dey, Manas Ghosh	Oxford University Press
2	The C Programming Language	2nd Edition	Kernighan B.W and Dennis M. Ritchie	Pearson Education India
3	Let Us C	16th Edition	Yashavant P. Kanetkar	BPB Publications
4	Problem Solving with C		Jacqueline A Jones and Keith Harrow	Pearson Education
5	C Programming for Problem Solving"		Dr. Guruprasad Nagraj	Himalaya Publishing House
Weblinks and Video Lectures (e-Resources):				
1	http://elearning.vtu.ac.in/econtent/courses/video/BS/14CPL16.html https://nptel.ac.in/courses/106/105/106105171/ https://nptel.ac.in/courses/106104128			

VI Semester
EL2371- OEIII: Renewable Energy Generation System

Course Objective	Course Outcomes
This subject introduce the different renewable energy sources to the students. Students get knowledge of Electric Power generation by wind, solar, small hydro.	1. Basic aspects of renewable energy supply presenting fundamental characteristics of the resource base (solar radiation, wind energy, geothermal, etc.) and principles of related technical systems (photovoltaic, wind, hydroelectric power generation, etc.).Fundamentals of fuel cells. 2. Solar radiation geometry , basic concepts of solar energy to heat conversion, different types of solar energy collectors with different applications. 3. Concepts of wind energy conversion system, types of WECS and their connection with the grid. 4. Basics of geological process, tapping geothermal energy, biomass energy resources and its conversion processes. 5. Basic concept of Mini & Micro hydro-plants with site selection criteria. 6. Basic concepts of energy from ocean including tidal and wave energy with focus on conversion cycles from ocean energy to electrical energy.

UNIT-1: Introduction

Fundamentals of Renewable / Non-renewable Energy Sources, Renewable Energy sources, Renewable Energy Potential in India, Renewable Energy Sources and their sustainable development. Storage methods for renewable energy sources

UNIT-2: Solar Energy

Principles, scope and applications, solar radiation, its measurement & prediction, flat plate collectors-design & theory, solar water heating, solar dryers, solar stills, solar cooling and refrigeration. Solar cells, thermal storage, street lighting, solar power generation.

UNIT-3: Wind Energy

Introduction, Historical development, Wind energy resources, sites identification, blade element theory, aero-foil design, component of wind energy conversion system, wind turbine generator classification, and windmill and wind electrical generator, Advantages, disadvantages, economics and present status of wind energy generation systems, grid connection of wind energy.

VI Semester
EL2371- OEIII: Renewable Energy Generation System

UNIT-4: Geothermal Energy and Biomass Energy

Introduction, history of geothermal resources, basics of geological process, dry rock and hot aquifer analysis, geothermal exploration, geothermal well drilling and fluid extraction, utilization of geothermal resources, geothermal heat pump, site of geothermal energy in India. Biomass energy resources and conversion processes, urban waste to energy conversion.

UNIT-5: Mini & Micro hydro-plants

Introduction, Classification of water turbines, hydroelectric system, essential components of hydroelectric system, system efficiency, advantages and disadvantages of hydroelectric system, present Indian power scenario of mini-micro hydro.

UNIT-6: Ocean Energy

Ocean thermal energy conversion (OTEC), Open cycle and closed cycle OTEC, Ocean wave energy conversion, tidal energy conversion. Introduction of Fuel cells.

Text Books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Non Conventional Sources of Energy	**4th edition**	G.D.Rai	Khanna Publisher
2	Energy Technology:Nonconventional Renewable and Conventional	,	S. Rao and B.B Parulekar	Khanna Publisher New Delhi

Reference books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Solar Energy : Principles of Thermal collection and storage	**3rd edition,1994**	S.P.Sukhatme,J.K.Nayak	Tata McGraw Hill
2	Wind and Solar Power System		M. R. Patel	CRC Press, New York
3	Renewable Energy Sources Basic Principles and Applications		G. N. Tiwari and M. K. Ghoshal	Narosa Publishing House,New Delhi

VI Semester
EL2372- OEIII: Electrical Machines and their Applications

Course Objective	Course Outcomes
This subject introduce the applications of different machines and commonly used drives.	1. To explain speed-torque characteristics, need for starters, starting methods and braking of AC and DC motors. 2. To build/apply criterion for selection of motors, duty cycle, enclosures, transmission system and insulation classes. 3. To illustrate/interpret/explain the principle, operation and construction of 1-phase and 3-phase transformers and autotransformers. 4. To show/define the principle. Construction, types, characteristics and performance of special machines like BLDC, Stepper motor and Universal motor

Unit 1: Introduction to Drives and Speed Control:

Classification of Drives, brief idea about commonly used drives (AC and DC) drives in industry, speed- torque characteristics of different drive motors, their behaviour under starting and running conditions.

Unit 2:

Need of starter, Starting methods, Braking and Speed Control of AC and DC motors.

Unit 3: Selection Criterion for Drive Motors:

Criterion for selection of motors, Duty Cycle, Power Rating for Continuous and Intermittent Duty Cycles, Environment and Enclosures, Transmission System, Insulation Classes.

Unit 4: Single Phase transformer

Review of Principle, constant flux machine, losses, efficiency etc., Operation on load (Phasor diagrams), Voltage regulation, effect of load power factor on regulation, Application of Single phase transformer in Electronic circuitry, autotransformer, welding transformer, furnace transformer.

Unit 5: Three Phase Transformer.

Concept of three phase transformer, Comparison between unit and bank of single phase transformer, connections,

All Day Efficiency, application in power system.

VI Semester
EL2372- OEIII: Electrical Machines and their Applications

Unit 6: Special Machines:

Brushless DC motor: - Principle, construction , operation, converter for BLDC, rotor position sensor (Hall Sensor), Stepper motor: types, slewing, torque-speed characteristics, stepper motor converter, Universal motor, applications Applications of three phase and single phase induction motors in cement industry, steel rolling mill, textile mill, etc.

Text books

S.N	Title	Year/Edition	Author	Publisher
1	A Course in Electrical Power	First-2005	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Fundamentals of Electric Drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

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3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

VI Semester
EL2373 - OEIII: Testing and Maintenance of Electrical Machines

Course Objective	Course Outcomes
To adopt various testing and maintenance procedures for electrical equipment's by providing effective insulation to enhance their life and working condition	The students will be able to: CO1: Classify, the causes of hazards, accidents, shock and the remedial action taken against the electrical shock. CO2: Demonstrate, apply and evaluate different types of tests and the various maintenance techniques to be employed on various electrical machines and it installation. CO3: Demonstrate, apply and estimate the factors affecting the life of insulation, its testing and maintenance. CO4: Explain, develop and determine the various tests to be conducted on distribution transformer, I. S. Standards.
Mapped program outcomes:1,6,7,8,12	

Unit 1: Safety & Prevention of Accidents

Definition of terminology used in safety; safety, hazards, accident, major accident hazard, responsibility, authority, accountability, monitoring, I.E. Act & statutory regulations for safety of persons & equipments working with electrical installation, Dos & don"ts for substation operators as listed in IS Meaning & causes of electrical accidents factors on which severity of shock depends, Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration, Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers.

Unit 2: General Introduction

Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests, Methods of testing a) Direct, b) Indirect, c) Regenerative. Concept of routine, preventive & breakdown maintenance, advantages of preventive maintenance, procedure for developing preventive maintenance schedule, Factors affecting preventive maintenance schedule. Introduction to total productive maintenance.

Unit 3: Testing & maintenance of rotating machines

Type tests, routine tests & special tests of 1 & 3 phase Induction motors, Routine, Preventive, & breakdown maintenance of 1 & 3 phase Induction motors as per IS 9001:1992. Parallel operation of alternators, Maintenance schedule of alternators & synchronous machines as per IS 4884-1968. Brake test on DC Series motor.

VI Semester
EL2373 - OEIII: Testing and Maintenance of Electrical Machines

Unit 4: Testing & maintenance of Insulation

Classification of insulating materials as per I.S. 8504(part III) 1994, factors affecting life of insulating materials, measurement of insulation resistance & interpretation of condition of insulating. Methods of measuring temperature of internal parts of windings/machines & applying the correction factor when the machine is hot.

Unit 5: Testing & maintenance of Transformer

Listing type test, routine test & special test as per I.S. 2026-1981. Procedure for conducting following tests:

Measurement of winding resistance, no load losses, & no load current, Impedance voltage, load losses, Insulation resistance, Induced over voltage withstand test, separate source voltage withstand test, Impulse voltage withstand test, Temperature rise test of oil & winding, Different methods of determining temp rise- back to back test, short circuit test, open delta (delta – delta) test. Preventive maintenance & routine maintenance of distribution transformer as per I.S. 10028 (part-III): 1981, Periodic checks for replacement of oil, silica gel, parallel operation of 1 & 3 phase transformer, load sharing calculations (numerical).

Unit 6: Installation

Factors involved in designing the machine foundation, Requirement of different dimension of foundation for static & rotating machines procedure for levelling & alignment of two shafts of directly & indirectly coupled drives, effects of misalignment. Installation of rotating machines as per I.S. 900-1992. Use of various devices & tools in loading & unloading, lifting, carrying heavy equipment.

Text Books:

S. N.	Author	Title	Publisher
01.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol - I	Media Promotors & Publisher Ltd. Mumbai
02.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol - II	Media Promotors & Publisher Ltd. Mumbai

Reference Books:

S. N.	**Author**	**Title**	**Publisher**
01.	B. L. Theraja	Electrical Technology Vol I to IV	S. Chand & Co., New Delhi
02.	C. J. Hubert	Preventive Maintenance Hand Books & Journals	----------

VI Semester
EL2381 - OEIV: Electrical Energy Audit and Safety

Course Objectives	Course Outcomes
Understand various operating characteristics of electrical equipments, its monitoring, tools used in comprehensive energy audit and its procedure to save the electricity with and without investment, calculation of energy saving and its global impact	The students will be able to: CO1: Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003. CO2: Demonstrate, apply and evaluate different forms of electrical and thermal energy. CO3: Demonstrate, apply and estimate the Energy Management, Energy Audit, Energy Monitoring and Targeting. CO4: Explain, develop and determine the various Global Environmental Concerns and Electrical safety procedures. 1) Mapped program outcomes:1,3,5,6,7,8,9,10,12

UNIT-1: Energy Scenario

Commercial and Non-commercial energy, primary energy sources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance. Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features, Salient Features of Electricity Act 2003.

UNIT-2: Basics of Energy and its various forms

Electricity basics- DC & AC currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

UNIT-3 : Energy Management & Audit

Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.

UNIT-4: Energy Monitoring and Targeting

Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM).

VI Semester
EL2381 - OEIV: Electrical Energy Audit and Safety

UNIT-5: Global environmental concerns

United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).

UNIT-6: Electrical Safety

Primary hazards associated with electricity. Control measures and safety-related work practices to minimize the risk associated with electrical hazards. Response procedures in the event of electrical shock or fire.

Text Books:			
S. N.	**Author**	**Title**	**Publisher**
01	Archie,W Culp	Principles of Energy Conversion	McGraw Hill
02	Wayne C Turner	Energy Management Handbook Bureau	John Willey and Sons
03		Bureau of Energy Efficiency Study Material for Energy Managersand Auditors Examination	Bureau of Energy Efficiency www.beeindia.in

Reference Books:			
S. N.	**Author**	**Title**	**Publisher**
01.	Amit Kumar Tyagi	Handbook on Energy Audit and Management	TERI

VI Semester
EL2382 - OE IV: Utilization of Electrical Energy

Course Objectives	Course Outcomes
To understand the basic principle of electrical heating, welding, illumination, refrigeration and air conditioning, fans, pumps, compressors and digi sets.	On completion of this course, students will be able to 1. understand working of various electric heating equipment 2. understand electric welding methods and its operation 3. understand nature of light and design various lighting schemes and fittings in use 4. Understand operation of refrigeration , AC system 5. figure-out the different schemes of traction schemes and its main components. Design a suitable scheme of speed control for the traction systems 1) understand economics of various power generating units, tariff

UNIT 1: Electric Heating:

i) Electric Heating : Types and methods of electrical heating, advantages of electrically produced heat Types & application of electric heating equipment"s, transfer of heat.
ii) Resistance Ovens: General constructions, design of heating elements, efficiency & losses, radiant heating.
iii) Induction heating: Core type & core less induction furnace, indirect induction oven, medium and high frequency eddy - current heating.
iv) Dielectric heating: Principle and application.
v) Arc furnace: Direct & indirect arc furnace, power supply, characteristics & control.

UNIT-2: Electric Welding:

i) Importance, Advantages & Disadvantages of welding, classification of welding processes.
ii) Resistance welding, Butt welding, Spot welding, Projection welding, Seam welding.
iii) Electric arc welding: carbon arc welding, metal arc welding, submerged arc welding, Welding positions, Types of welding electrodes
iv) Ultrasonic welding, electron beam welding, laser beam welding.

UNIT-3: Illumination:

Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), types of lamps, luminaries, Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.

UNIT-4: Refrigeration & Air conditioning:

Terminology, refrigeration cycle, refrigeration systems (Vapour compression, vapour absorption), domestic refrigerator, water cooler, desert cooler.

Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.

VI Semester
EL2382 - OE IV: Utilization of Electrical Energy

UNIT-5: Electric Traction

Traction system, requirement of an ideal traction system, different systems for traction, system of railway electrification, comparison between AC and DC systems, power supply for electric traction system, overhead equipments (collector gear for overhead equipments, conductor-rail equipment)Speed- Time curve for train movement, crest speed, average speed and schedule speed, simplified speed-time curve

UNIT-6: Economics of Power Generation, Electric Power Supply and Utilization

Terms and Definitions, base load and peak load, selection of power plant equipment (boilers, prime-movers, size and number of generating units), economics in plant selection, economics of hydroelectric power plant, economics of combined hydro and steam power plant, performance and operating characteristics of power plants, power plant useful life, tariff for electrical energy, objective and requirements of tariff, general tariff forms, comparison between private generating plant and public supply.

Text books:

S. N	TITLE	EDITION	AUTHOR	PUBLISHER
1	Utilization of Electric Power & Electric Traction		J.B. Gupta	Kataria & Sons
2	Art and Science of Utilization of Electrical Energy		H Pratap	Dhanpat Rai & Sons, Delhi
3	Utilization of Electrical Power		R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:

	TITLE	EDITION	AUTHOR	PUBLISHER
1	Guide book for National Certification Examination for Energy Managers and Energy Auditors			Bureau of Energy Efficiency
2	Utilization of Electrical Power		Dr N. V. Suryanarayana	Wiley Eastern Ltd, New Age International
3	Utilization of Electrical Energy		E.Openshaw Taylor	Orient Longman

VI Semester
EL2383 - OEIV: Power System Engineering

Unit 1: Introduction to Power System

Restructuring of power sector, Constituents of present day power system, sources of electrical energy, types and characteristics of generating stations: Thermal, hydro, nuclear , solar ,wind and other renewable, salient features of electricity act 2003.

Unit 2: Load on Power Stations

Load, Important terms and factors, and Units generated per annum , Load duration curve , Types of loads, Load demand and diversity factors, Load curves and selection of generating units, Base load and peak load on Power station, Method of meeting the load ,Interconnected grid system.

Unit 3: Transmission System I

Electric supply system, A.C power supply scheme, D.C transmission scheme, Comparison of AC and DC transmission system, advantages of A.C. transmission system, Comparison of various transmission system (Two wire dc system, Single phase two wire A.C system, Single phase three wire system , three phase three wire system, Three phase four wire system) Elements of transmission line, Economic choice of transmission voltage, requirements of satisfactory electric supply, Concept of HVDC transmission.

Unit 4: Transmission System II

Line support insulators, types of insulators (pin type, suspension type, strain type, shackle type), Commonly used conductor material, concept of corona, factor affecting corona, advantages and disadvantages of corona, methods of reducing corona effect, Sag and its effects, Constants of transmission line (R, L and C) , Resistance of transmission line, skin effect , Classification of overhead transmission line and voltage regulation .

Unit 5: Distribution System

Classification of distribution system, Types of distribution AC and DC, Overhead verses underground system, Requirements of distribution system, Design consideration of distribution system, AC distribution types, Voltage drop calculations in different distribution system , importance of voltage control, location of voltage control equipment and its methods, Tap changing transformer , Concept of tariff, desirable characteristics of tariff, types of tariff.

Unit 6: Introduction to Switchgear

Essential features of switchgear, switchgear equipment's, switches, fuses, circuit breakers, relays, HRC fuses, Bus Bar arrangement (single bus system, One and half feeder ,Main and transfer bus system) , MCB, MCCB, ELCB Introduction to Instrument transformer Current Transformer (CT) and Potential transformer (PT).

VI Semester
EL2383 - OEIV: Power System Engineering

Text books:				
	Title	**Edition**	**Author**	**Publication**
1.	Power System Analysis	1st edition 2007	T.K. Nagsarkar, M.S. Sukhija	Oxford
2.	Principles of Power System	2nd edition 2005	V.K.Mehta, Rohit Mehta	S.Chand
3.	Electrical Power System	5th edition 2007	Ashfaque Hussain	CBS

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2020
7th & 8th Semester
Electrical Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EL-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	EL2401	Switchgear & Protection	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	EL2402	Lab.:Switchgear & Protection	**P**	0	0	2	2	1		60	40	
3	7	PC	EL2403	High Voltage Engineering	T	3	0	0	3	3	30	20	50	3 Hours
4	7	PC	EL2404	Lab.:High Voltage Engineering	**P**	0	0	2	2	1		60	40	
5	7	PE		**Professional Elective II**	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		**Professional Elective III**	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		**Professional Elective IV**	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	EL2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	EL2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -II

1	7	PE	EL2411	**PEII:** Fundamentals of Power Quality
2	7	PE	EL2412	**PEII:**Electrical Installation Design
3	7	PE	EL2413	**PEII:**Electrical Machine Design
4	7	PE	EL2421	**PEII:** Power System Operation and Control
5	7	PE	EL2422	**PEII:** Sensors and Actuators

Professional Electives -III

5	7	PE	EL2422	**PEIII**:FACTS Devices
6	7	PE	EL2423	**PEIII**: Electrical Energy Management and Audit
7	7	PE	EL2424	**PEIII:**Advanced Control System
8	7	PE	EL2425	**PEIII:**Artificial Intelligence Based System

Professional Electives -IV

9	7	PE	EL2431	**PEIV:**Advanced Electrical Drives
10	7	PE	EL2432	**PEIV**:Fundamentals of Smart Grid
11	7	PE	EL2433	**PEIV**:Computer Methods in Power System
12	7	PE	EL2434	**PEIV**:EHVAC-HVDC Transmission

Coursera Electives				
1	6	PE	EL2366	**PEI**:Energy Production, Distribution and Safety
1	7	PE	EL2435	**PEIV**: Power Electronics Specialization

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2020	**1.04**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2020-21 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EL-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electrical Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	EL2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	EL2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**86**	**0**	**46**	**132**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

VII Semester

EL2401 : Switchgear and Protection

Objective	Course Outcome
The student should be able to 1. The theory and applications of the main components used in power system Protection. 2. The protection systems used for electric machines, transformers, bus bars, Transmission lines. 3. The theory, construction, and applications of main types of circuit breakers. 4. To design the feasible protection systems needed for each main part of a power system.	On completion of this course, the student will be able to 1) Explain and define the various basic principles of protection system 2) Compare & apply overcurrent protection Principle 3) Develop , Compare & Solve the problems of distance protection. 4) Explain , Justify and Compare the types of circuit breaker **5)** Explain, Determine and decide the Equipment Protection

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Explain and define the various basic principles of protection system	1						1							
CO2	Compare & apply overcurrent protection Principle	1	1	2				1		1		1	1	2	1
CO3	Develop , Compare & Solve the problems of distance protection.	1	1	2				1		1		1	1	2	1
CO4	Explain , Justify and Compare the types of circuit breaker	1		1				1					1	2	
CO5	Explain, Determine and decide the Equipment Protection	1	1	1				1		1		1	1	2	1

Unit No.	Contents	Max. Hrs.
1	**Introduction** General Philosophy of Protective Relaying:- Protective Zones. Primary Protection, Back up protection. Primary and Local Back Up. Desirable properties of relay. Introduction to Static relays: - Comparison of static and electro-mechanical relays, two input amplitude and phase comparators. Introduction to Numerical relays:- Basic elements of digital protection, Signal conditioning subsystem, Conversion system subsystem & Digital processing relay subsystem.	7
2	**Overcurrent Protection** Medium voltage Line Protection: Overcurrent relaying, directional overcurrent relays.	7

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
EL- 2401 Switchgear and Protection

Unit No.	Contents	Max. Hrs.
3	**Distance protection** High voltage line Protection: - Distance relays, carrier distance schemes, Generation of various distance relay characteristics using static comparators.	7
4	**Circuit Breaker** **Circuit breakers** Switchgear : Circuit breakers Arc interruption theory, recovery and Restriking voltage ,RRRV, breaking of inductive & capacitive currents, C. B. rating, different media of arc interruption, overview of oil circuit breakers, Air blast, SF6 and vacuum breakers.	6
5	**Equipment Protection** Equipment Protection: Principles of differential relaying, protection, transformers and busbars by differential relaying and other relays. Miniature circuit breakers, moulded case circuit breaker, release, earth leakage circuit breaker.	7
6	**Equipment Protection** **Protection of Generators** Various Faults and Abnormal Operating Conditions, Transverse Differential Protection, Rotor Faults, Abnormal Operating Conditions, Loss of Prime Mover **Protection of Induction Motors** Various Faults and Abnormal Operating , Inter-turn Faults, Abnormal Operating Conditions from Supply Side and Mechanical Side, Overload. Fuse (wire and HRC).	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Protection and Switchgear	2012	R.P.Maheshwari, Nilesh G.Chothani, Bhavesh Bhalija	Oxford University Press
2	Switchgear and Protection	2003	S.R.Bhide and Y.G. Paithankar	PHI
3	Power System Protection and Switchgear	2007	Badri Ram	TMH.
4	Switchgear and Protection	**1990**	S. S. Rao Khanna	

Reference Books

SN	Title	Edition	Authors	Publisher
1	The Art and science of protective relaying	**1992**	Russel, Mason	Wiley Eastern
2	Computer relaying for power system	2009	Arun G. Phadke and JamesThorpe	S John Wiley

VII Semester
EL 2402 - Lab: Switchgear and Protection

Minimum 8 practicals to be performed

S.N	TITLE
1	Design a protection system to protect system for given fault currents & plot the characteristics of relay used *(IDMT)*
2	Design a protection system to protect system for fault direction & plot the characteristics of relay used
3	Design a protection system to protect system for Reactance fault only & plot the characteristics of relay used
4	Design a protection system to protect system for Impedance type fault & plot the characteristics of relay used
5	Plot the Characteristics of Numerical Relay L&T make *MC61C*
6	Study of Differential Protection Scheme
7	Study of Relay Test set & to verify Relay Characteristics of *ICM21N*
8	Identify Different Circuit Breaking Devices
9	To Study ANSI Device Numbers (ANSI - American National Standards Institute)
10	To study MICOM P430 distance protection relay.
11	To Study Minliec make SPPR & Overload Relay
12	To study Generator Protection Scheme*
13	To study Feeder Protection Scheme*
14	To Study Percentage biased Differential Protection

VII Semester

EL2403 - High Voltage Engineering

Objective	Course Outcome
The course objective is understanding of high-voltage phenomena, and the basics of high voltage insulation design with the analytical and modern numerical tools available to high-voltage equipment designers. The areas covered comprise a short but fundamental introduction to dielectric properties of materials, non-destructive tests applicable also to on-site monitoring of power equipment. The purpose of this is to provide information on transient and temporary over voltages and currents in end-user AC power systems	**On completion of this course, the student will be able to** 1) Explain Breakdown of various dielectrics and calculate their breakdown voltage. 2) Explain causes of overvoltage's due to lightning and switching and protective devices used for the same. 3) Explain propagation of travelling waves along with insulation coordination. 4) Explain generation and measurement of high voltage and current. 5) Explain Non-destructive and high voltage testing of electrical apparatus.

CO	Statement	Mapped PO												PSO	
		PO 1	PO	PO	PO	PO	PO	PO	PO	PO	PO 10	PO 11	PO 12	PS 1	PS 2
CO	Explain Breakdown of various dielectrics and calculate their breakdown voltage	2	3	1	1								1	2	
CO	Explain causes of overvoltage's due to lightning and switching and protective devices used for the same.	2	3	1	1								1	2	
CO	Explain propagation of travelling waves along with insulation coordination.	2	3	3	1								2	2	
CO	Explain generation and measurement of high voltage and current	2	3	3	1								2	2	
CO	Explain Non-destructive and high voltage testing of electrical apparatus.	2	3	3	1								2	2	

VII Semester
EL2403 - High Voltage Engineering

Unit No.	Contents	Max. Hrs.
1	**Breakdown Mechanism in Dielectrics** Ionisation process : Townsend"s criterion for breakdown, Break-down in electro-negative gases, Time -lag for breakdown, Streamer theory for breakdown in gases, Paschen's law, Breakdown in non-uniform fields, corona discharges and introduction of corona, post breakdown phenomenon and applications, practical considerations in using gases for insulation purposes, vacuum insulation, liquid as insulators, conduction and breakdown in pure and commercial liquids. Intrinsic electromechanical and thermal breakdown. Breakdown of solid dielectric in practice, breakdown in composite dielectric.	7
2	**Lightning and switching over voltages** Mechanism of lightning types of strokes, parameter and characteristics of lightning strokes, characteristics of switching surges; power frequency over voltages, control of over voltages due to switching. Protection of lines by ground wire, protection by Lightning Arrester (LA), gap type and gapless LA, selection of LA ratings, Surge absorbers.	7
3	**Travelling Waves and Insulation Co-ordination** Travelling waves on transmission lines, classifications of lines, attenuation and distortion of travelling waves, reflection and transmission of waves, behaviour of rectangular waves at transition points. Introduction to insulation co-ordination and associated terms, impulse wave-form, introduction to Basic Insulation Level (BIL), Reduced BIL and Switching Impulse Level (SIL).	6
4	**Generation of High Voltage and Currents** Generation of High D.C. voltages by rectifiers, voltage doubler and multiplier circuits (Derivation not required) electrostatic machines. Generation of high ac voltage by cascade transformers, resonant transformers. Generation of high impulse voltages: Standard impulse wave shapes, analyses of model and commercial impulse generation circuits, waveshape control, Marx Circuit, tripping and control of impulse generation, generation of switching surges, generation of impulse current.	7
5	**Measurement of High Voltage and Current** Measurement of high AC and DC voltages by micro ammeter, generating voltmeters, resistance and capacitance potential dividers, series impedance voltmeter, Capacitive Voltage Transformer (CVT), Magnetic type potential transformers, electrostatic voltmeter, peak reading AC voltmeters, sphere gap arrangement, measurement of impulse voltage by potential dividers and peak reading voltmeters. Measurement of High AC/DC currents: Measurement of high frequency and impulse current by resistive shunts (Bifilar strip shunt only).	7
6	**Non Destructive and High Voltage Testing of Electrical Apparatus** Non-destructive testing : Measurement of DC Resistivity, measurement of dielectric constant and loss-factor (low and power frequency only), Schering bridge for high voltage circuits, for high dissipation factor for three terminal measurements, transformer ratio arm bridges, partial discharge measurements by straight detector, balance detectors, calibration of detectors, discharge detection in power cables. High voltage testing: Testing of insulators, bushings, isolators, circuit breakers, cables, transformers, lightning arresters and power capacitors.	6

VII Semester
EL2403 - High Voltage Engineering

Text books:				
SN	**Title**	**Edition**	**Author**	**Publisher**
1	EHV AC Transmission	2nd	R.D.Begamudre	New Age international Publisher
2	High Voltage Engineering	3rd -2006	M. S. Naidu and V. Kamaraju	Mc GrawHill Publisher
3	High Voltage Engineering	1st -1994	C.L. Wadhwa	New Age international Publisher

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Advances in High Voltage Engineering	**2004**	M.Haddat and Warne	IET

VII Semester
EL2404 – Lab : High Voltage Engineering

Minimum 8 practicals to be performed

S.N	TITLE
1	Study of High Voltage Laboratory Equipments.
2	Calibration of Panel Voltmeter by Sphere Gap.
3	Study of Corona effect
4	Study of Movement of arc in horn gap
5	To determine Flash over voltage test: 11 kV pin type insulator.
6	Determination of string efficiency of suspension insulator
7	Determination of breakdown voltage for transformer oil sample
8	Determination of breakdown voltage for solid insulator
9	To study Cable Fault locator
10	Measurement of Resistivity of Transformer oil. .
11	Measurement of dielectric constant of transformer oil.
12	Measurement of Loss Angle of transformer oil
13	Study of 100 kV AC/ 140 kV DC test set and calibration of Panel Voltmeter by Sphere gap.
14	Study of 150 kV, 225 Joules Impulse Generator and test on Pin type Insulator.

VII Semester

EL2411- PEII: Fundamentals of Power Quality

Objective	Course Outcome
• To introduce students the power quality issues their causes, effects and solutions. • To familiarize students to the synthesis of voltage sag, principle operation, analysis and applications of passive power filter, active power filter and custom power devices. • To provide strong foundation for further study of power quality issues	**On completion of this course, the student will be able to** **1.** Illustrate power quality disturbances and typical problems associated with it. **2.** Analyse and evaluate the voltage sag. **3.** Appraise the fundamentals of harmonics and develop solutions through filters to minimise the harmonic distortion. **4.** Plan of mitigating the power quality events through custom power and network configuring devices with applying suitable control strategies

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Illustrate power quality disturbances and typical problems associated with it	3												1	
CO2	Analyse and evaluate the voltage sag.	3	2											2	
CO3	Appraise the fundamentals of harmonics and develop solutions through filters to minimise the harmonic distortion	3	2	2										2	1
CO4	Appraise the fundamentals of harmonics and develop solutions through filters to minimise the harmonic distortion	3													1

VII Semester
EL2411- PEII: Fundamentals of Power Quality

Unit No.	Contents	Max. Hrs.
1	**Overview and definition of power quality** Overview and definition of power quality (PQ): Sources of pollution and regulations, Power quality problems: rapid voltage fluctuations voltage unbalance, Voltage dips and voltage swells, Short duration outages, long duration variations, power acceptability curves.	6
2	**Voltage sag analysis** Definitions Voltage sag analysis: Sag caused by motor starting, Sag caused by utility fault clearing, Sag magnitude and duration calculations, RMS voltage, calculation in single phase systems, Computers, AC and DC drives etc. performance in presence of sag.	7
3	**Harmonics** Power system harmonics: Harmonic analysis, Harmonic sources and their effects, Introduction to power converters, Fourier analysis, Total harmonic distortion, rms & average value calculation, Effects of harmonic distortion on power factor.	7
4	**Filter Design** Filters: passive filters, active filters, hybrid filter design and working principles.	6
5	**Control of APF and configuring devices** Control of APF : Instantaneous reactive power theory (p-q theory) ,Synchronous reference frame theory(d-q theory), Synchronous detection theory, Regulation of DC link voltage and frequency domain control. Network configuring devices: Solid State Current Limiter (SSCL),Solid State Breaker(SSB),Solid State Transfer Switch(SSTS)	7
6	**Custom power devices** Introduction to custom power devices, Dynamic Voltage Restorer (DVR) ,Distribution Static Compensator (DSTATCOM) and Unified Power Quality Conditioner (UPQC), Control strategies, Applications.	7

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Electrical Power Systems Quality	2nd edition.	R. C. Dugan, M. F. Mcgranaghan	McGraw-Hill
2	Power Quality	1st edition 2002 E book 2017	C. Sankaran	CRC Press
3	Understanding Power Quality Problems: Voltage sag and interruptions	2011	M. H. Bollen Ledwich	Wiley India

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power System Harmonics	2nd edition, 2003	J. S. Arillaga	Wiley
2	Power Quality Enhancement using custom power devices	2002	Arindam Ghosh Ledwich	Kluwer Academic Publishers

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester

EL2412- PEII: Electrical Installation Design

Objective	Course Outcome
The student should be able to To understand and design the methods used in electrical installation for commercial building and the tools used for it as per IE and IS Standards .	**On completion of this course, the student will be able to** 1) Classify, various techniques used to identify the load pattern. 2) Demonstrate, apply and evaluate the various wires and cables and their tests. 3) Demonstrate, apply and estimate the various types of luminaries and its calculation. 4) Explain, develop and determine the components involves in substation and their function.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify, various techniques used to identify the load pattern.	1													1
CO2	Demonstrate, apply and evaluate the various wires and cables and their tests.	2	1										1		
CO3	Demonstrate, apply and estimate the various types of luminaries and its calculation.	1	2	3		1							2	1	
CO4	Explain, develop and determine the components involves in substation and their function.	3		1			1		1	1			2	2	1

Unit No.	Contents	Max. Hrs.
1	Load forecasting, regression analysis, numerical based on linear and exponential trends, Electrical installation for domestic, commercial and industrial consumers, calculation of connected load, selection of transformers, switchgears, cables and wires, single line diagram, special provisions for high rise buildings (IER-50-A), earthing requirements, megger and earth tests, use of earth leakage circuit breakers (special reference to be given to IER 2 (i, n, o, p, v, aa, aaa, aq, aqq, ar, av).	7
2	Cables: PVC and XLPE cables, their construction in brief, current ratings, specifications, derating factors, Megger and continuity test. Overhead distribution lines upto 33 kV, Line apparatus and basic construction, clearances, selection of AAC and ACSR conductors, voltage drop calculations, Selection of Insulators, earthing requirements. (Special reference to be given to IER 77, 79, 80, 81, 87, 89, 90, 91, 92)	7

VII Semester
EL2412:PEII: Electrical Installation Design

Unit No.	Contents	Max. Hrs.
3	Definitions, polar curves, simple calculations, working principles of fluorescent, sodium vapour and mercury vapour lamps, Capacitors and power factor improvement: Determination of rating and location of capacitors, calculation of payback period for additional capacitors.	6
4	Single line diagram, plan, elevation and clearances for 11 kV pole mounted, 11 kV plinth mounted (upto 1000 kVA and above 1000 kVA), 33 kV (upto 2500 kVA and above 2500 kVA) substations. Single line diagram for substation with two transformers in parallel, specifications of isolators, lightening arrestors, horn gap fuses, D.O. fuses, circuit breakers, instrument transformers, power transformers, LV HRC fuses, LV circuit breakers, (Special reference to be given to IER 31, 33, 35, 43, 44, 47, 48, 50, 51, 54, 58, 64, 64A, 67 and IS3043)	7
5	Determination of fault levels of various locations in substation, use of current limiting reactors, philosophy of protective relaying, over current, earth fault, REF protection, earth leakage protection, OTI, WTI, Buchholz relays, Firefighting equipments, restoration of a person affected by electric shock, Earthing: types, measurement of earth resistance.	6
6	Site testing of transformers (Visual, pre-commissioning tests like megger, magnetic balance, turns ratio), testing of oil, operational test for Buchholz, OTI, WTI, alarm and trip functions.	7

Text Books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Electric Power	2016	Soni, Gupta, Bhatnagar	Dhanpat Rai Publication
2	Electrical Installation Design	2012	Jain, Bajaj	Laxmi Publication
3	Power Electronics and AC Drives	2003	B.K. Bose	Pearson Education

Reference books:

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Electric Power Distribution Systems	2004	Pabla	McGraw Hill
2	Electrical Substation	1992	S. Rao	Khanna Publication
3	Electrical Engineering handbook	2018	C.L.Wadhwa	New Age International
4	IER (Latest edition)			

VII Semester

EL2413- PEII: Electrical Machine Design

Course Objective	Course Outcome
The course will help the students to understand the step by step procedure for the complete design of electrical machine specificifically diameter,length,height aand such other parameters depending on application or requirement	**On completion of this course, the student will be able to** 1. Classify, select various materials used in construction of electrical machines and interpret their rating and performance 2. Demonstrate, apply and evaluate design ers of transformer 3. Demonstrate, apply and estimate stator, rotor design of induction motor 4. Explain, develop and determine design parameters of synchronous machine

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Classify, select various materials used in construction of electrical machines and interpret their rating and performance	3	2	1	1									1	
CO2	Demonstrate, apply and evaluate design parameters of transformer	3	2	1	1									2	
CO3	Demonstrate, apply and estimate stator, rotor design of induction motor	3	2	1	1									2	
CO4	Explain, develop and determine design parameters of synchronous machine	3	2	1	1									3	

Unit No.	Contents	Max. Hrs.
1	**Review of material used in construction of electrical machines** Magnetic material such as amorphous, ferrite etc. Classification of insulating materials depending upon permissible temperature rise, properties of transformer oil, standard specifications, C.M.R. and short time of machines, Heating and cooling characteristics.	6
2	**Transformer design : Main Dimensions** Output equation, equation for voltage per turn for power and distribution transformer, core design, overall dimensions of single phase and three phase transformer.	7

VII Semester
EL2413 - PEII: Electrical Machine Design

Unit No.	Contents	Max. Hrs.
3	**Transformer design : Performance Characteristics** Resistance and leakage reactance of winding for concentric cylindrical and sandwich type winding, estimation of no load current , method of cooling and cooling tank design.	7
4	**Induction motors: Stator Design** Total loading, specific loading on the machine, output equation, main dimension, estimation of axial lengths and air gap diameter based on different design criterion, estimation of number of slots, area of slot, stator teeth and stator core dimensions, length of mean turn, stator winding.	7
5	**Induction motor rotor design** Air gap length, no. of rotor slots, cage rotor and wound rotor , Design of rotor bar and slots, design of end ring, design of wound rotor, rotor teeth and rotor core design, Calculation of no load current, stator and rotor resistance and other performance characteristics for design data.	7
6	**Synchronous machines** Types of synchronous machines, Output equation , specific loadings, Design of salient pole (Main dimensions, length of air gap, shape of pole face, armature design) and turbo alternators (Main dimensions , length of air gap, stator and rotor design), Effect of SCR on machine performance, ventilation of synchronous generator, cooling circuit design, Hydrogen and water as cooling media	6

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Performance and Design of A.C. Machine	1995	M.G. Say.	English L B S
2	Electrical Machine Design	2016	A.K. Sawhney	Dhanpat Rai & Sons, Delhi

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Electrical Machine Design	3rd	Balbir Singh	Brite Student Publication, Pune
2	Power Transformers	2nd	S.B.VasuBinsky	

VII Semester

EL2421- PEII: Power System Operation and Control

Objective	Course Outcome
The student should be able to The student will understand the economic aspects of power system operation, methods of power frequency control, economic dispatch control, reactive power control and voltage control. .	**On completion of this course, the student will be able to** **1.** Explain, analyse reserve requirement & load forecasting methods. **2.** Analyse optimal scheduling of generating units, determine with the help of flowcharts. **3.** Develop and illustrate optimal unit commitment problem & its solution methods. **4.** Discuss various methods of voltage control & Load Frequency Control and design of reactive power compensation equipment used for transmission line.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Explain, analyse reserve requirement & load forecasting methods		3	3									1	1	
CO2	Analyse optimal scheduling of generating units, determine with the help of flowcharts.		3	3									1	1	
CO3	Develop and illustrate optimal unit commitment problem & its solution methods		3	3	2								1	1	
CO4	Discuss various methods of voltage control & Load Frequency Control and design of reactive power compensation equipment used for transmission line.		1	1	2								1	1	

VII Semester

EL2421:PEII: Power System Operation and Control

Unit No.	Contents	Max. Hrs.
1	**Economic Aspects** Introduction, system load characteristics curves-chronological load curves-load duration curves-energy time curves load factor utilization factor-diversity factor- coincidence factor- demand factor- reserve requirements installed reserve- spinning reserve- cold reserve- hot reserve – operational restrictions, load dispatching.	6
2	**Pre requisite of Load Dispatchi** Load forecasting- components of system load- classification of base load- forecasting of the base load by method of least square fit introduction to unit commitment, unit commitment using priority ordering.	7
3	**Load Frequency Control (LFC)** Introduction, necessity of maintaining frequency constant, Load frequency Control, Governor Characteristics of single Generator, Adjustment of Governor Characteristic of Parallel Operating Unit, LFC (P-f control) Q-V Control, Generator Controller (P-f control & Q-V controllers), P-f control versus Q-V control, Dynamic Interaction between P- F and Q-V Loops, Speed-Governing System, Control Area Concept, Incremental Power Balance of Control Area, Requirements of the Control Strategy, Integral control, Concept of two area.	7
4	**Economic Dispatch Control** Incremental cost curve- co-ordination equations with loss included (No derivation of B_{mn} coefficient) solution of co- ordination equations using B_{mn} co-efficient by iteration method Base point & participation factors- Economic dispatch controller added to LFC.	7
5	**Reactive Power Control** Introduction, objective of load compensation, theory of load compensation, uncompensated transmission line, compensated transmission line, shunt compensator, series compensator, basic relationship for power flow control, Sub synchronous resonance, comparison of different types of compensating equipment for transmission systems,	6
6	**Voltage Control** Introduction, necessity of voltage control, generation and absorption of reactive power, location of voltage control equipment, methods of voltage control, rating of synchronous phase modifier.	7

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power System Operation and control	1st edition	S. Sivanagarju and G. Srinivasan	Pearson Publisher
2	Power System Stability and control	1st edition	P. Kundur	TMH Publisher
3	Electrical Power system	6th edition	C. L. Wadhwa	New Age International Pvt Ltd Publisher
4	Economic Operation of power system studies	3rd edition 2010	L. K. Kirchmayer	Wiley Eastern India, New Delhi

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Power Generation, Operation and control	2nd Edition	A. J. Wood and B.F. Woolenberg	John Wiley & Sons
2	Power System: Operation & Control	1st edition, 2013	Dr. K. Uma Rao	Wiley

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
EL2426- PEII: Sensors and Actuators

Objective	Course Outcome
1. To understand basics of sensors, actuators and their operating principle. 2. To educate the students on different types of microfabrication techniques for designing and developing sensors. 3. To explain working of various types of electrochemical sensors and actuators. 4. To provide information about interfacing of sensors and signal conditioning circuits to establish any control system or monitoring system. To provide an understanding on characteristic parameters to evaluate sensor performance.	

PREREQUISITES: Basic Electronics

Unit No.	Contents
1	**UNIT 1:** Basics of Energy Transformation: Transducers, Sensors and Actuators, Understanding of thin film physics: Application in MOSFET and its variants
2	**UNIT 2:** Thin Film Deposition Techniques: Chemical Vapor Deposition (APCVD, LPCVD, UHVCVD, PECVD, ALCVD, HPCVD, MOCVD)**,** Thin Film Deposition Techniques: Physical Vapor Deposition (Thermal Deposition, E-beam Evaporation, Sputtering, Pulsed Laser Deposition)
3	**UNIT 3:** Basics understanding of Photolithography for pattering layer. Detailed overview of Etching methods, Understanding various gas sensors: Optical gas sensor, Metal oxide semiconductor gas sensor, Field effect transistor gas sensor, Piezoelectric gas sensor, Polymer gas sensor, Nano-structured based gas sensors
4	**UNIT 4:** Design and fabrication process of Microsensors: Force Sensors, Pressure Sensors, Strain gauges and practical applications, explain working principles of Actuators. Piezoelectric and Piezoresistive actuators, micropumps and micro actuators with practical applications
5	**UNIT 5:** Understanding basics of microfluidics to assist Photomask design using Clewin Software, pattern transfer techniques, PDMS moulding and degassing, device bonding techniques, Simulation, Optimization and characterization of various sensors using COMSOL Multiphysics
6	**UNIT 6:** Understanding of Sensor Interfacing with Microprocessor to build electronic system**,** Static and Dynamic Characteristic Parameters for Sensors and Actuators, Calibration of Sensor based electronics systems.

References Books:

SN	Title	Year	Author	Publication
1	Sensors and Signal Conditioning :Handbook of modern sensors	2008	Jacob Fraden, Stefan Johann Rupitsch	Wiley-Blackwell Springer
2	Piezoelectric Sensors and Actuators: Fundamentals and Applications	2018	Senturia S. D.	Springer
3	Microsystem Design	2001	J.D. Plummer, M.D. Deal, P.G. Griffin	Kluwer Academic Publisher
4	Silicon VLSI Technology	1998	S.M. Sze	Pearson Education
5	VLSI Technology	1998	Madou	McGraw Hill
6	Fundamentals of Microfabrication	1997		CRC Press

VII Semester

EL2422- PEIII: FACTS Devices

Objective	Course Outcome
The student should be able to To understand the problems and constraints related with stability of large interconnected systems and to study their solutions using different FACTS Controllers, Shunt (SVC,STATCOM),Series (TCSC,GCSC,SSSC),Series Shunt(UPFC),Series Series(IPFC)	**On completion of this course, the student will be able to** 1. Define FACTS Concept, various FACTS Controllers, its classification and explain its applications in Transmission system. 2. Explain, show, implement and design different shunt and series compensators and its control schemes 3. Demonstrate, examine and apply voltage and phase angle regulators in power system 4. Extend, apply and analyze the FACTS concept using combine series-shunt and series-series controllers to evaluate the improved transmission system performance

CO	Statement	Mapped PO												PSO	
		PO 1	PO 2	PO 3	PO 4	PO	PO	PO	PO	PO	PO 10	PO 11	PO 12	PS 1	PS 2
1	Define FACTS Concept, various FACTS Controllers, its classification and explain its applications in Transmission system.	1												1	
2	Explain, show, implement and design different shunt and series compensators and its control schemes	1	2	2										3	
3	Demonstrate, examine and apply voltage and phase angle regulators in power system	1	2	2										3	
4	Extend, apply and analyze the FACTS concept using combine series-shunt and series-series controllers to evaluate the improved transmission system performance	1	2	2										3	

VII Semester
EL2422- PEIII: FACTS Devices

Unit No.	Contents	Max. Hrs.
1	**Flexible AC Transmission Systems (FACTS)** FACTS concept and General System Consideration, Transmission interconnections, Flow of power in an AC System, factors affecting the Loading Capability, power flow and Dynamic Stability Consideration of Interconnected Transmission. Importance of controllable Parameters, FACTS Controller. HVDC and FACTS.	7
2	**Static shunt compensators** SVC and STATCOM, Objectives of Shunt Compensation, Methods of Controllable Var Generation, Static Var Compensators SVC and STATCOM,Control scheme for SVC and STATCOM ,Comparison between STATCOM and Static Var System (SVS).	7
3	**Static Series Compensators** GCSC, TSSC, TCSC and SSSC, Objectives of series Compensation, Variable Impedance Type Series compensators, Switching Converter Type Series Compensators, Control Schemes for GCSC,TSSC,TCSC and SSSC, External (System) Control for Series Reactive Compensators	6
4	**Static Voltage and Phase Angle Regulators** TCVR and TCPAR, Objectives of Voltage and phase angle regulators, Approaches to Thyristor Controlled Voltage Regulators (TCVR) and Thyristor Controlled Phase Angle Regulators (TCPAR), Switching Converter- Based Voltage and Phase Angle regulators, Hybrid Phase Angle Regulators.	7
5	**Shunt-Series Compensators:UPFC** Shunt series Compensators UPFC, Operating modes of UPFC, Basic control system for P and Q control, Comparison of UPFC to Series Compensators and Phase angle regulators.	6
6	**Other FACTS Controllers** Series –series compensators IPFC,Basic structure and operation,Thyristor controlled braking resistor	7

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Understanding FACTS	2001	Narayan G.Hingorani	Standard Publishers
2	FACTS : Controllers in Power	1st edition 2007	K. R. Padiyar	New Age International
3	Transmission & Distribution	1st edition 2002	R. Mohan Mathur, Rajiv K Verma	Wiley

Reference Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Flexible AC Transmission System(FACTS)		Edited by Yong Hua and Johns	IEEE Press

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester

EL2423:PEIII: ELECTRICAL ENERGY AUDIT AND SAFETY ANALYSIS

Objective	Course Outcome
The student should be able to Understand various operating characteristics of electrical equipments, its monitoring, tools used in comprehensive energy audit and its procedure to save the electricity with and without investment, calculation of energy saving, its global impact and its performance evaluation.	On completion of this course, the student will be able to 1. Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003. 2. Demonstrate, apply and evaluate different forms of electrical and thermal energy. 3. Demonstrate, apply and estimate the Energy Management, Energy Audit,Energy Monitoring and Targeting. 4. Evaluating the Performance of Electric Motor and variable Speed drivesand cogeneration systems. .

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS 1	PS 2
1	Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003.	1				1	1		1				2	1	1
2	Demonstrate, apply and evaluate different forms of electrical and thermal energy	1	1			1				1			1		1
3	Demonstrate, apply and estimate the Energy Management, Energy Audit,Energy Monitoring and Targeting	1	1	1		1	2			1			2	1	1
4	Evaluating the Performance of Electric Motor and variable Speed drivesand cogeneration systems.	1	1		3					2			2	1	2

VII Semester
EL2423:PEIII: ELECTRICAL ENERGY AUDIT AND SAFETY ANALYSIS

Unit No.	Contents	Max. Hrs.
1	Energy Scenario Commercial and Non-commercial energy, primary energy sources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance. Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features, Salient Features of Electricity Act 2003.	6
2	Basics of Energy and its various forms Electricity basics- DC & AC currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion	7
3	Energy Management & Audit Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.	7
4	Energy Monitoring and Targeting Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM).	7
5	Performance Evaluation of Electric Motor and variable Speed Drives Methods for determining motor loading, methods of determining motor efficiency, evaluating performance of rewound motors, variable speed drive: principles and applications, factors for successful implementation of variable speed drive.	7
6	Captive and Cogeneration Systems Introduction, purpose of the performance test, performance terms and definitions, reference standards, field testing procedure, examples, Case study of bottoming cogeneration in industries.	6

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Principles of Energy Conversion		Archie,W Culp	McGraw Hill
2	Energy Management Handbook		Wayne C Turner	John Willey and Sons
3	Bureau of Energy Efficiency Study Material for Energy Managers and Auditors Examination			Bureau of Energy Efficiency www.beeindia.in

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Handbook on Energy Audit and Management		Amit Kumar Tyagi	

VII Semester

EL2424 - PEIII: ADVANCED CONTROL SYSTEM

Objective	Course Outcome
The student should be able to elaborate concept of compensation in control system. Compensation design is explained. Optimal control and sample data control system is also discussed in this subject	On completion of this course, the student will be able to **1)** Explain concept of lag and lead compensator design in time and frequency domain, theory of PI, PD and PID control in time domain and frequency domain. **2)** Illustrate and apply state variable approach with solution of state models and concepts of controllability, observability and state variable feedback. **3)** Classify and analyse non-Linear Control System, types of non-linearities, its cha[illegible]Students will a[illegible]e to demonstrate and apply different me[illegible]ating non-linea[illegible] like describing function method and phase plane method for stability analysis. **4)** Explain sample data control system, Stability analysis with Z-transforms and solution of discrete time systems.

CO	Statement	Mapped PO												PSO 1	PSO 2
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12		
1	Explain concept of lag and lead compensator design in time and frequency domain, theory of PI, PD and PID control in time domain and frequency domain.	2	1	1	1								1	1	3
2	Illustrate and apply state variable approach with solution of state models and concepts of controllability, observability and state variable feedback.	3	2	1											3
3	Classify and analyse non-Linear Control System, types of non-linearities, its characteristics. Students will also be able to demonstrate and apply different methods of evaluating non-linear control like describing function method and phase plane method for stability analysis.	3	2		1									1	3
4	Explain sample data control system, Stability analysis with Z-transforms and solution of discrete time systems.	3	2		1										3

VII Semester
EL2424:PEIII: ADVANCED CONTROL SYSTEM

Unit No.	Contents	Max. Hrs.
1	**UNIT-1**: **Compensation** Compensation: - Review of performance Analysis of type O, type 1 & type 2 systems. Need for compensation. Performance Analysis of Compensators in time & frequency domain, Bode Plots and Design of Compensators.	6
2	**Design of PID Controller:** Fixed configuration design, theory of PI, PD and PID control in time domain and frequency domain, Zeigler Nichol"s method of PID tuning.	7
3	**State variable Feedback** Design by State variable Feedback: Review of state variable representations. Solution of state equation Controllability & observability, Design of State Feedback.	7
4	**Non Linear control system (NLCS)** Non Linear Control System: Types of non-linearities, characteristics of NLCS. Inherent & intentional non- linearities. Describing function method for Analysis Describing functions of some common non-linearities. Stability analysis. Limit cycles & stability of limit cycles.	7
5	**Phase -Plane Method** Phase -Plane Method:Singular points stability from nature of singular points Construction of trajectory by Isocline and Delta Method Computation of time.	6
6	**Sample Data control System (SDCS)** Sample Data control System; - Representation of SDCS, Sample and Hold Circuit Z-Transform, Inverse Z- Transform & solution of difference equation "Z" & "S" domain relationship. Stability by Bi-linear transformation & Jury"s test. Discretization of continuous time state equation.	7

Text Books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Control Systems Analysis	4th edition2008	I.J.Nagrath, M.Gopal	
2	Modern Control Theory	2014	M.Gopal	New Age International Private Limited

Reference books

S.N	TITLE	EDITION	AUTHOR	PUBLICATION
1	Modern Control Engineering	4th	Katsuhiko Ogata	Prentice Hall Pearson Edcation International
2	Automatic Control Systems	9th	B C..Kuo Farid Golnaraghi	WILEY
3	Modern Control System		B.C.Kuo	2003

VII Semester
EL 2425 - PEIII: ARTIFICIAL INTELLIGENCE BASED SYSTEM

Objective	Course Outcome
The student should be able to understand the concept of fuzzy logic and neural network and the basic concepts and mathematical models of fuzzy and neural network are covered	On completion of this course, the student will be able to **1)** Recall, explain, solve and analyse the principles of fuzzy logic and control. **2)** Explain and discuss adaptive fuzzy control. **3)** Explain, analyse and solve problems in basic neural networks and associative memories **4)** Explain, analyse and solve problems on recurrent networks and neural control.

CO	Statement	Mapped PO												PSO	
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	Recall, explain, solve and analyse the principles of fuzzy logic and control.	3	3	2	1									3	3
2	Explain and discuss adaptive fuzzy control.	3	3	2	1									3	3
3	Explain, analyse and solve problems in basic neural networks and associative memories	3	3	2	1									3	3
4	Explain, analyse and solve problems on recurrent networks and neural control.	3	3	2	1									3	3

VII Semester
EL 2425 - PEIII: ARTIFICIAL INTELLIGENCE BASED SYSTEM

Unit No.	Contents	Max. Hrs.
1	**Introduction:-** Fundamental concepts of fuzzy systems Fuzzy sets, Approximate reasoning Representing set of rules. Fuzzy knowledge based (FKBC) parameters. Introduction rule and data base inference engine, choice of fuzzification and defuzzification processes.	6
2	**Nonlinear fuzzy control** Introduction, Control problem, FKBC as nonlinear transfer element, types of FKBC.	7
3	**Adaptive Fuzzy control** Introduction, design and performance evaluation, main approach to design.	7
4	**Artificial Neural Network** Fundamental concept of ANN. Model of artificial neural network (ANN), Learning & adaptation learning rules. **Feed forward networks:** Classification Model, features & decision, regions, Minimum distance classification, perceptron, delta learning rules for multi perceptron layer, generalized learning rules, back propagation algorithm, back propagation training, learning factors.	7
5	**Recurrent networks** Mathematical foundation of discrete time & gradient type Hopfield networks, transient response & relaxation modeling.	7
6	**Associative memories, self-organizing networks and Neural Control** Basic concept & recurrent associative memory, Bi-directional associative memory, Hamming net & MAXNET Unsupervised learning of clusters, , feature mapping, self-organizing feature maps, Basics of Neural Network Control, Predictive Control.	6

Text books

S.N	Title	Year/Edition	Author	Publisher
1	Introduction of Artificial Neural Networks	1992	Jacek Zurada	JPH
2	An Introduction to Fuzzy Control	2010	D. Drianko	Springer
3	Design of Neural Networks	2nd edition	Hagen,Demuth,Beale	Cengage Learning,ISBN-10:0-9717321-1-6,ISBN-13:978-0-9717321-1-7

Reference books

S.N	Title	Year/Edition	Author	Publisher
1	Neural Network & Fuzzy Systems	1992	Bart Kosko	Prentice Hall of India
2	Neural Networks	2009	Simon Haykin	(Maxwell) Macmillan Canada Inc.)
3	Fuzzy ets:Uncertainty and information	1988	Klir and Folger	Prentice Hall of India
4	MATLAB Toolbox			

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester

EL 2431 - PEIV: ADVANCED ELECTRICAL DRIVES

Objective	Course Outcome
The student should be able 1) To study the converter and Chopper control of DC drives. 2) To study the semiconductor based control of Induction and Synchronous motors. 3) To learn the basics of Switched reluctance motor and Brushless DC motor. 4) To Study the non-conventional and renewable energy based drives	On completion of this course, the student will be able to 1) Analyse and determine the converter parameters of bridge and chopper controlled DC drives. 2) Analyse the various schemes for Induction motor control and estimate the parameters of converters for Induction motor drives. 3) Explain synchronous motor, stepper motor and switched reluctance motor drives. **4)** Explain and compare the various drives used in electrical traction and explain solar and battery powered drives.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Analyse and determine the converter parameters of bridge and chopper controlled DC drives	3	2	2	1										2
CO2	Analyse the various schemes for Induction motor control and estimate the parameters of converters for Induction motor drives	3	2	2	1										2
CO3	Explain synchronous motor, stepper motor and switched reluctance motor drives	3	2	2	1										2
CO4	Explain and compare the various drives used in electrical traction and explain solar and battery powered drives.	3	2	2	1										2

VII Semester
EL 2431 - PE IV: ADVANCED ELECTRICAL DRIVES

Unit No.	Contents	Max. Hrs.
1	**Introduction to Electric Drives** Dynamics of electric drives and control of electric drives, Fundamental Torque equation, Control Schemes, Power modulator, Four Quadrant operation, Energy conservation in electric drives.	6
2	**D.C. Drives** Controlled rectifier fed D.C. drives, single phase and three phase rectifier control of Separately excited D.C. motor; Dual Converter control of separately excited D.C. motor; Power factor, supply harmonics and ripples in motor current; Chopper controlled of separately excited dc motor; chopper control of series motor; source current harmonics.	7
3	**Induction Motor Drives** Stator voltage control, V/f control, static rotor resistance control, slip power recovery schemes, variable frequency control using voltage source inverter. Current sources inverter and cyclo converter, Introductionto vector control of Induction motor	7
4	**Synchronous Motor Drives** Starting and Braking of Synchronous motor; variable frequency control; self-controlled synchronous motor drive employing load commutated thyristor inverter , Introduction of Cyclo-converter control of Synchronous motor; starting of large synchronous motors.	7
5	**Special Motors Drives** Brush less dc motor, stepper motor switched reluctance motor drives and eddy current drives. Introduction to solar and battery powered drives.	7
6	**Traction Drives** DC and AC traction drives, semiconductor converter controlled Drives; 25 KV AC traction using semi conductor converter controlled DC motor; DC traction using semiconductor chopper controlled dc motors; polyphase AC motors for traction drives.	6

Text books

S.N	Title	Year/Edition	Author	Publisher
1	Fudamentals of Electric drives	2nd Edition	G. K.Dubey	Narosa Publications
2	Modern Electric Traction	2003	H.Pratap	Dhanpat Rai & Company
3	Electric drives concepts and applications	2005	V.Subramaniam	Tata McGraw Hill
4	Electric Motor Drives	2001	R. Krishnan	Prentice Hall India

Reference books

S.N	Title	Year/Edition	Author	Publisher
1	Electrical Machines Drives and Power Systems	6th edition 2008	Theodore Wildi	Pearson Education

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester

EL 2432 - PE IV: FUNDAMENTALS OF SMARTGRID

Course Objectives	Course Outcomes
• To introduce the students with basics of Smart Grid. • To inform about components and communication tools of smart grid. • To explain methodology to identify computational tools and performance analysis of smart grid. • Knowledge about Strategic issues related with sustainable development, storage and renewable energy.	**The student should be able to:** 1. To compare conventional and smart grid and illustrate role of stake holders and functions of smart grid. 2. To identify components and computational tools for smooth functioning of smart grid. 3. To determine the performance of smart grid based on congestion, security and contingency studies for optimal solutions. 4. To discuss designing of smart grid with options like automation, sustainable energy and storage.

CO	Statement	Mapped PO												PSO	
		PO	PO	PO	PO	PO	PO	PO	PO	PO	PO 10	PO 11	PO 12	PS 1	PS 2
1	To compare conventional and smart grid and illustrate role of stake holders and functions of smart grid	2	1				1							3	
2	To identify components and computational tools for smooth functioning of smart grid	2				2	3						1	2	
3	To determine the performance of smart grid based on congestion, security and contingency studies for optimal solutions.	3	2		2	2	2						1	2	
4	To discuss designing of smart grid with options like automation, sustainable energy and storage.	2		3	2	2	1	3	1		1	1	1	3	

VII Semester
EL 2432 - PE IV: FUNDAMENTALS OF SMARTGRID

Unit No.	Contents	Max. Hrs.
1	**Introduction to Smart Grid & Power System Enhancement:** Introduction to smart grid, Comparison between Present grid and Smart grid, Electricity Act 2003, Energy Conservation Act 2001, Energy Independence and Security, computation intelligence, Communication Standards, Environment and Economics. General view of the Smart grid market drivers, Function and role of stakeholder, Smart grid based performance measures, Representative Architecture, Functions of smart grid components	6
2	**Smartgrid Communications :** Communication and measurement, Monitoring, PMU, Smart meters, Measurement technologies, GIS and Google mapping tools, multi agent technology, microgrid and smart grid comparison.	7
3	**Performance Analysis Tools for Smart grid Design** Congestion management effect, load flow for smart grid design, Static Security assessment (SSA) and contingencies, Contingencies and their classification, contingency studies for smart grid.	7
4	**Computational Tools for Smart grid Design** Introduction to computational tools, Decision support Tools (DS), Heuristic Optimization, Evolutionary Computational Techniques, Adaptive Dynamic Programming Techniques, Hybridizing optimization techniques and applications to the smart grid, Computational Challenges.	7
5	**Pathway for designing Smart grid:** Introduction to Smart Grid Pathway Design, Barriers and Solutions to Smart Grid Development, General Level Automation, Bulk Power Systems Automation of the Smart Grid, Distribution System Automation Requirement of the Power Grid, End User/Appliance Level of the Smart Grid, Applications for Adaptive Control and Optimization.	7
6	**Renewable Energy and Storage:** Sustainable energy options for the smart grid, Penetration and variability issues associated with sustainable energy technology, Demand-response issue, Electric vehicles and Plug-in Hybrids, PHEV Technology, Environmental Implications, Storage Technologies, Tax Credits.	6

Text books:

	TITLE	YEAR	AUTHOR	PUBLICATION
1	Smart Grid: Fundamentals of Design and Analysis	2012	James Momoh	Wiley

Reference books:

1	Smart Grid: Technology and Applications	March 2012	JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama	Wiley

VII Semester

EL 2433 - PE IV: COMPUTER METHODS IN POWER SYSTEM

Course Objectives	Course Outcomes
The student should be able to 1. The theory and applications of the main components used in power system Protection. 2. The protection systems used for electric machines, transformers, bus bars, Transmission lines. 3. The theory, construction, and applications of main types of circuit breakers. 4. To design the feasible protection systems needed for each main part of a power system.	**The student should be able to:** 1) Explain, different types of Matrix using graph theory , Apply different methods to Build & Develop the A, B, C, K and Bus Impedance Matrix 2) Classify, Compare, Make use of different methods and Analyze Load Flow studies 3) Analyze & Inspect the system for different types of faults 4) Analyze & make use of different methods for Transient Stability Studies .

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	Explain, different types of Matrix using graph theory , Apply different methods to Build & Develop the A, B, C, K and Bus Impedance Matrix	1	1	2		1				1			1		
2	Classify, Compare, Make use of different methods and Analyze Load Flow studies	1	1	2		1				1			1	2	1
3	Analyze & Inspect the system for different types of faults	1	1	2		1		1	1				1	2	1
4	Analyze & make use of different methods for Transient Stability Studies	1	1	1		1		1	1	1			1	2	

VII Semester

EL 2433 - PE IV: COMPUTER METHODS IN POWER SYSTEM

Unit No.	Contents	Max. Hrs.
1	**UNIT-1**: **Incidence and network matrices** Incidence and network matrices: - Graph incidence Matrices, Primitive network, formation of network matrices by singular transformations	6
2	**Algorithm for single phase network** Algorithm for formation of Bus Impedance and Bus Admittance matrix for system without mutual coupling	7
3	**Three Phase Networks** Three Phase Networks: - Three phase balance network elements with balanced and unbalanced excitation incidence and network matrices for three phase element Algorithm for formation of three phase bus impedance matrices without mutual coupling	6
4	**Short circuit studies** Short circuit studies: Three phase network short circuit calculations using bus impendence matrix for balanced and unbalanced faults. Computer programme for short circuit studies on simple system	7
5	**Transient stability studies** Transient stability studies: Modelling of synchronous machine, power system network for transient stability studies. Numerical solution of swing equation by modified Euler and Runge Kutta 4th order method..	7
6	**Load Flow Studies** Load Flow Studies: Power system load flow equation, solution technique: Gauss Seidal , Newton Raphson and fast decoupled technique with and without (voltage) control buses. Representation of tap changing and phase shifting transformers. Elementary load flow programmes	7

Text books:

S. N	TITLE	EDITION	AUTHOR	PUBLISHER
1	Computer Methods in Power Systems	1st 1968	Stag and El – Abiad	Mc Graw Hill
2	Elements of Power System Analysis	1982	William D.Stevenson	Mc Graw Hill

Reference books:

	TITLE	EDITION	AUTHOR	PUBLISHER
1	Computer Analysis in Power System Modern Power System Analysis	1982	R.N.Dhar	Mc Graw Hill
2	Modern Power System Analysis	3rd-2006	D.P.Kothari and I.J.Nagrath	TMH

VII Semester
EL 2434 - PE IV: EHVAC-HVDC TRANSMISION

Objective	Course Outcome
The student should be able The student will understand the various aspects of transmission system, systems for power flow control, design parameters of filters and layout of HVDC power plant .	On completion of this course, the student will be able to **1)** Design and analyse Power handling capacity of EHVAC Transmission systems. **2)** Explain and analyse Corona, the concept of Electrostatic and electromagnetics, Electrical safety. **3)** Demonstrate , Classify HVDC Transmission system , Analyse the methods of HVDC Control. **4)** Design of Harmonic filters and reactive power configuration, HVDC Circuit breaker and Types and applications.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Design and analyse Power handling capacity of EHVAC Transmission systems	3	2	1									1	1	
CO2	Explain and analyse Corona, the concept of Electrostatic and electromagnetics, Electrical safety	3	2				3						1		
CO3	Demonstrate , Classify HVDC Transmission system , Analyse the methods of HVDC Control	2	3										1		
CO4	Design of Harmonic filters and reactive power configuration, HVDC Circuit breaker and Types and applications	3	2	2									1		1

VII Semester
EL 2434 - PE IV: EHVAC-HVDC TRANSMISION

Unit No.	Contents	Max. Hrs.
1	**Power handling and voltage gradient** 1) Power handling capacities of EHV AC transmission lines. 2) Voltages gradients: Electric field of point charge, sphere gap line-charge. Single and three phase lines, and bundled conductors. Maxwell"s potentials coefficients.	6
2	**Electrostatic and electromagnetic fields of EHV lines & corona** 1) Electrostatic and electromagnetic fields of EHV lines, electric shock and Threshold current , calculation of electrostatic field of A.C. lines (3 phase single and double circuit lines only). Effect of high electrostatic field. 2) Corona: Types, critical disruptive voltages, Factors affecting corona, Methods for reducing corona power loss (empirical formula), corona current waveform, audible noise and radio interference.	7
3	**HVDC Power transmission** DC Power transmission technology: Introduction, comparison of AC and DC Transmission, application of DC transmission, Description of DC transmission system, configuration, planning for HVDC transmission, types of DC link. Introduction to HVDC light, Earth electrode and earth returns. Introduction, objectives, location and configuration, resistance of electrodes, means of reducing earth electrode resistance	7
4	**Analysis of HVDC converters** Analysis of HVDC converters: Pulse number, choice of converter configuration, simplified Graetz circuit, converter bridge characteristics, characteristics of twelve pulse converter Power flow control in HVDC system :- Constant current. Constant voltage, constant ignition and excitation angle control, control characteristics.	7
5	**Harmonic Filters & Reactive power compensation** Harmonic Filters :- Introduction, Filters, surge capacitors and damping circuits, shunt filters, series filters, AC filters, design of AC filters and tuned filters, double frequency and damped filters, cost considerations and ratings. Harmonics on D.C side of converters. DC Harmonics filters. - Reactive power requirement of HVDC converters, substations.	6
6	**HVDC circuit breakers** HVDC circuit breakers: - Introduction, construction and principle of operation. Interruption of DC current, application of MRTB, Type of HVDC circuit breaker, capability and characteristics of HVDC circuit breakers	7

Text books:

	Title	Edition	Author	Publication
1.	EHV AC & HVDC Transmission & Distribution	**3rd-2006**	S. Rao	Khanna
2.	EHV AC Transmission	2nd	Begamudre	New Age international Publisher
3.	Power system Stability and Control	**2nd - 2006**	P. Kundur	Publisher

Reference books:

1	HVDC Power Transmission System	1982	R.N.Dhar	Publisher

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B.Tech SoE and Syllabus 2020

ELECTRICAL ENGINEERING

VIII Semester

EL2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	On successful completion of the course students will be able to: 1. Demonstrate a sound technical knowledge of their selected project topic. 2. Undertake problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Communicate effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 **PSO** : i,ii,iii	

The group of students will continue to work for the project allotted previously and will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

VIII Semester
EL2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
1. To expose to culture and tradition. 2. To provide opportunity for student to perform and present their hidden talent, still and art. 3. To nurture hobbies. 4. To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits. 5. To develop creative talent, self-confidence, sense of achievement. 6. To be able to design process on environmental, social, political, ethical, health and safety. 7. To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	1. An ability to work initially as well as part of team to achieve set goals. 2. An ability to work to serve society and for betterment of society. 3. An ability to communicate with people at large.
Mapped Program Outcomes : 5,6,7,9,10,11	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.

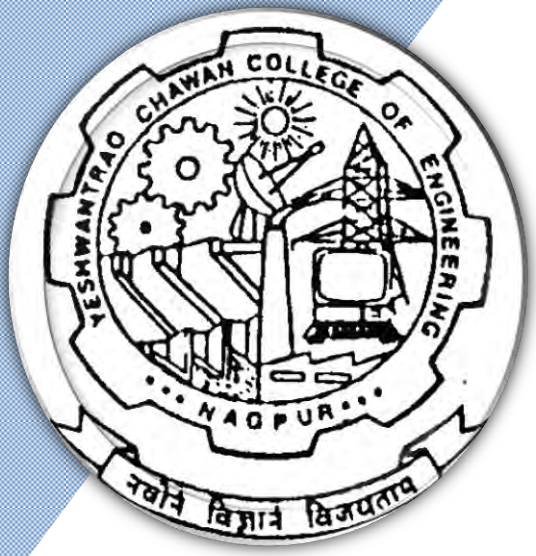
Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology

SoE & Syllabus 2020

3rd to 8th Semester

Electronics Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
TOTAL FIRST & SECOND SEM										47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	EE2201	Electronic Devices	T	3	1	0	4	4	30	20	50	3 Hours
3	3	PC	EE2202	**Lab:**Electronic Devices	P	0	0	2	2	1		60	40	
4	3	PC	EE2203	Signal and Systems	T	3	0	0	3	3	30	20	50	3 Hours
5	3	PC	EE2204	**Lab**:Programming Language	P	0	0	2	2	1		60	40	
6	3	PC	EE2205	Digital Logic Design	T	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	EE2206	**Lab:** Digital Logic Design	P	0	0	2	2	1		60	40	
8	3	PC	EE2207	Network Analysis	T	3	0	0	3	3	30	20	50	3 Hours
9	3	PC	EE2208	**Lab:**Network Analysis	P	0	0	2	2	1		60	40	
					TOTAL	**15**	**1**	**8**	**24**	**20**				
Fourth Semster														
1	4	BS	GE2204	Advance Mathematical Techniques	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	EE2251	Electronic Circuits	T	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	EE2252	**Lab:**Electronic Circuits	P	0	0	2	2	1		60	40	
4	4	PC	EE2253	Microcontroller and its Applications	T	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	EE2254	**Lab:** Microcontroller and its Applications	P	0	0	2	2	1		60	40	
6	4	PC	EE2255	Analog Communication	T	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	EE2256	**Lab**.: Analog Communication	P	0	0	2	2	1		60	40	
8	4	PC	EE2257	Electromagnetic Fields	T	3	1	0	4	4	30	20	50	3 Hours
9	4	PC	EE2258	**Lab**: Simulation Lab/Workshp Lab	P	0	0	2	2	1		60	40	
					TOTAL	**15**	**1**	**8**	**24**	**20**				
Audit Courses														
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	A	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2125	YCCE Communication Aptitude Preparation (YCAP4.2) for EL,EE,ET	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	EE2301	Digital Signal Processing	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	EE2302	**Lab:** Digital Signal Processing	**P**	0	0	2	2	1		60	40	
4	5	PC	EE2303	Analog Integrated Circuit & its Application	**T**	3	0	0	3	3	30	20	50	3 Hours
5	5	PC	EE2304	**Lab:** Analog Integrated Circuit & its Application	**P**	0	0	2	2	1		60	40	
6	5	PE		Professional Elective-I	**T**	3	0	0	3	3	30	20	50	3 Hours
7	5	PE		Lab.: Professional Elective-I	**P**	0	0	2	2	1		60	40	
8	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3 Hours
10	5	STR	EE2310	**Industry Visit and its report**	**P**	0	0	0	0	1		100		
				TOTAL		**18**	**0**	**6**	**24**	**22**				

List of Audit Courses														
1	5	HS	AU2127	YCCE Communication Aptitude Preparation (YCAP5.2) for EL,EE,ET	**A**	3	0	0	3	0				

Professional Electives -I

1	5	PE-I	EE2311	PE-I:Computer Communication Network
2	5	PE-I	EE2312	**Lab:**PE-I:Computer Communication Network
3	5	PE-I	EE2313	PE-I:Embedded System
4	5	PE-I	EE2314	**Lab:**PE-I:Embedded System
5	5	PE-I	EE2315	PE-I:Algorithm & Data Structure
6	5	PE-I	EE2316	**Lab:**PE-I:Algorithm & Data Structure
7	5	PE-I	EE2317	PE-I: Applied Machine Learning
8	5	PE-I	EE2318	**Lab:**PE-I:Applied Machine Learning

Open Electives -I

1	5	OE-I	EE2331	OE I : Fuzzy Logic & Neural Network
2	5	OE-I	EE2332	OE I : Basics of Analog and Digital Communication
3	5	OE-I	EE2333	OE I : Biomedical Instrumentation

Open Electives -II

1	5	OE-II	EE2341	OE II : Data Acquisition & Signal Conditioning
2	5	OE-II	EE2342	OE II : Microprocessor Programming
3	5	OE-II	EE2343	OE II : Consumer Electronics

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	EE2351	Control System Engineering	**T**	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	EE2352	Transmission Lines and Waveguides	**T**	3	0	0	3	3	30	20	50	3 Hours
4	6	PC	EE2353	Digital Communication	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PC	EE2354	**Lab:**Digital Communication	**P**	0	0	2	2	1		60	40	
6	6	PE		Professional Elective-II	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PE		**Lab.:** Professional Elective-II	**P**	0	0	2	2	1		60	40	
8	6	OE		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	OE		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3 Hours
				TOTAL		**21**	**0**	**4**	**25**	**23**				

Professional Electives -II

1	6	PE II	EE2361	PE II:Internet of Things
	6	PE II	EE2362	**Lab:** PE II:Internet of Things
2	6	PE II	EE2363	PE II:Digital CMOS Circuits
	6	PE II	EE2364	**Lab:** PE II:Digital CMOS Circuits
3	6	PE II	EE2365	PE II:Digital Image Processsing
	6	PE II	EE2366	**Lab:**PE II:Digital Image Processsing
4	6	PE II	EE2367	PE II:Object Oriented Programming
	6	PE II	EE2368	**Lab:**PE II:Object Oriented Programming

Open Electives -III

1	6	OE-III	EE2381	OE III : Fuzzy Logic & Neural Network
2	6	OE-III	EE2382	OE III : Basics of Analog and Digital Communication
3	6	OE-III	EE2383	OE III : Biomedical Instrumentation
Open Electives -IV				
4	6	OE-IV	EE2391	OE IV : Data Acquisition & Signal Conditioning
5	6	OE-IV	EE2392	OE IV : Microprocessor Programming
6	6	OE-IV	EE2393	OE IV : Consumer Electronics

Audit Courses											
1	6	HS	AU2129	YCCE Communication Aptitude Preparation (YCAP6.2) for ME, EE, ETC	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	EE2401	Digital System Design	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	EE2402	**Lab.**: Digital System Design	**P**	0	0	2	2	1		60	40	
3	7	PE		Professional Elective-III	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE		Professional Elective-IV	**T**	3	0	0	3	3	30	20	50	3 Hours
5	7	PE		Lab. : Professional Elective-IV	**P**	0	0	2	2	1		60	40	
6	7	PE		Professional Elective-V	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		Professional Elective-VI	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	EE2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	EE2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -III

1	7	PE III	EE2411	PE III: Switching Theory & Finite Automata
2	7	PE III	EE2412	PE III :Power Electronics
3	7	PE III	EE2413	PE III: Wireless Sensor Network
4	7	PE III	EE2414	PE III: VLSI Signal Processing

Professional Electives -IV

1	7	PE IV	EE2421	PE IV: Wireless Communication
	7	PE IV	EE2422	**Lab:** PE IV:Wireless Communication
2	7	PE IV	EE2423	PE IV: RF and Microwave
	7	PE IV	EE2424	**Lab:** PE IV: RF and Microwave
3	7	PE IV	EE2425	PE IV: Analog VLSI Design
	7	PE IV	EE2426	**Lab. :** PE IV: Analog VLSI Design
4	7	PE IV	EE2427	PE IV: Operating Systems
	7	PE IV	EE2428	**Lab:** PE IV:Operating Systems

Professional Electives -V

1	7	PE V	EE2431	PE V: Industrial Automation
2	7	PE V	EE2432	PE V: Nano Electronics
4	7	PE V	EE2433	PE V: Optical Communication
5	7	PE V	EE2434	PE V: RF Circuit Design

Professional Electives -VI

1	7	PE-VI	EE2441	PE-VI: E-Commerce and Data Analytics
2	7	PE-VI	EE2442	PE-VI: Micro Electro Mechanical Systems (MEMS)
3	7	PE-VI	EE2443	PE-VI: Biomedical Instrumentation
4	7	PE-VI	EE2444	PE-VI: Computer Organization
5	7	PE-VI	EE2445	PE VI : Introduction to Remote Sensing and Image Analysis

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.04**	**Applicable for AY 2022-23 Onwards**
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SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	EE2451	Major Project	P	0	0	12	12	9		60	40	
2	8	STR	EE2452	Extra curricular Activity Evaluation	P	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**84**	**2**	**46**	**132**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

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(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

3rd Semester

Electronics Engineering

III Semester
GE2201 - Engineering Mathematics III

Objectives	Outcomes
1. Able to find numerical solution of various mathematical equations 2. Give knowledge of Laplace transform, Z transform, Fourier transform 3. Define the periodic functions in the form of Fourier series 4. Solve partial differential equations	The student will be able to: 1. Estimate the Calculus of Numerical Function. 2. Determine transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations. 3. Discuss the nature of periodic function and express it in terms of series. 4. Use appropriate method/s to solve partial differential equations.

Unit I: Finite Differences
Difference table; Operators E and Δ, Central differences, Factorials notation, Numerical differentiation and integration, Difference equations with constant coefficients. **(6 hours)**

Unit II: Laplace Transform
Laplace Transforms: Laplace transforms and their simple properties, Unit step function, inverse of Laplace transform, convolution theorem, Applications of Laplace transform to solve ordinary differential equations . **(7 hours)**

Unit III: Z-transform
Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant co-efficient. **(6 hours)**

Unit IV: Fourier Series
Periodic Functions and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions **(7 hours)**

Unit V: Partial Differential Equation
Partial Differential Equations of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve first and second order partial differential equations. **(7 hours)**

Unit VI : Fourier Transform : Definition: Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem**.** **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John Wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John Wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan
5	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	Laxmi Prakashan

III Semester
EE2201 - Electronic Devices

Course Objective	Course Outcomes
1. The purpose of this course is to present a clear consistent picture of the internal physical behaviour of many electronic devices so that their studies of electronic circuit and system will be meaningful. 2. The purpose of this course is to introduce to the students, the basics of biasing of transistor circuits, feedback amplifiers & analyzing different two port devices.	Students will be able 1. To understand the concepts of Energy Bands, Charge Carriers and various semiconductor devices like diodes and BJT 2. Be familiarized with semiconductor device fabrication processes. 3. To understand various configurations and their characteristics for BJT and MOSFET amplifiers 4. To understand the concepts of Stabilization and operating points of BJT and MOSFET amplifiers

Unit I: Energy Bands and Charge carriers in Semiconductors
Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; Generation and recombination of carriers; Poisson and continuity equations.

Unit II: Diode and its applications
PN junction diode, diode equation, The Volt-Ampere Characteristics, The Temperature Dependence of the Characteristics, Diode Resistance, Diode Circuits: DC Analysis and Models, AC Equivalent Circuit, Zener breakdown, avalanche breakdown, Clipping, Clamping, Rectifier circuits, Basic Design of DC Power Supply ,Tunnel Diode, Schottky Barrier Diodes, Varactor Diodes, LED, photo diode and solar cell.

Unit III: Device Fabrication Process
Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography and twin-tub CMOS process.

Unit IV: Bipolar Junction Transistor and its Configurations
Bipolar Junction Transistor Construction, Operation, The Common-Base Configuration and its Characteristics, The Common-Emitter Configuration and its Characteristics, Common-Collector Configuration and its Characteristics, Transistor as an Amplifier and Switch.

Unit V: MOSFET and its Configurations
MOS Field-Effect Transistor, Two-Terminal MOS Structure, n-Channel Enhancement-Mode MOSFET, Ideal MOSFET Current–Voltage Characteristics—NMOS Device, p-Channel Enhancement-Mode MOSFET, Ideal MOSFET Current–Voltage Characteristics—PMOS Device.

Unit VI: BJT and MOSFET Amplifier Configurations
Common Emitter, Common Base, Common Collector Common-Source Circuit, Common-Drain Circuit, Common-Gate Circuit, Biasing.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Electronic Devices and Circuits Theory	BoyleSted, Nashelsky,	10th Edition.	Pearson
2	Microelectronics Circuit Analysis and Design	Donald Neaman	4th Edition	McGraw Hills, 2010
3	Op-amps and linear integrated circuits,	R. A. Gayakwad	3rd edition	PHI, 1995

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Integrated Electronics,	MillManHalkias	3rd reprint, 2007.	Tata McGraw Hil
2	Microelectronics Circuits	Sedra Smith	6th Edition	Oxford Uni. Press

III Semester
EE2202 - Lab. : Electronic Devices

Course Objective	Course Outcomes
↙ The purpose of this course is to present a clear consistent picture of the internal physical behavior of many electronic devices so that their studies of electronic circuit and system will be meaningful. ↙ The purpose of this course is to introduce to the students, the basics of biasing of transistor circuits, feedback amplifiers & analyzing different two port devices.	Students will be able 1. To understand the concepts of Energy Bands, Charge Carriers and various semiconductor devices like diodes and BJT 2. Be familiarized with semiconductor device fabrication processes. 3. To understand various configurations and their characteristics for BJT and MOSFET amplifiers 4. To understand the concepts of Stabilization and operating points of BJT and MOSFET amplifiers

Expt. No.	Name of Experiment
1	To plot the V- I characteristics of PN junction diode (Silicon and Germanium) and perform simulation in LT-Spice.
2	To plot the V- I characteristics of Zener shunt regulator.
3	To determine the Ripple factor and efficiency of Half wave and full wave rectifier with and without capacitive filter and perform simulation in LT-Spice.
4	To plot I/P & O/P Characteristics of Common Base Transistor Configuration. Find I/P & O/P Resistance and Current Gain.
5	To plot I/P & O/P Characteristics of Common Emitter Transistor Configuration. Find I/P & O/P Resistance and Current Gain.
6	Analysis of Fixed Bias circuit of transistor.
7	Analysis of Self Bias circuit of transistor
8	To plot the Drain and Transfer characteristics of Field Effect Transistor (FET) in CS mode.
9	To plot the Drain and Transfer characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET) in CS mode.
10	Mini Project

III Semester
EE2203 - Signals & Systems

Course Objective	Course Outcomes
↙ The objective of this course is to have an introduction to approaches of signals & systems analysis with an increased emphasis on the frequency response and Analysis of system with continuous signal. ↙ To enable the students, their time and Frequency characteristics.	Students will be able to 1. Classify continuous time signals and systems, transformation of independent variable. 2. Analyze Fourier series, Fourier transform representation of continuous-time periodic and aperiodic signals. 3. Determine and evaluate Laplace Transform of continuous time signals. 4. Analyze time & frequency characterization of Signals and Systems & Sampling Theorem

Unit I: Continuous and Discrete time signals **[6 hr]**
Signal representation, Transformation of the independent variable, classification of signals, Signal Energy and Power, Periodic, Even & Odd, Real and Exponential Signals

Unit II: Continuous and Discrete time System [6 hr]
Continuous-Time Systems, system properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, convolution

Unit III: Fourier Series Representation of Periodic Signals [6 hr]
Fourier Series Representation of Continuous-Time Periodic Signals, convergence of the Fourier Series.

Unit IV: Fourier Transform [6 hr]
Convergence of Fourier Transform and its Properties, Representation of Aperiodic Signals, The Fourier Transform for Periodic Signals. Analysis and Characterization of LTI Systems using the Fourier Transform.

Unit V: The Laplace Transform [6 hr]
The Laplace Transform. The Region of Convergence for Laplace Transforms. The Inverse Laplace Transform. Properties of the Laplace Transform. Analysis and Characterization of LTI Systems Using the Laplace Transform. The Unilateral Laplace Transform

Unit VI: Z transform [6 hr]
The Z Transform. The Region of Convergence for Z Transforms. The Inverse Z Transform. Properties of the Z Transform. Analysis and Characterization of LTI Systems Using the Z Transform

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Signals and Systems	Alan V. Oppenheim, Alan S. Willsky, with S. Hamid	2nd Edition, 1996	Prentice Hall
2	Digital signal processing –Principles, algorithms and applications	J. G. Proakis, D. G. Manolakis	3rd Edition, 1996	PHI

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Outline of Signals and Systems	Hwei Hsu,Schaum's	1st Ed 1995	McGraw-Hill
2	Signals & Systems	Simon Haykin and Van Veen	2nd Edition, 2002	Wiley
3	Signals & Systems Analysis Using Transformation Methods & MAT Lab	Robert	2003	TMH
4	Signals, Systems and Transforms	C. L. Philips, J.M.Parr and Eve A.Riskin	3rd Edition, 2004.	
5	Signals & Systems	I.J.Nagrath, S.N.Sharan, R.Ranjan, S.Kumar	2001	Pearson education

III Semester
EE2204 - Lab : Programming Language

Course Objective	Course Outcomes
1. To understand Python is a useful scripting language for developers. 2. To learn how to design and program Python applications.	1. To understand syntax and semantics of language 2. To understand and apply the basics of the programming language 3. To understand and apply special language features 4. To develop any application

Expt. No.	Name of Experiment
1	Write, test, and debug simple Python programs
2	Implement Python programs with conditionals and loops
3	Develop Python programs step-wise by defining functions and calling them.
4	Develop Python programs step-wise by Python lists
5	Develop Python programs step-wise by Python tuples
6	Develop Python programs step-wise by Python dictionaries for representing compound data.
7	Read and write data from/to files in Python.
8	Application Development

III Semester
EE2205 - Digital Logic Design

Course Objective	Course Outcomes
⇗ Develop a strong foundation of digital electronics. ⇗ Understand concepts of combinational and sequential circuits. ⇗ Develop and design synchronous circuits and sequential machines.	Students will be able to: 1. Simplify combination logic circuits using Boolean algebra and exhibit the methods to solve logical functions using K-map and Quine-Mc-Clauskey methods. 2. Understand and apply the concept of combinational logic circuits in various digital systems. 3. Understand and demonstrate the various codes and illustrate concept of logic family with their characteristics. 4. Understand the working of Flip-flops and its use to design Synchronous counters and Design and demonstrate finite state machines.

Unit I: **(7 Hr)**
Number Systems and IEEE Floating point representations, Logic gates, Switching Algebra & simplification of Boolean expressions, Boolean algebraic theorems, DeMorgan's theorem, SOP, POS, Canonical forms of Boolean expression. Implementations of Boolean expressions using logic gates.

Unit II: **(6 Hr)**
Combinational Circuits: Minimization methods: Incompletely specified functions, Karnaugh map, Quine McClauskey methods.

Unit III: **(7 Hr)**
Design of Arithmetic circuits: Half & Full adders, Half & Full Subtractions, Multi-bit parallel adders Carry Propagate adder & Carry Look ahead adder, Comparators, Multi-bit Application designs, Formation of switching functions from word statements, Functions & its implementation using Multiplexer, Demultiplexer, Encoder, Decoder,

Unit IV: **(6 hr)**
Combinational circuits design using MSI and LSI chips, PLA's ,Parity Checkers and generators, Introduction to Logic families & their characteristics such as Fan-In, Fan-out, Propagation delay, Power dissipation, Noise Margin.

Unit V: **(7 Hr)**
Sequential circuits: Latches and flip-flops: RS-FF, D-FF, JK-FF, Master-Slave JK-FF & T-FF's, Excitation & Truth Table, Flip-flop conversions, Shift registers. Introduction to Synchronous, Counters: Ring counter, Johnson counter, Ripple counter, Design of synchronous counter.

Unit VI: **(7 Hr)**
Classification of synchronous machines, Design of synchronous sequential machines using Moore & Mealy circuits: Sequence detector, State diagram, State reduction (Method of Partitioning) and implementation.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Digital Circuits & Microprocessors	Hebert Taub	1988.	Mc Graw Hill
2	Switching Theory & Finite Automata	Zvi Kohavi	2nd edition 2004	Mc Graw Hill

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Fundamentals of Logic Design	C.H.Roth	7th edition 2014.	Public Work & Services
2	Modern Digital Electronics	RP Jain	3rd Edition	Tata McGraw Hill
3	Digital Design	M. Morris Mano	4th edition 2008	Prentice Hall of India

III Semester
EE2206 - Lab. : Digital Logic Design

Course Objective	Course Outcomes
⇗ Develop a strong foundation of digital electronics. ⇗ Understand concepts of combinational and sequential circuits. ⇗ Develop and design synchronous circuits and sequential machines.	Students will be able to: 1. Simplify combination logic circuits using Boolean algebra and exhibit the methods to solve logical functions using K-map and Quine-Mc-Clauskey methods. 2. Understand and apply the concept of combinational logic circuits in various digital systems. 3. Understand and demonstrate the various codes and illustrate concept of logic family with their characteristics. 4. Understand the working of Flip-flops and its use to design Synchronous counters and Design and demonstrate finite state machines.

Expt. No.	Name of Experiment
1	Introduction to SPICE Digital model and commands.
2	Finding out Vohmin, Volmax, Vihmin, Vilmax,Delay Td, Power Supply Range (using SPICE)
3	Finding out Vohmin, Volmax, Vihmin, Vilmax, Delay Td, Power Supply Range (using Hardware)
4	Verify basic Logic gates, MUX, DeMUX, Truth Tables(using SPICE and using Hardware)
5	To Implement Coder decoder (using SPICE and using Hardware)
6	To Implement & verify adder circuits.
7	To Implement & Verify parity checkers circuit (using SPICE and using Hardware)
8	To verify the truth table of all flip-flops. (using SPICE and using Hardware)
9	To Design binary synchronous/asynchronous counter. (using SPICE and using Hardware)
10	To Design Finite State Machine (using SPICE and using Hardware)

III Semester
EE2207- Network Analysis

Course Objective	Course Outcomes
The basic objective of this course is to introduce students to the fundamental theory and mathematics for the analysis of electrical circuits. Through the material presented in this course, students will learn: ↗ To understand basic of circuits elements and energy sources ↗ To know the fundamental theory and Mathematics for the analysis of electrical circuits.	On successful completion of this course, students should be able to: 1. Apply and analyze nodal and mesh analysis on circuits 1. Apply network theorems initial and final conditions to analyze circuits 2. Understand, apply and analyze circuits in transform domain 3. Apply the concept of two – port networks to find different two-port parameters.

UNIT-1: **Nodal Analysis of Electric Circuits**
Basics of electric circuits, circuit elements and their voltage – current relationship, classification of circuit elements, sources - their types and characteristics, concept of equivalent sources, source transformation and duality, concept of supernode and V – shift, nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-2: **Mesh Analysis of Electric Circuits**
Concept of super mesh and I – shift, mutual inductance, coefficient of coupling, dot convention, dot marking in coupled coils, mesh analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-3: Network Theorem
Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem

UNIT-4: Initial and Final Conditions, Impedance Functions and Circuit Analysis with Laplace Transform
Concept of initial and final conditions, behaviour of resistor, inductor and capacitor at t = 0- and at t = 0+, procedure for evaluating initial and final conditions, analytical treatment. Review of Laplace Transform, concept of complex frequency, transform impedance and admittance, s – domain impedance and admittance models for resistor, inductor and capacitor, series and parallel combinations of elements. Transformed network on loop and mesh basis, mesh and node equations for transformed networks, time response of electrical network with and without initial conditions by Laplace transform.

UNIT-5 : Transforms of other Signal Waveforms, Network Functions, Poles and Zeros of network functions
Unit step, ramp and impulse functions with and without time delay, their Laplace transform, waveform synthesis and its application to electrical networks. Terminal pairs or ports, network functions for one port and two port networks, definition and physical interpretation of poles and zeros, pole-zero plot for network functions, restrictions on pole and zero locations for driving point and transfer functions, time domain behaviour from the pole – zero plot, network synthesis using pole – zero plot.

UNIT-6: Two Port Parameters
Standard reference directions for the voltages and currents of a two – port network, defining equations for open circuit impedance, transmission, inverse transmission, hybrid and inverse hybrid parameters, relationships between parameter sets, conditions for reciprocity and electrical symmetry in terms of two – port parameters, interconnections of two - port networks.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Network Analysis	M. E. Van Valkenburg	3rd Edition	PHI Learning Private Limited.
2	Circuits and Network	Sudhakar, A., Shyammohan, S. P.;		Tata McGraw-Hill New Delhi
3	Engineering Circuit Analysis	A William Hayt	8th Edition	McGraw-Hill Education.

III Semester
EE2208- Lab. : Network Analysis

Course Objective	Course Outcomes
The basic objective of this course is to introduce students to the fundamental theory and mathematics for the analysis of electrical circuits. Through the material presented in this course, students will learn: ↙ To understand basic of circuits elements and energy sources ↙ To know the fundamental theory and Mathematics for the analysis of electrical circuits.	On successful completion of this course, students should be able to: 1. Apply and analyze nodal and mesh analysis on circuits 2. Apply network theorems, initial and final conditions to analyze circuits 3. Understand, apply and analyze circuits in transform domain 4. Apply the concept of two – port networks to find different two-port parameters.

Expt. No.	Name of Experiment
1	Introduction To PSPICE Software.
2	SPICE Models for various components. Verification of Kirchhoff's law.
3	SPICE Models for various sources. Perform nodal analysis on complex electrical circuits
4	Perform mesh analysis on complex electrical circuits.
5	Verification of Superposition Theorem.
6	SPICE Analysis Methods. Verification of Thevenin's Theorem.
7	SPICE Analysis Methods. Verification of Norton's theorem.
8	SPICE Analysis Methods .Verification of Maximum power transfer theorem.
9	SPICE Analysis Methods .Determinations of Transfer function of Two port network.
10	Determination of Z & Y parameters of Two Port Network.

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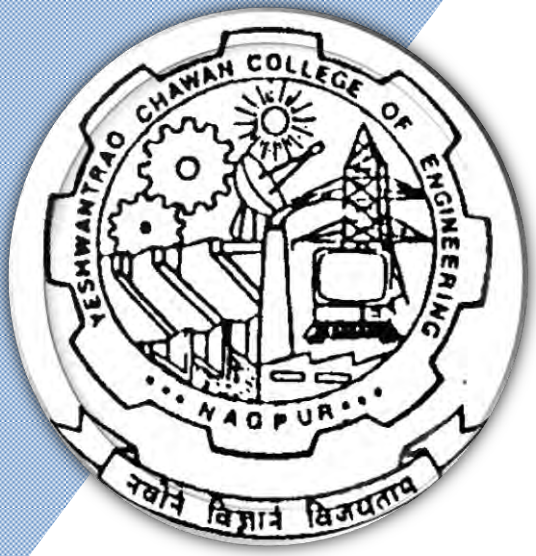


Bachelor of Technology
SoE & Syllabus 2020
4th Semester
Electronics Engineering

IV Semester
GE2204 - Advanced Mathematical Techniques

Objective	Outcomes Students will be able to
• To introduce various Numerical Methods to solve algebraic and differential equations • To understand the concept of Probability distribution • To introduce the concept of Fuzzy Set theory and functions • To make aware of different optimization techniques	• Utilize numerical techniques to obtain approximate solutions of mathematical equations • Measure the Statistical parameters for random variables • Explain the basic concept of fuzzy sets, Relations and fuzzy logic. • Design and determine the solution of linear programming problems

Unit I:
Numerical Methods for Algebraic And Transcendental Equations: Errors in numerical calculation, Errors in series approximation, Rounding of error solutions of algebraic and transcendental equations, Iteration method, Bisection method, False position method, Newton Raphson method and their convergence **Numerical Methods System of Algebraic Equations**: Solution of System of linear equations, Gauss- Seidel method, Crouts method**.**
(7 hours)

Unit II:
Numerical Methods for Differential Equations: Numerical solution of ordinary differential equation by Taylor's series method, Picard's method, Runge's second and third order method, Runge-Kutta 4^{th} order method, Euler's method, Euler's modified method, Milne's Predictor and Corrector method. **(6 hours)**

Unit III:
Random Variables and Probability Distribution: Discrete and continuous random variables, probability density function of one and two variables, Probability distribution function of one and two variables, Joint distributions and conditional distributions. **(6 hours)**

UNIT IV:
Mathematical Expectation: Definition of mathematical expectation, functions of one and two random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis. **(7 hours)**

UNIT V:
Fuzzy Sets And Fuzzy Logic: Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.
(7 hours)

Unit VI:
OPTIMIZATION TECHNIQUES: Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method. **(6 hours)**

Text Books:

SN	Title	Edition	Authors	Publisher
1	Computer based Numerical and Statistical Techniques	Paperback Firstedition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	Fourth Edition (2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	Year-2009.First Edition	C.Mohan and Kasum Deep	New Age International Publication

IV Semester
GE2204 - Advanced Mathematical Techniques

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers
6	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	LaxmiPrakashan

IV Semester
EE2251 - Electronic Circuits

Objective	Outcomes
The purpose of this course is to present a clear consistent picture of the high frequency behavior of BJT and MOSFET based amplifiers and classification based on different modes of working so that their studies of electronic circuit and system will be meaningful.	1. Students will be able to know the low frequency parameters and analysis of BJT, MOSFET and its configuration. 2. Students will be able to know the high frequency parameters and analysis of BJT, MOSFET and its configuration. 3. Students will be able to analyze amplifiers with and without feedback. 4. Students will be able to analyze Power amplifier and Oscillators.

Unit I: BJT Amplifiers (Low frequency: (Single and Multi-stage)
The Bipolar Linear Amplifier, Graphical Analysis and ac Equivalent Circuit, Small-Signal Hybrid-π Equivalent Circuit of the Bipolar Transistor, Small-Signal Voltage Gain, Hybrid-π Equivalent Circuit, Including the Early Effect, Other Small-Signal Parameters and Equivalent Circuits, Basic Transistor Amplifier Configurations, Common-Emitter Amplifiers, Ac Load Line Analysis, Common-Collector (Emitter-Follower) Amplifier, Common-Base Amplifier, Multistage Amplifiers.

Unit II: MOSFET Amplifiers (Low frequency: Single-Stage)
The MOSFET Amplifier, Graphical Analysis, Load Lines And Small-Signal Parameters, Small-Signal Equivalent Circuit, The Common-Source Amplifier, The Common-Drain (Source-Follower) Amplifier, The Common-Gate Configuration, Multistage Amplifiers

UNIT III: Transistor Amplifiers at High-frequency
Amplifier Frequency Response, System Transfer Functions, Transistor Amplifiers With Circuit Capacitors, Frequency Response: Bipolar Transistor, Expanded Hybrid- π Equivalent Circuit, Short-Circuit Current Gain, Cut-off Frequency, Miller Effect.

UNIT III: MOSFET Amplifiers at High-frequency
The MOSFET Amplifiers: Common Source Amplifier, Common Drain Amplifier, High-Frequency Equivalent Circuit, High-Frequency Response of MOSFET Circuits, Multistage MOSFET Amplifiers.

UNIT V: Feedback Configurations
Basic Feedback Concepts, Feedback Topologies, Analysis of Voltage-Series, Voltage-Shunt, Current- series and Current Shunt feedback amplifiers, Oscillators: Barkhausen's criterion, RC phase shift oscillators, Wien bridge, Tuned Oscillators: Hartley, colpitts, crystal Oscillators

UNIT VI: Power Amplifiers
Power Amplifiers, Power Transistors, Power MOSFETS, Heat Sinks, Classes Of Amplifiers, Class-A Operation, Class-B Operation, Class-AB Operation, Class-C Operation, Class-A Power Amplifiers, Inductively Coupled Amplifier, Transformer-Coupled Amplifiers, Class-AB Output Stage.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Electronic Devices and Circuits Theory	BoyleSted, Nashelsky,	10th Edition.	Pearson
2	Microelectronics Circuit Analysis and Desig	Donald Neaman	4th Edition	McGraw Hills, 2010
3	Op-amps and linear integrated circuits,	R. A. Gayakwad	3rd edition	PHI, 1995

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Integrated Electronics,	MillManHalkias	3rd reprint, 2007.	Tata McGraw Hil
2	Microelectronics Circuits	Sedra Smith	6th Edition	Oxford Uni. Press

IV Semester
EE2252 - Lab. : Electronic Circuits

Objective	Outcomes
The purpose of this course is to present a clear consistent picture of the high frequency behavior of BJT and MOSFET based amplifiers and classification based on different modes of working so that their studies of electronic circuit and system will be meaningful.	1. Students will be able to know the low frequency parameters and analysis of BJT, MOSFET and its configuration. 2. Students will be able to know the high frequency parameters and analysis of BJT, MOSFET and its configuration. 3. Students will be able to analyze amplifiers with and without feedback. 4. Students will be able to analyze Power amplifier and Oscillators.

Exp No	Name of Experiment
1.	Evaluation of small signal h and π-parameter using BJT.
2.	To Plot the Frequency Response of single stage RC coupled CE amplifier with feedback
3.	To Plot the Frequency Response of single stage RC coupled CE amplifier without feedback
4.	To simulate the Frequency Response of single stage RC coupled CE amplifier on LT-spice.
5.	To Plot the Two stages RC coupled amplifier with voltage series feedback.
6.	To simulate the Frequency Response of Two stage RC coupled CE amplifier on LT-spice.
7.	To simulate the Frequency Response of Common Source MOSFET Amplifier on LT-spice.
8.	To determine the efficiency of Class B push pull power amplifier and to study cross over distortion.
9.	To determine the phase shift in RC phase shift oscillator.
10.	Mini project

IV Semester
EE2253 - Microcontroller & its Applications

Objective	Outcomes
↙ To provide the acquaintance with concepts of inbuilt memory, I/O Ports ,timer, serial communication using 8051 ↙ To develop the 8051 based projects	A student who completes this course will be able to: 1. Understand & Learn concept of Architecture of 8051 µc 2. Apply the concept of programming language to interface I/O Devices 3. Establish the serial communication between the I/O Devices. 4. Design Data Acquisition System related to Industries

Unit I: (8 Hrs)
Overview of 8051 Microcontroller family, Introduction to MCS 51 family, Architecture, Memory organization, Internal RAM, Flag Register, Register Banks, SFRs , Functional pin description and various resources of MCS 51, Hardware Overview, Addressing modes, Instruction set and Assembly language programming Programs using look up table.

Unit II: (7 Hrs)
Loop, Jump and Call instructions, Bit manipulation, 8051 I/O programming, Delay Programs. I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming.

Unit III: (8 Hrs)
8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access, Timer programming in assembly and C: Various modes of operation, SFR related to timer operation.

Unit IV: (7 Hrs)
Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs. 8051 interrupts, Interrupts programming in assembly and C, programming timer interrupt, external interrupt, serial interrupt.

Unit V: (7 Hrs)
Interfacing and programming for LCD, Interfacing RTC, EEPROM using I2C Bus and programming.

Unit VI: (8 Hrs)
Interfacing of ADC, DAC, stepper motor and PS2 keyboard and programming

Text Books:
1) The 8051 Microcontroller and Embedded systems , Muhammad Ali Mazidi , J.G. Mazidi, 2nd edition Pearson Education, Prentice Hall of India.
2) 8051 Microcontrollers programming and practice By Mike Predcko.
3) The 8051 Microcontroller Architecture, programming and Applications By Kenneth Ayala, Penram India publication.
4) Advanced Microprocessors and Peripherals , A. K. Ray, K. M. Bhurchandi, Second edition, Tata McGraw Hill, 2000.

Reference Book:
1) Intel or Atmel MCS 51 Family Microcontrollers Data Sheets.

IV Semester
EE2254 - Lab. : Microcontroller & its Applications

Objective	Outcomes
↗ To provide the acquaintance with concepts of inbuilt memory, I/O Ports ,timer, serial communication using 8051 ↗ To develop the 8051 based projects	A student who completes this course will be able to: 1. Understand & Learn concept of Architecture of 8051 µc 2. Apply the concept of programming language to interface I/O Devices 3. Establish the serial communication between the I/O Devices. 4. Design Data Acquisition System related to Industries

Exp No	Name of Experiment
1	Add data bytes in an internal RAM.
2	Convert single digit Hex number to its ASCII equivalent
3	Find the maximum data byte in a block
4	Data block transfer.
5	Find three numbers of negative data bytes in a block.
6	Convert BCD to its binary equivalent.
7	Generate a saw tooth waveform using DAC.
8	Read Analog signal from channel 2 of ADC and store it to internal RAM.
9	Rotate stepper motor into clockwise and counter clockwise direction
10	Generate square waveform from pin no P 1.2 of 8051
11	Display character on LCD.

IV Semester
EE2255 - Analog Communication

Objective	Outcome
To Study different modulation techniques. To understand transmitter &receivers communication systems. To learn the concept of PPM, PAM, PWM & PCM. To learn basics of noise, types of noise & various propagation layers, spectrum of electromagnetic waves.	Students will be able to 1. Demonstrate and analyze various amplitude, angle modulation techniques. 2. Understand various types of receivers & noise in communication system and investigate noise parameters. 3. Understand pulse modulation & multiplexing techniques. 4. Apply the concept of Radiation & Propagation of waves to design communication system

UNIT-1: **(7 Hrs)**

Amplitude Modulation: Need for modulation, mathematical Analysis, modulation index, frequency spectrum, power requirement of AM, DSB-SC, Balanced Modulator for carrier suppression, SSB, Methods of SSB Generation, ISB, VSB transmissions, Generation of AM system.

UNIT-2: **(8 Hrs)**

Angle Modulation: Frequency Modulation (FM), mathematical Analysis, modulation index, frequency spectrum, power requirement of FM, narrowband & wideband FM, noise triangle in FM, pre-emphasis & de-emphasis techniques, phase modulation, noise reduction characteristics of angle modulation, FM Transmitter.

UNIT-3: **(8 Hrs)**

Receivers: Basic receiver (TRF), Super heterodyne receiver, performance parameters for receiver such as sensitivity, selectivity, fidelity, image frequency rejection etc., AM detectors, FM discriminators, AGC technique, double-spotting effect.

UNIT-4: **(8 Hrs)**

Noise: External Noise, internal Noise, Noise Calculations, Addition of Noise due to several sources, Addition of Noise due to several amplifiers in cascade, Noise in reactive circuits, Definition of Noise figure, signal to noise ratio, calculation of noise figure, Noise figure from equivalent resistance, Noise Temperature.

UNIT-5: **(8 Hrs)**

Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing, Pulse code modulation.

UNIT-6: **(8 Hrs)**

Radiation & Propagation of waves:-Fundamental of electromagnetic waves, propagation of waves- Ground wave, space wave and sky wave propagation, tropospheric scatter propagation, extraterrestrial communications.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Electronic Communication System	Gorge Kennedy	4th Edition, 1999	Tata McGraw-Hill
2	Digital and analog communication systems	K. Sam Shanmugam	5th Edition, 2003	John Wiley & Sons

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Electronic Communication Systems	Frank R. Dungan	Second Edition, 1993	Delmar Publishers
2	Communication Electronics	Louis Frenzel	Third Edition, 2007	McGraw-Hill

IV Semester
EE2256 - Lab. : Analog Communication

Objective	Outcome
↙ To Study different modulation techniques. ↙ To understand transmitter &receivers communication systems. ↙ To learn the concept of PPM, PAM, PWM & PCM. ↙ To learn basics of noise, types of noise & various propagation layers, spectrum of electromagnetic waves.	Students will be able to 1. Demonstrate and analyze various amplitude, angle modulation techniques. 2. Understand various types of receivers & noise in communication system and investigate noise parameters. 3. Understand pulse modulation & multiplexing techniques. 4. Apply the concept of Radiation & Propagation of waves to design communication system

Exp No	Name of Experiment
1	To study the Generation of Amplitude Modulation using transistor. Calculate modulation index for value of modulating amplitude.
2	To study the Generation of Amplitude Demodulation using Envelop Detector.
3	To study the Generation of Frequency Modulation using IC 8038 function generator.
4	To perform Frequency Demodulation using Foster Seeley Detector.
5	To perform DSB-SC using Ring Modulator.
6	Generation of Pulse Amplitude Modulation using IC 555 & IC 4016.
7	Generation of PWM signal using IC 555.
8	Generation of PPM signal using IC 555.
9	To perform Time Division Multiplexing (TDM).
10	To perform Amplitude Modulation using Simulink tool in MATLAB
11	To perform Frequency Modulation using Simulink tool in MATLAB

IV Semester
EE2257 - Electromagnetic Fields

Objective	Outcome
↗ To introduce students with different coordinate systems. ↗ To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems. ↗ To understand the basic laws applicable to electric and magnetic field. ↗ To expose the students to the ideas of electromagnetic waves.	After study through lectures and assignments, students will able to: 1. Define and recognize different co-ordinate systems, apply different techniques of vector calculus to understand concepts of electromagnetic field theory. 2. Determine the electromagnetic force exerted on charged particles, current elements, working principle of various electric and magnetic fields. 3. Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields in different media using the fundamental laws. 4. Deduce and justify the concepts of electromagnetic waves, means of transporting energy or information, in the form of radio waves.

Unit I: **(7 Hours)**
Orthogonal coordinate systems: Cartesian, Cylindrical, Spherical and Transformations, differential lengths, surfaces and volumes.

Unit II: **(7 Hours)**
Coulomb's law, Electric field Intensity for different charge distribution: Point, Line, Surface & Volume, Electric flux, Gauss's law and Application, Divergence, Maxwell's First equation (Electrostatics), The Divergence Theorem.

Unit III: **(7 Hours)**
Energy & Potential: Energy Expended in Moving a Point charge in an Electric Field, Definition of Potential Difference and Potential, Potential field of a point charge, Potential field of a System of charges: Conservative Property, Potential Gradient, The Dipole, Poisson's and Laplace's equation, Uniqueness Of Electrostatic solution.

Unit IV: **(8 Hours)**
Biot-Savart's law and its applications, Ampere's Circuital law and its applications, Curl, Stoke's Theorem, Magnetic flux and magnetic flux density, Faraday's law, displacement current, Maxwell's equations for static and time varying fields with physical significance.

Unit IV: **(7 Hours)**
Uniform plane wave, wave propagation in free space & dielectric, Poynting's Theorem and Wave Power, Propagation in Good Conductors: Skin Effect.

Unit VI: **(7 Hours)**
Reflection of uniform plane waves at Normal incidence, standing wave ratio, plane wave propagation in general directions, plane wave reflection at oblique incidence angles, Brewsters angle.

Text Books:

SNo	Title	Authors	Edition	Publisher
1	Engineering Electromagnetic	William H. Hayt,	7th Edition	Tata McGraw – Hill, 2006 reprint.
2	Electromagnetics	J D Kraus	3rd edition 1984	McGraw – Hill

Reference Books:

SNo	Title	Authors	Edition	Publisher
1	Electromagnetism: Theory and application	Ashutosh Pramanik	2nd edition august 2009	Prentice Hall
2	Elements of Electromagnetics	M. N. O. Sadiku	4th edition 2007	Oxford Press
3	Field and Wave Electromagnetics	David K. Cheng	Second Edition	Addison Wesley

IV Semester
EE2258 - Lab: Simulation Lab/Workshp Lab

Objective	Outcome
↙ To Acquaint Students with basic Electronics Workshop practices like, identification of components, operate and control various machines, repair, troubleshooting, and Circuit Design Methods. ↙ To create interest in Hardware Technology. ↙ Student will understand Project Implementation and testing with proper report writing.	Students Will able to 1. Identify different Electronics Components. 2. Do mini project to enhance their practical Knowledge. 3. Artwork, printing, Etching & drilling of PCB 4. Work in a teamwork

Exp No	Name of Experiment
1	Study of Passive Elements : Resistors, Capacitors, Inductors etc.
2	Study of Active Elements : Diodes, Transistors, Thyristors, Power Supplies etc.
3	Study of Electronic Transformers.
4	Study of Wires, Cables etc.
5	Study of Interconnect Components: Electromechanical Switches, Solid state relays, Optocouplers etc.
6	Study of Speakers and Microphones.
7	Study of Electronic Circuit Protection Components: Fuses, Circuit Breakers, Zener Diodes etc.
8	Electronics Mini Project : Selection, Estimation, PCB layout design, Fabrication, Soldering, Testing, Troubleshooting , Results , Report etc.
9	Interconnect components: Solid state Relays, Coaxial RF connectors, Mechanical switches for electronic Circuits.
10	Electronic Circuit Protection: Snubber Capacitor (IGBT Protection), Thermisters, Discrete Semiconductor, Over voltage Protection, Over Current Protection.
11	Study of LTCC (Low Temperature co -fired Ceramic Tapes, Niobium Oxide Capacitors, EDLC (Electronic Double Layer Carbon) Super Capacitors.
12	Study of Chip Resistors, Line feed Resistors (Surge Resistors Networks).

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

5th Semester

Electronics Engineering

V Semester

GE2311 - Fundamentals of Management

Objective	Outcomes Students will be able to
To introduce the fundamentals and legal provision of Management	Explain the Legal provision and Functions of Management.
To introduce the Human Resource and Financial practice of organization	Analyze the role of Human Resource and Financial Management in the organization.
To Introduce the Project Management	Analyze the project life cycles.
To provide knowledge of Marketing Activities of Management	Identify tools and techniques for the marketing of goods and services.

Unit – 1 - Principle of Management

Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership

UNIT-2: Legal Aspects of Management

The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company

UNIT-3: Human Resource Management

Human Resource Management-Meaning and Scope, Principles of HRD, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Grievance Redressal Procedure .

UNIT-4: Project Management

Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Tools and Techniques of Project Management, Network techniques - Introduction and Use of CPM &PERT for planning, SWOT Analysis, Project Risk Analysis, Project Control.

UNIT-5: Marketing Management

Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

V Semester
GE2311 - Fundamentals of Management

UNIT-6: Financial Management

Definition & Functions of Finance department, Sources of finance, Types of capital, Profit maximization vs. Wealth Maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

Text book and Reference

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

V Semester

EE2301 – Digital Signal Processing

Objective	Course Outcome
1. This course will provide solid foundations of discrete time signal processing fundamental concepts, Transform domain analysis, Mathematical analysis of FIR and IIR filter design.	**On completion of this course, the student will be able to** 1. Apply DFT and Z transform for the analysis of signals and systems 2. Construct and optimize structures for the realization of discrete Time system 3. Design of Analog and Digital Filters for given specifications 4. Understand fundamentals and architecture of DSP processor. 5. Simulation and verification of various transform techniques and filter Design

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Apply DFT and Z transform for the analysis of signals and systems	3	2	1	2	2									
CO 2	Construct and optimize structures for the realization of discrete Time system	3	3	1	2	2									
CO 3	Design of Analog and Digital Filters for given specifications	3	3	3	2	2									
CO 4	Understand fundamentals and architecture of DSP processor	2	2	1	1	1									
CO 5	Simulation and verification of various transform techniques and filter Design	2	2	2	2	2								2	2

V Semester

EE2301 – Digital Signal Processing

Unit No.	Contents	Max. Hrs.
1	Discrete Time(DT) Signals and System, Classification of DT signals, classification of DT systems, linear Convolution, Sampling and reconstruction.	7
2	Discrete Time Fourier Transform, Discrete Fourier Transform, Computation of DFT, Properties of DFT, convolution of data sequences, FFT algorithms, Decimation in time, Decimation in Frequency	7
3	Digital Filter structures: FIR digital filter structures, IIR digital filter structures, Lattice structures, Finite word length effect.	7
4	IIR Digital filter Design, Bilinear transformation, Impulse invariant transformation, Low pass IIR digital filters, Butterworth and Chebyshev filter.	7
5	FIR Digital Filter Design, FIR filter design using windowing techniques	7
6	Multirate Digital Signal processing fundamentals, sampling rate alteration, multirate structures, Decimator and Interpolator and Multistage design.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Discrete time signal processing	2nd edition, 1999	V. Oppenheim, R, W, Schafer	PHI
2	Digital signal processing – Principles, algorithms and applications	3rd Edition ,1996	J. G. Proakis, D. G. Manolakis	PHI

V Semester

EE2302 – Lab: Digital Signal Processing

Expt. No.	Name of Experiment
1	Sampling and reconstruction of signal using MATLAB
2	To generate and plot discrete time signals.
3	To perform operations on discrete time signals.
4	To compute convolution on discrete time signals.
5	To compute DFT and IDFT of discrete time signals.
6	To determine pole zero plot and inverse Z transform of a signal.
7	To design FIR and IIR filter using FDA Tool.
8	To illustrate signal processing application using SP Tool.
9	To perform upsampling and downsampling on discrete time signal.
10	To study of DSP Starter Kit (TMS 320C6XX DSK).

V Semester

EE2303 –Analog Integrated Circuits & Its Applications

Objective	Course Outcome
1. The objective of this course is to analyze and design a wide variety of operational amplifier / integrated circuits based applications and to have a firm grasp of basic principle of these to adapt to a changing technology as the new devices appear in the market	**On completion of this course,** 1. Student will acquire knowledge of the fundamentals, the different Parameters and internal structure of the operational amplifier. 2. Student will analyze and design the linear applications of the operational amplifier. 3. Students will analyze and design active Butterworth filters using operational amplifier 4. Student will analyze and design the non-linear applications of the operational amplifier.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Student will acquire knowledge of the fundamentals, the different Parameters and internal structure of the operational amplifier.	3													
CO 2	Student will analyze and design the linear applications of the operational amplifier.	2	3	3										2	
CO 3	Students will analyze and design active Butterworth filters using operational amplifier	1	3	3										2	
CO 4	Student will analyze and design the non-linear applications of the operational amplifier.	1	2	3										2	

V Semester
EE2303 –Analog Integrated Circuits & Its Applications

Unit No.	Contents	Max. Hrs.
1	Differential Amplifier, configurations, DC & AC Analysis of DIBO and DIUBO, Differential amplifier using swamping resistor, constant current bias, current mirror, cascaded differential amplifier. DC Level Shifter.	8
2	OPERATIONAL AMPLIFIER FUNDAMENTALS: Block Diagram of Op-AMP, Ideal Op-Amp, OPAMP parameters, Basic Op-Amp Configurations: Open loop, Feedback in OPAMP circuit: Inverting, Non-inverting, voltage follower. Compensation of error parameters :Input Bias and Offset Current, Input Bias and Offset voltages, frequency compensation.	7
3	LINEAR APPLICATIONS : Summing, difference amplifier, integrator, differentiator, Current-to-Voltage Converter, Voltage-to-Current Converter, Instrumentation Amplifiers, Instrumentation Applications, Transducer Bridge amplifiers.Precision Rectifiers, Log/Antilog amplifiers.	7
4	ACTIVE FILTERS: Transfer function, first order filter, Standard second order response, higher order filter, KRC Filters, Multiple feedback filters, second and higher order Butterworth filter design.	8
5	NONLINEAR CIRCUITS: Voltage Comparators, Comparator Applications, Peak Detectors, Schmitt Triggers: Inverting & Non-inverting, Sample-and-Hold Circuits, clipper, clamper, WAVEFORM GENERATORS: multivibrators, triangular wave generator, Sinusoidal Oscillators.	7
6	Phase Locked Loop IC565, Monolithic timer IC555, D-A AND A-D CONVERTERS: Performance Specifications of D-A Converters (DACs) and A-D Converters (ADCs), D-A Conversion Techniques, A-D Conversion Techniques.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Linear Integrated Circuits	3rd Edition	S. Salivahanan, V. S. Bhaaskaran	Tata McGraw Hill Publication
2	Op-amps and Linear Integrated Circuits	3rd Edition	RamakantA.Gayakwad,	Prentice Hall Publication

Reference Books

SN	Title	Edition	Authors	Publisher
1	Linear Integrated Circuits	3rd Edition	D. Roy Chaudhuri, Shail Jain	New Age International
2	Design with Operational Amplifiers and Analog Integrated Circuits	3rd Edition	Sergio Franco	McGraw-Hill

V Semester

EE2304 –Lab: Analog Integrated Circuits & Its Applications

Exp No.	Name of Experiment
1	Verify differential amplifier configurations DIBO and DIUBO using simulation.
2	Verify Gain relationship of Inverting and Non-inverting amplifier and plot frequency response of Non-Inverting amplifier and verify gain bandwidth relation. (Bread-Board and simulation)
3	Determine CMRR and Slew rate of OP-AMP and compare with theoretical values.(Bread-Board and simulation)
4	Verify gain relationship of Summer, Scalar and Subtractor circuits.(Bread-Board and simulation)
5	Determine cut-off frequencies f_a and $f_b$of Integrator using frequency response and verify input output waveforms.(Bread-Board and simulation)
6	Determine cut-off frequencies f_a and $f_b$ofDifferntiator using frequency response and verify input output waveforms.(Bread-Board and simulation)
7	Determine cut-off frequency of second order Butterworth Low pass filter using frequency response and verify order of filter from stop band of frequency response.(Bread-Board and simulation)
8	Determine cut-off frequency of second order Butterworth High pass filter using frequency response and verify order of filter from stop band of frequency response.(Bread-Board and simulation)
9	Verify Comparator operations using single supply op-amp configuration. (Bread-Board and simulation)
10	Verify VUT and VLT of Schmitt trigger using OP-AMP IC 741 and plot the hysteresis curve.(Bread-Board and simulation)
11	Determine frequency of operation and duty cycle of Astable Multivibrator using OP-AMP IC 741.(Bread-Board and simulation)
12	Determine frequency of operation and duty cycle of Astable Multivibrator using IC 555 and modify it for 50% duty cycle.(Bread-Board and simulation)
13	Design a Wein bridge oscillator and study its operation using 741 op-amp.(Bread-Board and simulation)
14	Verify the operation of Half wave and Full wave Precision Rectifier using OP AMP IC 741. (Bread-Board and simulation)

V Semester

EE2311 – PE I: Computer Communication Network

Objective	Course Outcome
1. To learn basics of data communication, wireless transmission, spread spectrum, medium access control- FDMA, TDMA & CDMA. 2. To study TCP/IP, ARP, RARP, UDP protocols & addressing. 3. To study network security & its applications.	**On completion of this course, Students will be able to** 1. Describe various protocols, models in Computer Networks 2. Compare Connectors, Network hardware, Media Types (cables, Wireless) 3. Design, implement and analyze simple computer networks. 4. Apply the different strategies and Operations of TCP/UDP, FTP, HTTP protocols

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe various protocols, models in Computer Networks	2	2												
CO 2	Compare Connectors, Network hardware, Media Types (cables, Wireless)	2	2												
CO 3	Design, implement and analyze simple computer networks	2	2												
CO 4	Apply the different strategies and Operations of TCP/UDP, FTP, HTTP protocols	2	2												

V Semester
EE2311 – PE I: Computer Communication Network

Unit No.	Contents	Max. Hrs.
1	Introduction, network and services: communication network, approaches to network design, types of network, two stage and three stage network. Uses of computer networks, LAN, MAN, WAN, design issues for layers, connection oriented and connectionless services, service primitives, Application and layered architecture, OSI reference model.	8
2	LAN network and medium access layer: LAN structure, random access, multiple access protocols, IEEE standard 802 for LAN and MAN, high speed LANS, repeaters, hubs, bridges, fast Ethernet, Wireless LAN	7
3	Physical layer and data link layer: transmission media, PSTN. Data link layer design issues, error detection and correction methods, elementary data link protocols, sliding window protocols.	8
4	Network layer and transport layer: Network layer design issues, routing, congestion, internetworking, transport layer design issues, transport service primitives, internet transport protocol, TCP/IP architecture, TCP/IP protocol, IP packets, IP addressing, TCP/IP utilities ,wireless TCP and UDP, routers and gateways	7
5	Application layer: Network security cryptography, secrete key, public key, digital signature, domain name system, electronic mail system	8
6	Multimedia, real time transport protocol, e-mail security, web security, communication security, electronic mail, world wide web.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Computer Networks	3rd Edition,1996	Tanenbaum	Prentice Hall
2	Data Communications and Networking	4th edition, 2007	Behrouz a Forouzan	Tata Mc. Graw Hill

Reference Books

SN	Title	Edition	Authors	Publisher
1	Data and Computer Communication	8th Edition,2006	W. Stallings	Prentice Hall
2	Telecommunication switching systems and networks	2004.	T. Vishwanathan	Prentice Hall

V Semester
EE2312 – Lab: PE I: Computer Communication Network

Expt. No.	Name of Experiments
1.	To perform stuffing and de-stuffing operation on a given array.
2.	To Perform data encryption and data decryption.
3.	Perform network utility commands.
4.	How to bring two computers in a network.
5.	To study LAN structures.
6.	To configure DNS server.
7.	To configure DHCP server.
8.	Write a program for simple stop n wait protocol.
9.	Write a program for go back n protocol.
10.	Write a program for selective repeat ARQ protocol.

V Semester

EE2313 – PE I: Embedded Systems

Objective	Course Outcome
To provide the acquaintance with 1. Concept of RISC processor, coprocessor, bus structure, memory management. 2. Concept of RTOS &different communication protocols	**On completion of this course, Students will be able to** 1. Understand & Learn concept of Architecture & organization of ARM. 2. Understand & Learn concept of RTOS Architecture. 3. Apply the concept of programming language to interface I/O Devices. 4. Establish the communication between the different Devices.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand & Learn concept of Architecture & organization of ARM.	3	3	3											
CO 2	Understand & Learn concept of RTOS Architecture	2	3	3											
CO 3	Apply the concept of programming language to interface I/O Devices.	1	2	3											
CO 4	Establish the communication between the different Devices	1	2	3											

V Semester
EE2313 – PE I: Embedded Systems

Unit No.	Contents	Max. Hrs.
1	Introduction to ARM, Advantages of architectural features of ARM Processor, Processor modes, Register organization, Exceptions and its handling, 3/5- stage pipeline ARM organization	7
2	ARM and THUMB instruction sets, ARM programmer's model, addressing modes, Instruction set in detail and programming, data processing instruction, data transfer instruction, Control flow instructions, simple assembly language programs.	8
3	ARM assembly language programs and C language programs. Code conversion programs.	7
4	LPC 2148 architecture block diagram , pins and signals. GPIO, I / O Interfaces like LED and Switch and their Programs.	7
5	Display interfacing with LPC 2148. 7segment display interfacing. LCD interfacing and programs.	8
6	LPC 2148 TIMER and PWM Applications. Embedded ARM applications	7

Text Books

SN	Title	Edition	Authors	Publisher
1	ARM System–on-chip Architecture	2nd edition, 2000	Steve Furber	Pearson Education Asia
2	Embedded Linux, Hardware, Software and interfacing	2002.	Craig Hallabaugh	Addison-Wesley Professional
3	ARM System Developer's Guide: Designing and Optimizing	2005	Sloss Andrew N, Symes Dominic & Wright Chris	Morgan Kaufman Publication

Reference Books

SN	Title
1	Technical references on www.arm.com.
2	Web base resources for RTOS and µCOS.

V Semester
EE2314 – Lab: PE I: Embedded Systems

Expt. No.	Name of Experiment (Any Ten)
1	To swap data byte
2	To perform addition, subtraction of 16 bit number
3	To find larger of a two numbers.
4	To perform factorial of a given number
5	To perform ON/OFF LED and show status of LED on LCD
6	To display number from 0 to 9 on seven segment display.
7	To ON/OFF LED using Switch.
8	To rotate a stepper motor in clockwise & anti-clock wise direction with equal delay.
9	Perform experiment on DAC of LPC2103
10	ADC and display value on LCD.
11	To find 1's complements of a given number.
12	Study of RTOS
13	device driver for UART.
14	Modify scheduler in such a way that it will assign highest priority to keypad.
15	values from RTC and display on LCD.
16	SMS to any mobile number.
17	Interface pen drive for writing predefined file.

V Semester

EE2315 – PE I: Algorithm & Data Structure

Objective	Course Outcome
1. To Study different Programming Aspect 2. To understand performance of System as per Time and Space Trade-off 3. To learn the various data structures	**On completion of this course, Students will be able to** 1. Study the trade off method Demonstrate and analyze various techniques. 2. Demonstrate various operation on data Structure 3. Understand various types Data Structure 4. Implement various types algorithm and analyze performance of system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Study the trade off method Demonstrate and analyze various techniques.	3	3	1	1	1									
CO 2	Demonstrate various operation on data Structure	3	3	3	3	2									
CO 3	Understand various types Data Structure	3	3	3	3	3									
CO 4	Implement various types algorithm and analyze performance of system.	3	2	3											

V Semester
EE2315 – PE I: Algorithm & Data Structure

Unit No.	Contents	Max. Hrs.
1	Introduction to Algorithms, Basics of Algorithm, Sub Algorithms, Procedures and Functions, Analysis of Algorithms, Time and Space Complexity, Programming aspects with respect to structured programming, Top down and bottom Up Approach	7
2	Arrays, Operations, Types, Representation of 1D, 2D arrays in memory, Sparse Matrices, Sorting, Quick Sort, Merge Sort, Insertion, Radix, Selection and Bubble Sort, Heap Sort, Searching , Linear, Binary Search, Hashing and collision Handling mechanism.	8
3	Stack , Fundamentals, Operations, Push , Pop , Applications of Stacks, Evaluation of Expressions, Recursion, Stack Machines and Multiple Stacks, Queues , Operations, Add , Delete, Types of Queues , Priority Queues, Circular Queue, Dequeue	7
4	Fundamentals of singly, Doubly, Circular, Linked Stacks and Queues, Examples of Linked List, Circular Linked List, Doubly Linked List and Dynamic Storage Management, Garbage Collection, Compaction and Applications of Linked List, Operations of Polynomials, Generalized Linked List.	8
5	Basic Terminology , Binary Tree Traversals, Threaded Storage Representation, Binary Search Tree, Applications of Tree, Preliminary Treatment of AVL Trees, B-Trees, B+ Trees	7
6	Basic Terminology, Graph Representation, Matrix, List, Multi-List, Graph Traversals, Breath First Search, Depth First Search, Minimum Cost Spanning Trees, Shortest Path Algorithm, Topological Sort, Critical Path.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Data Structures and Program, Design in C	Second Edition	Kruse, Leung and Tondo	PHI
2	Fundamentals of Data Structures	Fifth Edition	Ellis Horowtiz and Sartaj Sahani	Galgotia,Publications

Reference Books

SN	Title	Edition	Authors	Publisher
1	An Introduction to Data Structures with Applications	Second Edition	Tremblay & Sorenson	TMH
2	Data Structures, Schuam Series,	Fifth Edition	Seymour Lipschutz, G.A. V. Pai,	TMH

V Semester

EE2316 – Lab: PE I: Algorithm & Data Structure

Expt. No.	Name of Experiment (Any Ten)
1	Write a program on control Structure & Statements
2	Write a program on If –else structure
3	Write a program on Case Statement
4	Write a program on Functions
5	Write a program on Macros
6	Write a program on Pointers
7	Write a program on Structures
8	Write a program on Linked List
9	Write a program on Doubly linked list
10	Write a program on graphs
11	Write a program on Trees
12	Write a program on Search Algorithms
13	Write a program on Stacks

V Semester
EE2317 – PE I: Applied Machine Learning

Objective	Course Outcome
Students should be able to 1. Understand the concepts of machine learning and regression models 2. Understand the concept of classification for model evaluation. 3. Learn Supervised and unsupervised learning algorithms. 4. Learn the concept of artificial neural network and deep networks	1) Apply the knowledge of Mathematics and programming to build machine learning models 2) Analyze different use cases to evaluate the performance of the models 3) Design and develop application models using supervised and unsupervised learning algorithms 4) Compare different machine learning techniques and demonstrate the comprehension of the trade-offs involved in design choices

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Apply the knowledge of Mathematics and programming to build machine learning models	3	3	1	1	1	-	-	-	-	-	-	3	-	-
CO 2	Analyze different use cases to evaluate the performance of the models	3	3	3	2	3	-	-	-	-	-	-	3	-	-
CO 3	Design and develop application models using supervised and unsupervised learning algorithms	**3**	**3**	**3**	**2**	**3**	**2**	**-**	**2**	**-**	**1**	**-**	**2**	**-**	**-**
CO 4	Compare different machine learning techniques and demonstrate the comprehension of the trade-offs involved in design choices	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**2**	**-**	**1**	**-**	**2**	**-**	**-**

V Semester
EE2317 – PE I: Applied Machine Learning

Unit No.	Contents	Max. Hrs.
1	Supervised and Unsupervised Learning, Regression, Model and Cost Function, Gradient Descent, Multivariate Linear Regression, Feature Scaling, Gradient Descent for multivariable	6
2	Classification, Hypothesis Representation, Decision Boundary, Cost function and Gradient Descent, Multi-classification, Regularization, Model Evaluation	6
3	KNN, SVM, Decision tree,Naive Bayes Classifiers, Random Forest	6
4	K-means clustering, Hierarchical Clustering, DBSCAN Clustering, PCA, Anomaly Detection, Recommender System	6
5	Introduction to neural network, Activation Functions, Perceptron rule, Backpropagation	6
6	Introduction to deep learning, building blocks of CNN, Computational Complexity, Lenet, Alexnet, **New topics to be announced time to time.**	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Understanding Machine Learning. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/copy.html	2017	Shai Shalev-Shwartz and Shai Ben-David.	Cambridge University Press.
2	The Elements of Statistical Learning. https://web.stanford.edu/~hastie/ElemStatLearn/	2009	Trevor Hastie, Robert Tibshirani and Jerome Friedman.	Second Edition
3	Pattern Recognition and Machine Learning. https://www.microsoft.com/en-us/research/people/cmbishop/downloads/	2006	Christopher Bishop.	Springer

Reference Books

SN	Title	Edition	Authors	Publisher
1	Foundations of Data Science.	2017	Avrim Blum, John Hopcroft and Ravindran Kannan.	
2	Learning, Part II, http://www.deeplearningbook.org/	2016	Goodfellow, I., Bengio, Y., Courville, A.	MIT Press
3	Machine Learning: A Probabilistic Perspective	2012	Kevin P. Murphy	MIT Press

V Semester
EE2318 – Lab: PE I: Applied Machine Learning

Expt. No.	Name of Experiment
1.	Data Pre-processing and cleaning
2.	Linear Regression
3.	Non Linear Regression
4.	K-Nearest Neighbours
5.	Decision Tree
6.	Support Vector Machine
7.	K-Means Clustering
8.	Hierarchical Clustering
9.	Content based Recommendation System
10.	Collaborative filtering Recommendation System

V Semester
EE2331 – OE I: Fuzzy Logic & Neural Network

Objective	Course Outcome
1. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. 2. Introduce students to artificial neural networks and fuzzy theory from an engineering perspective	**On completion of this course, Students will be able to** **CO1:** Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks. **CO2:** Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches **CO3:** Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks **CO4:** Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks.	3	2	1	-	1	1	1	2	1	1	-	1	-	-
CO 2	Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches	3	3	3	2	2	1	1	2	1	1	-	1	3	-
CO 3	Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks	3	3	3	3	2	2	1	2	2	2	1	3	3	-
CO 4	Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.	3	3	3	3	2	2	1	2	2	2	2	3	3	-

V Semester

EE2331 – OE I: Fuzzy Logic & Neural Network

Unit No.	Contents	Max. Hrs.
1	Crisp sets: An overview, Fuzzy sets: Basic types, basic concepts, basic properties of α-cuts, representation of fuzzy sets, and extension principle of fuzzy sets	8
2	Operations on fuzzy sets, Fuzzy numbers, Arithmetic operations on intervals, arithmetic operations on fuzzy numbers, fuzzy equations	7
3	Fuzzy controllers: an overview with applications, applications of fuzzy logic	7
4	Fundamental concepts of ANN: Basic building blocks of artificial neural networks, network architectures, activation functions, McCulloch-Pitt's neuron model, Learning rules: Hebbian learning rule, Perceptron learning rule, Delta learning (Widrow- Hoff and LMS)rule, Competitive learning rule, Boltzmann learning	8
5	Brief introduction to single layer and multilayer perceptions, ADALINE and MADALINE, feed-forward networks, back propagation networks and applications.	8
6	Radial basis function network, Self organizing feature map and applications	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Fuzzy sets and Fuzzy logic	2008	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks: A comprehensive Foundation'	2nd Edition, 2005	Simon Haykin	Pearson publications

Reference Books

SN	Title	Edition	Authors	Publisher
1	Fuzzy sets: Uncertainty & information	1988	Klir and Folger	PHI
2	Introduction of Artificial Neural Networks	1999	Jacek Zurada	Pws Pub Co
3	Fuzzy Logic with engineering applications,	3rd Edition	Timothy Ross,	Wiley Publication
4	Principles of Soft Computing	2nd Edition	S. N. Sivanandanam and S. N. Deepa,	Wiley Publication

V Semester
EE2332 – OE I: Basics of Analog and Digital Communication Systems

Objective	Course Outcome
1. To Study different analog and digital modulation techniques. 2. To understand transmitter & receivers in communication systems	**On completion of this course, Students will be able to** 1. Understand different modulation and demodulation schemes for analog communication with the concept of noise 2. Understand different pulse analog and digital modulation techniques. 3. Understand different digital modulation schemes 4. Understand the different coding techniques for communication systems.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand different modulation and demodulation schemes for analog communication with the concept of noise	2	1												
CO 2	Understand different pulse analog and digital modulation techniques.	2	1												
CO 3	Understand different digital modulation schemes	2	1												
CO 4	Understand the different coding techniques for communication systems	2	1												

V Semester

EE2332 – OE I: Basics of Analog and Digital Communication Systems

Unit No.	Contents	Max. Hrs.
1	Basic block diagram of Analog communication system, Modulation techniques: Need for modulation, Basic concepts of AM, FM, PM, Transmitters.	8
2	Receivers: Basic receiver (TRF), Super heterodyne receiver, AM detectors, FM Detectors, Noise Types of Noise, Definition of Noise figure, signal to noise ratio, calculation of noise figure.	7
3	Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing, Basic digital Modulation System- PCM.	7
4	Channel capacity, DPCM, Delta Modulation, ADM, ADPCM, Adaptive sub-band coding, applications.	8
5	Digital Modulation techniques: ASK, FSK, PSK, BPSK, QPSK, MSK, DPSK, BFSK, M-ary PSK, FSK, and QAM.	8
6	Source coding and channel coding, Information theory, Huffman coding, LZ coding, Basic concept of convolution code.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Electronic Communication System	Fourth Edition,	Gorge Kennedy	Tata McGraw-Hill
2	Digital Communications	1999	SymonHykin	Wiley, 1988

Reference Books

SN	Title	Edition	Authors	Publisher
1	Electronic Communication Systems	Second Edition, 1993	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition, 2007	Louis Frenzel	McGraw-Hill
3	Digital and analog communication systems	Fifth Edition,2003	K. Sam Shanmugam	John Wiley & Sons

V Semester
EE2333 – OE I: Biomedical Instrumentation

Objective	Course Outcome
1. This course is intended for introducing the students to evolution and development of biomedical instrumentation. 2. The purpose of this course is to develop a strong foundation of use of transducers in biomedical measurements. 3. Understand concepts of working principle of various biomedical instruments and analysis their output graphs like ECG,EEG,EMG, X-rays, plethys mograph and spirogyra 4. Understand the fundamentals of Telemedicine like Teleradiology, Telecardiology, Telepsychiatry and Medical Informatics	**On completion of this course, Students will be able to** 1. Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation 2. Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram 3. Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care. 4. Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation	3	2	1		1									
CO 2	Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram	3	2	1		1									
CO 3	Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care.	3	2	1		1									
CO 4	Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.	3	2	1		3									

V Semester
EE2333 – OE I: Biomedical Instrumentation

Unit No.	Contents	Max. Hrs.
1	Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.	8
2	Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers	7
3	The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers	7
4	Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG	8
5	Patient care and monitoring, the elements of intensive care monitoring , instrumentation for monitoring patient, pacemakers, defibrillators. Physiological effects of electrical current, shock hazards from electrical equipments.	8
6	Telemedicine concept, Telemedicine applications, video conferencing, digital communication in telemedicine Teleradiology, Tele Cardiology, Telepsychiatry.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Biomedical Instrumentation & Measurement	19 Jan 2010	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	Prentice Hall
2	Biomedical Instrumentation	1 Jan 2010	Mandeep Singh	Prentice Hall

Reference books:

1	Handbook of Biomedical Instrumentation	1987	R.S.Khandpur	TMH
2	Bioelectronics Measurement	1983	Dean A Dmane, David Michaels	Prentice Hall
3	Medicine and Clinical Engineering	1 August 2008	Jacobson and Webster	PHI

V Semester
EE2341 – OE II: Data Acquisition & Signal Conditioning

Objective	Course Outcome
The course gives an overview about the data acquisition methods, to acquaint students with ADCs and DACs and various data acquisition techniques	After study through lectures and assignments, Students will be able to: 1. Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning 2. Identify the various types of data acquisition hardware and the serial data communication standards. 3. Distinguish different standards for connection of different programmable instruments like GPIB and SCPI 4. Define use of Ethernet, Medium Access control and USB

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning	3	2	2											
CO 2	Identify the various types of data acquisition hardware and the serial data communication standards	2	1	1											
CO 3	Distinguish different standards for connection of different programmable instruments like GPIB and SCPI	3	2	1											
CO 4	Define use of Ethernet, Medium Access control and USB	3	2	1											

V Semester

EE2341 – OE II: Data Acquisition & Signal Conditioning

Unit No.	Contents	Max. Hrs.
1	Definition of data acquisition and control, Fundamentals of data acquisition, Signal conditioning, Data acquisition and control system configuration, Computer plug-in I/O, Distributed I/O, Stand-alone or distributed loggers/controllers, Analog and digital signals: Classification of signals, Sensors and transducers, Transducer characteristics, Resistance temperature detectors (RTDs), Thermistors, Thermocouples, Strain gauges, Wheatstone bridges.	8
2	Signal conditioning: Types and classes, Field wiring and signal measurement, Noise and interference, Minimizing noise, Shielded and twisted-pair cable.	7
3	Plug-in data acquisition boards, A/D Boards, Single ended Vs differential signals, Resolution, dynamic range and accuracy of A/D boards, Sampling rate and the Nyquist theorem, Sampling techniques, D/A boards, Digital I/O boards.	7
4	Serial data communications, Transmission modes – simplex and duplex, RS-232-C interface standard, RS-485 interface standard, Comparison of the RS-232 and RS-485 standards, Serial interface converters, Protocols, Error detection.	8
5	IEEE 488 Standard, Introduction, Electrical and mechanical characteristics, Physical connection configurations, Device types, Bus structure, GPIB handshaking, Device communication, Requirements of IEEE 488.2 controllers, Standard commands for programmable instruments (SCPI).	8
6	Ethernet and field buses for data acquisition, Physical layer, Medium access control, Difference between 802.3 and Ethernet, The universal serial bus (USB), USB overall structure, Topology.	7

Text books:

SN	Title	Edition	Authors	Publisher
1	Data Acquisition for Instrumentation and Control Systems	10 June 2003	John Park and Steve Mackay	Elsevier

Reference books:

SN	Title	Edition	Authors	Publisher
1	Electronic Analog Digital Conversion	1st Edition	H. Schmid	Tata McGraw Hill
2	Data Converters	1st Edition , 1993	B. S. Sonde	Tata McGraw Hill

V Semester
EE2342 – OE II: Microprocessor Programming

Objective	Course Outcome
▪ To understand the architecture, programming and addressing modes of Intel 8085 ▪ To study the instruction set and programming of 8085 ▪ To understand various interfacing of devices for various applications.	Students 1. Will be able to understand the architecture of 8085. 2. Will demonstrate the ability to identify, Formulate and design Program for an assigned task. 3. Will be able to interface Peripheral devices. 4. Will apply the knowledge of microprocessor in their respective field.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Will be able to understand the architecture of 8085.	3	3	3	3										
CO 2	Will demonstrate the ability to identify, Formulate and design program for an assigned task.	2	3	3	2										
CO 3	Will be able to interface Peripheral devices	1	2	3	1										
CO 4	Will apply the knowledge of microprocessor in their respective field.	1	2	3	1										

V Semester
EE2342 – OE II: Microprocessor Programming

Unit No.	Contents	Max. Hrs.
1	Concept of bit, byte & word, Micro Computer organization with I/O devices and memory. Microprocessor, address, data & control bus, RAM / ROM memory.	8
2	Architecture of 8085 Intel microprocessor, Flag Register ,Addressing mode, pins diagram of 8085, Demultiplexing of Address & Data Bus, Generation of various control signals for I/O & Memory Organization	7
3	Basic Instruction set, Subroutine instructions like CALL, PUSH, POP, XTHL instructions and their uses,Programs based on instructions.	7
4	Delay Program,Memory Interfacing - ROM, RAM With 8085, Absolute and Linear decoding techniques.	8
5	MICROPROCESSOR APPLICATIONS - Programmable peripheral IC (8255)- Pin functions, Different Modes & Block Diagram, ADC interfacing , DAC interfacing .	8
6	USART 8251, PIT 8253, Interrupt Structure, Interrupt Controller 8259	7

Text books:

SN	Title	Edition	Authors	Publisher
1	Microprocessor Architecture ,Programming& Interfacing 8085	1 Dec 2000	Ramesh Gaonkar	Penram Publication

Reference books:

SN	Title	Edition	Authors	Publisher
1	8085 Microprocessor	2014	Ajit Pal	Tata Mc-Graw Hill ,
2	Microprocessors & interfacing	2005	D. V. Hall	Tata McGraw-hill

V Semester
EE2343 – OE II: Consumer Electronics

Objective	Course Outcome
➢ To give knowledge and competencies regarding consumer electronic equipments.	Students will be able to 1. Understand the knowledge of the safety aspects in the field of Electrical and Electronics products. 2. Analyze the basics of Audio and Video Systems. 3. Know about recent trends in Processors and computer peripherals, mobile and wireless technologies. 4. Understand the basics of refrigeration cycle and cooling system.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Will be able to understand the architecture of 8085.	3	3	3	3	3									
CO 2	Will demonstrate the ability to identify, Formulate and design program for an assigned task.	2	3	3	2	2									
CO 3	Will be able to interface Peripheral devices	1	2	3	1	1									
CO 4	Will apply the knowledge of microprocessor in their respective field.	1	2	3	1	1									

V Semester
EE2343 – OE II: Consumer Electronics

Unit No.	Contents	Max. Hrs.
1	Standards and Safety norms:Electronics and Electrical safety norms and standards, Electronic products covered under compulsory registration	8
2	Audio Systems: Sound Recording and reproduction, Hi-Fi Sound System, Audio Mixers, Graphics Equalizers, Public Address System.	7
3	Video Systems:Color fundamentals, Luminance and Chrominance signal , Color camera, digital television systems.	7
4	Wireless Technology & Mobile phones:Mobile Phones, various wireless technologies, Introduction to 3G, WiFiTechnology, GSM	8
5	Air conditioner and Refrigerators:Fundamentals, Refrigeration cycles, compressors, home automation	8
6	Computers:Recent microprocessor, Pentium family architecture and salient features , Recent Memories technologies (RAM, HDD), Computer peripherals	7

Text books:

SN	Title	Edition	Authors	Publisher
1	Consumer Electronics	First Edition	S.P. Bali	Pearson Education
2	Consumer Electronics",	2000	B. R. Gupta, Vandana Singhal	S. K. Kataria& Sons,

V Semester

EE2310 – Industry Visit and its Report

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology
SoE & Syllabus 2020
6th Semester
Electronics Engineering

VI Semester
GE2312 - Fundamental of Economics

Objectives	Outcome (Students will be able to)
Recognizes consumer's behavior and pricing.	Relate their buyer behaviour to particular product and the pricing in the market.
Extrapolates an operations in market with productions constrain.	Examine and classify various market structure and factors of production and its role in production process.
Describes the national income accounting and public finance.	Analyse the national income accounting and the various issues related to banking, taxation, and inflation.
Interprets international trade and institutions.	Elaborate about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institutions.

UNIT-1: Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, exceptions to law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, exception to law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. **(8 Hours)**

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation. **(6 Hours)**

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination. **(7 Hours)**

UNIT-4: National income accounting:
Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation. **(5 Hours)**

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (GST, Import duties), Revenue and capital expenditure.

(7 Hours)

VI Semester
GE2312 - Fundamental of Economics

UNIT-6: International Trade and Institutions

Definitions of closed vs. open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions. **(5 Hours)**

Text Books:

1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher, 2007

Reference Books:

1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

VI Semester
EE 2351- Control System Engineering

Objective	Outcome
This is a first course in feedback control of dynamic systems. The main goal is to introduce and familiarize students with dynamic systems modeling and analysis techniques that can be employed on a large variety of engineering systems. Being an interdisciplinary course, students will learn: 1 the role of a control engineer in multi-disciplinary teams. 2 to apply the knowledge gained in basic mathematics, physical sciences and engineering courses to derive mathematical models of typical engineering processes. 3 to use transfer function and state space models for control system analysis in time and frequency domain. 4 the importance of stability in control systems and the various methods to determine it. 5 to construct root locus plot and frequency response plots such as polar plot, Bode plot, Nyquist plot etc.	Upon successful completion of this course, students should be able to: 1. Understand the use of block diagram and signal flow graph as a modeling tool and the role of feedback in control systems. 2. Understand the response characteristics of basic first- and second-order dynamic systems. Be able to use Routh's criterion for absolute and relative stability analysis. 3. Construct and recognize the properties of root-locus and its role in the analysis of control systems. 4. Obtain frequency response indices. Be able to draw frequency response plots such as polar plot, Bode plot etc.

Unit I: Introduction to Control Systems:
History of control system, Basic Components of Control System. Open loop control and close loop control with examples. Classification of control systems**, Transfer function, block Diagram and signal flow graph:**-Transfer function and gain. Order of a system. Block diagram algebra & reduction techniques Signal flow graph, its constructions and Mason's gain formula.

Unit II: Mathematical modeling of physical system:
Mathematical modelling of physical system such as –electrical, mechanical, electro-mechanical, thermal, hydraulic, pneumatic etc., Analogous systems,**Characteristics of Feedback Control Systems:** Effect of negative feedback compared to open loop system such as –sensitivity to parameter variation. sensitivity to parameter variation such gain and forward path, Speed of time response, bandwidth, and disturbance rejection., Linearizing effect, Effect of positive feedback.

Unit III: Time Domain Analysis of Control Systems:
Concept of transient response, Steady state response, time response, standard test signals, Time response of first order systems, Transfer function of second order system, Time response of second order system, Time response specifications of second order system, steady state error (ess) analysis, static error constants and system type, dominant poles. Relation between roots of characteristic equation, damping ratio and transient response.

Unit IV: Stability of Linear Control Systems:
Concept of stability, stable, unstable and marginally stable system, Absolutely stable and conditionally stable system, Necessary conditions for stability, method to determine stability, Routh-Hurwitz stability criterion with special cases, relative stability analysis, Routh-Hurwitz stability criterion with special cases, relative stability analysis. State Variable Analysis.

VI Semester
EE 2351- Control System Engineering

Unit V: Root Locus Technique:
Definition, magnitude and angle criteria, properties of root locus, construction rules, for root locus plot of negative feedback systems, determining the gain from root locus plot, effect of addition of poles and zeros of G(s) H(s).

Unit VI: Frequency domain analysis of control systems:
Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, and correlation between time and frequency response, polar plot, Bode plot, all pass and minimum, log magnitude verses phase plot. **Stability in Frequency domain:**Nyquist stability criteria, concept of gain margin and phase margin and its computation using polar plot and log magnitude verses phase plot. **Lag, lead and lag-lead compensation**

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Control system engineering	5th Edition	I. J. Nagrath& M. Gopal	New Age International
2	Automatic control systems	7thEdition	B. C. Kuo	PHI Learning Private Limited
	Modern control engineering	5th Edition	Katsuhiko Ogata	PHI Learning Private Limited

VI Semester
EE2352- Transmission Lines and Wave Guides

Objective	Outcome
➢ To enable the students, to have a fair knowledge about the theory and problems of EM wave transmission through waveguides and transmission line. ➢ To lay a strong foundation on the theory of transmission line. ➢ To avail deep knowledge and mathematical analysis of Radiation of EM wave, Classification of different types of waveguides and their characterization.	After the completion of course students will able to, 1. Explain fundamental parameters of transmission line and its constraints in high frequency transmission of information. 2. Make use of Transmission line to develop impedance matching networks and any communication system. 3. Relate the propagation characteristics of electromagnetic waves in various wave guide structures. 4. Analyze transmission line using Smith Chart and Design Impedance Matching network.

UNIT-1:
TRANSMISSION LINE THEORY :Different types of transmission lines , Definition of Characteristic impedance ,The transmission line as a cascade of T-Sections Definition of Propagation Constant, General Solution of the transmission line , The two standard forms for voltage and current of a line terminated by an impedance , physical significance of the equation and the infinite line , The two standard forms for the input impedance of a transmission line terminated by an impedance , meaning of reflection coefficient , wavelength and velocity of propagation.

(8 Hours)

UNIT-2:
Waveform Distortion: Distortion less transmission line, The telephone cable, Inductance loading of telephone cables, Input impedance of lossless lines – reflection on a line not terminated by Zo, Transfer impedance reflection factor and reflection loss, T and ∏ Section equivalent to lines.

(7 Hours)

UNIT-3
LINE AT RADIO FREQUENCIES: Standing waves and standing wave ratio on a line , One eighth wave line , The quarter wave line and impedance matching , the half wave line, The circle diagram for the dissipation less line , The Smith Chart , Application of the Smith Chart , Conversion from impedance to reflection coefficient and vice-versa. Impedance to Admittance conversion and vice versa, Input impedance of a lossless line terminated by impedance, single stub matching and double stub matching.

(8 Hours)

UNIT-4:
GUIDED WAVES: Waves between parallel planes of perfect conductors, Transverse electric and transverse magnetic waves, characteristics of TE and TM Waves, Transverse Electromagnetic waves, Velocities of propagation, component uniform plane waves between parallel planes, Attenuation of TE and TM waves in parallel plane guides, Wave impedances.

(7 Hours)

UNIT-5
RECTANGULAR WAVEGUIDES: Transverse Magnetic Waves in Rectangular Wave guides ,Transverse Electric Waves in Rectangular Waveguides ,characteristic of TE and TM Waves , Cutoff wavelength and phase velocity , Impossibility of TEM waves in waveguides , Dominant mode in rectangular waveguide ,Attenuation of TE and TM modes in rectangular waveguides , Wave impedances , characteristic impedance ,Excitation of modes.

(8 Hours)

VI Semester
EE2352- Transmission Lines and Wave Guides

UNIT-6:

CIRCULAR WAVE GUIDES AND RESONATORS: Bessel functions, Solution of field equations in cylindrical co-ordinates , TM and TE waves in circular guides wave impedances and characteristic impedance ,Dominant mode in circular waveguide ,excitation of modes.

(7 Hours)

Text books:				
1	Networks, Lines and Fields	2003	J.D.Ryder	PHI
2	Electro Magnetic Waves and Radiating System	2003	E.C. Jordan and K.G.Balmain	PHI
3	Transmission lines and wave guides	2003	L.Ganesan,S.S.Sreeja Mole	PHI

VI Semester
EE2353- Digital Communication

Objective	Outcome
➢ This course provides compressive coverage of digital communication systems and understanding of the operation of digital modulation schemes.	A student who completes this course will be able to: 1. Learn pulse modulation & discuss the process of sampling, quantization & coding that is fundamental to the digital transmission of analog signals. 2. Understand fundamental concepts & limits in information theory in the context of digital communication theory/ 3. Analyze mathematical model of digital communication systems. 4. Apply error control coding techniques at the receiver.

Unit I: PCM, DM, ADM, DPCM, sub-band and transform coding, model based speech coding like LP coding, CELP coding.

Unit II: Introduction to information theory, entropy, Huffman, Prefix code, and L-Z encoding algorithm, Rate distortion theory for optimum quantization.

Unit III: Gram-Schmitt procedure, Signal space representation of baseband and modulated signals, line coding and baseband digital transmission, Error probability and optimum receivers for AWGN channels, Matched filters.

Unit IV: Digital Modulation techniques, Transmitter, Receiver and signal space representation of BPSK, BFSK,QPSK Introduction to TDM,FDM.

Unit V :Channel capacity Review of channel coding, Linear block codes, cyclic codes, convolution, encoding and decoding, distance properties, Viterbi algorithm and Fano algorithm. Trellis coded modulation methods

Unit VI: Study of PN sequences, direct sequence methods, Frequency hop methods, digital spread spectrum, slow and fast frequency hop, performance analysis, synchronization methods for spread spectrum. Application of spread spectrum, CDMA.

Text books:

1	Digital communication	3rd Edition, 2004	John G Prokis	Springer publication
2	Digital communication	2nd Ed, 2002.	Simon Haykin	John Wiley & sons

Reference books:

1	Modern Communication systems (Principles and application)	6th Edition, 2002	Leon W. Couch	Pearson
2	Digital Communication	5th Edition, 2003.	ShanmughamK.Sam	John Wiely
3	Modern Digital & Analog Communication Systems	3rd Edition, 1999.	B.P.Lathi	Oxford university Press

VI Semester
EE2354- Lab: Digital Communication

Objective	Outcome
This course gives implementation of various modulation techniques, coding, decoding & mathematical modeling using related software.	Students will be able 1. Understand different modulation and demodulation schemes 2. Apply the knowledge of signal space representation 3. Analyze the coding techniques for communication systems. 4. Describe different digital spread spectrum techniques

Expt. No.	Name of Experiment
1	Study of sampling process (MATLAB & Simulink)
2	Study of Pulse Coded Modulation Technique (MATLAB & Simulink)
3	Study of Delta Modulation Technique (MATLAB & Simulink)
4	Calculation of Entropy ,Efficiency,Average code word length,Variance for Huffman Code
5	Gram Schimdtorthogonalization procedure for given set of signals
6	Plot Amplitude Shift Keying, Frequency Shift Keying , Phase shift keying
7	Design of coherent Binary Phase shift keying system
8	Design of coherent Quaternary Phase shift keying system
9	Design of Encoder for Cyclic Hamming Code
10	Convolutional code generation (Time domain & Transform domain approach)

VI Semester
EE2361- PE II: Internet of Things

Objectives	Outcomes
➢ Get acquainted with various IOT environments. ➢ Study IOT architecture and its enabling technologies. ➢ Acquire hands on laboratory experience, utilizing IOT kit.	Upon successful completion of the course, the student will be able to: 1. Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved 2. Understand IoT sensors andtechnological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules 3. Market forecast for IoT devices with a focus on sensors 4. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

UNIT-1 :Introduction

Internet of Things Promises–Definition–Scope–Sensors for IoT Applications–Structure of IoT–

(7Hr)

UNIT -2: Connectivity Technologies in IoT

Connectivity Technologies in IoT: MQTT, COAP, XMPP, AMQP, Network Layer: IPv4, IPv6, 6LoWPAN, IoT Communication protocols: IEEE802.15.4, ZigBee, Wireless HART, Zwave, Bluetooth, NFC, RFID

(7Hr)

UNIT -3 : Wireless Sensor networks

Wireless Sensor networks: Components of sensor nodes, Node Behavior in WSNs, Applications, WSN Coverage, OGDC algorithm, Stationary and Mobile Wireless Sensor Networks.

(7Hr)

UNIT -4 : Cloud Computing

Cloud Computing: Characteristics, Components of Cloud Computing, Service Models, Deployment Models, Service Management, Cloud Security, IoT Data analytics, Middleware for IoT.

(7Hr)

UNIT -5 : Machine to Machine Communication

Machine to Machine Communication: Node types, IP and Non-IP based M2M network Interoperability in Internet of Things: Current Challenges in IoT, Interoperability, Types of Interoperability

(7Hr)

UNIT -6: Software-Defined Networking

Software-Defined Networking: Current Network to SDN, SDN Architecture, Challenges, Open Flow Protocol, APIs in SDN, Controller Placement, Recent Advances of SDN in IoT, Industrial internet of things, Case studies.

Text Books:

1. Dr. Guillaume Girardin , Antoine Bonnabel, Dr. Eric Mounier, 'Technologies & Sensors for the Internet of Things Businesses & Market Trends 2014 -2024',Yole Développement Copyrights ,2014
2. NPTEL course material on Introduction to Internet of Things

REFERENCES

1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015
2. Editors OvidiuVermesan Peter Friess,'Internet of Things –From Research and Innovation to Market
3. Deployment', River Publishers, 20145.N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014

VI Semester
EE2362- Lab: PE II: Internet of Things

Objective	Outcomes
➢ Get acquainted with various IOT environments. ➢ Study IOT architecture and its enabling technologies. ➢ Acquire hands on laboratory experience, utilizing IOT kit.	Upon successful completion of the course, the student will be able to: 1. Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved 2. Understand IoT sensors andtechnological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules 3. Market forecast for IoT devices with a focus on sensors 4. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

Expt. No.	Name of Experiments
1.	Define and Explain Eclipse IoT Project.
2.	List and summarize few Eclipse IoT Projects
3.	Sketch the architecture of IoT Toolkit and explain each entity in brief
4.	Demonstrate a smart object API gateway service reference implementation in IoT toolkit
5.	Write and explain working of an HTTP-to-CoAP semantic mapping proxy in IoT toolkit
6.	Describe gateway-as-a-service deployment in IoT toolkit
7.	Explain application framework and embedded software agents for IoT toolkit
8.	Explain working of Raspberry Pi
9.	Connect Raspberry-Piwith your existing system components
10.	Give overview of Zetta

VI Semester
EE2363- PE II: Digital CMOS Circuits

Objective	Outcomes
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To understand basic properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of Layout rules.	A student who completes this course will be able to: 1. Describe and interpret the basic concepts of MOS transistors, 2. Construct the ability to design a system, component or process as per needs and specifications. 3. Analyze inverter design, characteristics and applications and performance parameters of CMOS Circuits. 4. Evaluate circuits using different CMOS styles and measure performance of the complex logic structures

UNIT-1: (6 Hours)
Introduction of MOSFETs: CMOS Fabrication Process steps, NMOS Enhancement Transistor, MOS Transistor Operations, PMOS Enhancement Transistor, Regions of Operations, Threshold Voltage, MOS Device Equations, Small Signal Modeling of MOSFETs.

UNIT-2 (6 Hours)
Logic Design With MOSFETs: Ideal Switches and Boolean Operations, MOSFETs as Switches, Basic Logic Gates in CMOS, Compound Gates in CMOS, Transmission Gate Circuits (TG), Pass Transistor.

UNIT-3: (6 Hours)
MOS inverter Characteristics: Resistive load inverter, Inverters with n type MOSFET load, CMOS inverter, Principle of operation, DC characteristics, Tristate Inverter, Noise Margin, Introduction to Bi-CMOS Inverter.

UNIT-4: (6 Hours)
Combinational circuit design, static CMOS, Ratioed Logic circuits, Analysis of CMOS Logic Gates: MOS Device Capacitance, Switching Characteristics, Rise Time, Fall Time, Propagation Delay, Power Dissipation in CMOS, Charge Sharing, Fan-in, Fan-out, Complex Logic Structures, Complementary Static CMOS, Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, CMOS Pass Transistor Logic

UNIT-5: (6 Hours)
Sequential Circuit Design, Latches and Flip Flops. Advanced Techniques in CMOS Logic Circuits: and Flip-Flops, data path design

UNIT-6: (6 Hours)
Data path VLSI System Components: Comparators, barrel shifters, Multiplexers, Binary Decoders, Equality Detectors and Comparators, Priority Encoders, Shift and Rotation Operations, Bit Adder Circuits,Multipliers.

Text books:				
1	Principle of CMOS VLSI Design	4th Edition, 2013	Neil H. E. WesteHarris	Addison Wesley VLSI Series
2	Introduction to VLSI Circuits and Systems	First Edition	John P. Uyemura	Wiley Publication

Reference books:				
1	CMOS VLSI Design	3rd Edition, 2005	Pucknell , K. Eshraghian	Prentice Hall
2	CMOS Digital Integrated circuits Analysis and Design	Third edition, 2008	Sung-Mo Kang, Yusuf leblebici	TataMcGraw Hill

VI Semester
EE2364- Lab: PE II: Digital CMOS Circuits

Objective	Outcomes
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To understand basic properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of Layout rules.	A student who completes this course will be able to: 1. Describe and interpret the basic concepts of MOS transistors, 2. Construct the ability to design a system, component or process as per needs and specifications. 3. Analyze inverter design, characteristics and applications and performance parameters of CMOS Circuits. 4. Evaluate circuits using different CMOS styles and measure performance of the complex logic structures

Expt. No.	Name of Experiment (Any Ten)
1	Design of CMOS Inverter using DSCH2 Tool.
2	Gate Level Analysis of 2-Input NAND & NOR Gate.
3	Implement the Following Function using Compound Gates. F(A,B,C,D)=(ABC+CD)'
4	Design Half Adder using NAND Gates.
5	Design Full Adder using NAND Gates.
6	Design 2:1 Multiplexer using NAND Gates.
7	Design 2:4 Decoder using NAND Gates.
8	Design of 4 bit binary Adder
9	Draw Layout of CMOS Inverter Microwind/Cadence Tools
10	Draw Layout of 2-Input NAND Gate using Microwind /Cadence Tools
11	Draw Layout of Multiplexer
12	Design 4 bit adder circuits
13	Design Multiplier circuits

VI Semester

EE2365- PE II: Digital Image Processing

Objective	Outcomes
➢ The objective of this course is to introduce the students to the concepts of Digital Image Processing so that it can be used in advanced studies and projects.	Students will be to 1. Understand the basic concepts of digital image processing and f digital image geometry. 2. Implement the image enhancement and restoration techniques in spatial and frequency domain. 3. Apply and implement image segmentation techniques using edge detection and merging. 4. Apply different Image processing algorithms.

UNIT-1:

Digital image fundamentals : Digital Image through scanner, digital camera, Concept of gray levels, Gray level to binary image conversion, Sampling and quantization, Relationship between pixel, Imaging Geometry.

(8 Hours)

UNIT-2:

Image Transforms: 2-D FFT, Properties, Walsh transform, Hadamard Transform, Discrete cosine Transform, Haar transform, Slant transform.

(7 Hours)

UNIT-3 :

Image enhancement : Point processing, Histogram processing, Spatial filtering and its frequency domain interpretation. Enhancement in frequency domain, Image smoothing, Image sharpening.

(8 Hours)

UNIT-4:

Image segmentation: Detection of discontinuities. Edge linking and boundary detection, Thresholding, Region oriented segmentation.

(7 Hours)

UNIT-5 :

Image Restoration: Degradation model, Algebraic approach to restoration, Inverse filtering, Least mean square filters, Constrained Least Squares Restoration, Interactive Restoration.

(8 Hours)

UNIT-6:

Image compression: Redundancies and their removal methods, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression.

(7 Hours)

Text books:				
1	Digital Image processing	2nd Edition, 2002	R.C. Gonzalez & R.E. Woods	Wesley/ Pearson education
2	Fundamentals of Digital Image processing	1989.	A.K.Jain	PHI
Reference books:				
1	Digital Image processing using MAT LAB	2004	Rafael C. Gonzalez, Richard E Woods and Steven L.	PEA,
2	Digital Image Processing	3rd Edition,2004.	William K. Pratt	John Wilely
3	Fundamentals of Electronic Image Processing	SPIC/IEEE Series,1996	Arthur R. Weeks	PHI

VI Semester
EE2366- Lab:PE II: Digital Image Processing

Objective	Outcomes
➢ The objective of this course is to introduce the students to the concepts of Digital Image Processing so that it can be used in advanced studies and projects.	Students will be to 1. Understand the basic concepts of digital image processing and f digital image geometry. 2. Implement the image enhancement and restoration techniques in spatial and frequency domain. 3. Apply and implement image segmentation techniques using edge detection and merging. 4. Apply different Image processing algorithms.

Expt. No.	Name of Experiment
1	To Explore statistical properties of Image
2	Spatial Image Enhancement
3	Histogram equalisation and modification
4	Image smoothing operations
5	Image Transform : DFT, DCT
6	Bit-plane Slicing
7	Spatial Filtering
8	Frequency Domain Filtering
9	Edge detection
10	Segmentation using threshold
11	Region based segmentation

VI Semester

EE2367- PE II: Object Oriented Programming

OBJECTIVES	OUTCOMES
1. The course aims is to introduce the concept of Object Oriented Programming 2. Demonstrate mastery of object oriented programming concepts: inheritance, polymorphism, and operator overloading. 3. To teach efficient storage mechanisms of data for an easy access 4. Demonstrate pointers, iterators, memory management including object creation and destruction	1. Understand the concept of concepts of Object Oriented Programming. 2. Analyze the using the concept of Inheritance, Polymorphism, Overloading 3. Choose the appropriate data structure and algorithm design method for a specified application. 4. Develop and use linear and non linear data structures and advanced features.

UNIT-1:

Principles of Object Oriented Programming (OOP), Software Evaluation, OOP Paradigm, Basic Concepts of OOP, Benefits of OOP, Application of OOP.

(8 Hours)

UNIT-2:

Introduction to C++, Tokens, Keywords, Identifiers, Variables, Operators, Manipulators, Expressions and Control Structures, Pointers, Functions, Function Prototyping Parameters Passing in Functions, Values Return by Functions, Inline Functions, Friend and Virtual Functions.

(7 Hours)

UNIT-3 :

Classes and Objects, Constructors and Destructors, Operator overloading, Type of Constructors, Function Overloading, Inheritance, Types of Inheritance Virtual Functions and Polymorphism.

(8 Hours)

UNIT-4:

Definition of a data structure, Primitive and Composite data types, Asympotic notations, Arrays, Operations of Arrays, Order lists, Stacks, Applications of Stack, Infix to Postfix Conversion, Recursion, Queues, Operations of Queues.

(7 Hours)

UNIT-5 :

Singly linked list, Operations, Doubly linked list, Operations, Trees and Graphs: Binary tree, Tree traversal; Graph, Definition, Types of Graphs, Traversal (BFS & DFS), Dijkstra`s algorithm

(8 Hours)

UNIT-6:

Files, classes for file stream operations, Opening, Closing and Processing files, End of file detection , File pointes, Updating a file , Error Handling during file operations, Command line arguments, Templates, Exception Handling.

(7 Hours)

Text books:				
1	Object Oriented programming with C++	4th Edition,2008	E. Balagurusamy	TMH
Reference books:				
1	Object Oriented Programming in Microsoft C++	Third Edition, 2003	Robert Lafore	Galgotia publication
2	Fundamental of data structure in C++	2002.	E. Horowitz and S.Shani	Galgotia Pub
3	Computer algorithms	1998.	Horowitz, S.Shani and S.Rajasekaran	Galgotia Pub Pvt Ltd

VI Semester
EE2368- Lab:PE II: Object Oriented Programming

Objective	Outcomes
➢ The course aims is to introduce the students to Object Oriented Programming Concepts memory management including object creation and destruction, and parameter passing in C++.	Students 1. Will learn the basic concepts of Object Oriented Programming. 2. Will design programming the concept of Inheritance, Polymorphism, Overloading 3. Can choose the appropriate data structure and algorithm design method for a specified application. 4. Will be able to use linear and non linear data structures and advanced features of C++ specifically stream I/O, templates and Exception Handling.

Exp No	Name of Experiment
1	Write a function using variables as arguments to swap the values of a pair of integers.
2	Write a program to read the ballot & count the votes cast for each candidate using an array, variable count. In case, a number read is outside the range 1 to 5, the ballot should be considered as a ' spoilt ballot' and the program should also count the number of spoilt ballot.
3	Write a program to read a matrix of size m*n from the keyboard and display the same on the screen.
4	Write a macro that obtains the largest of three numbers.
5	As the practical 4, using inline function. Test the function using the main program.
6	Define a class to represent a bank account including the following members:- Data Members, Member function to display the name and balance.
7	Modify the class and the program of practical 6 for handling 10 customers.
8	Create 2 classes OM and DB which store the value of distance. DM store distances in meters and cm and DB in feet and inches. Write a program that can read values for the class objects and add 1 object OM with another object of DB. Use a friend function to carry out the addition operation the object that stores the results may be a DM object or a DB object, depending upon the units in which the results are require. The display should be in the format of feet and inches or meters and cms depending on the object on display.
9	Write a program for maintaining the inventory of books that are being sold at the shop the Design a system using a class called books with suitable member functions and constructors. Use new operator in constructor to allocate memory space require.
10	Define a class string that could work as a user defined string type include constructors that will enable us to create an .un-initialized string String s1; :/ string with length 0 And also to initialize an object with string constant at the time of creation like String s2("well done"); . Include a function that adds two strings to make a third string.
11	Create a class float that contains 2 float data member. Over load all the 4 arithmetic operators so that do operate on the objects of float.
12	Define 2 classes POLAR and RECTANGLE to represent points in the POLAR and RECTANGLE systems. Use conversion routines to convert from one system to the other.
13	Exercise on file handling

VI Semester
EE2381- OE III : Fuzzy Logic & Neural Network

Objective	Outcome
1. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. 2. Introduce students to artificial neural networks and fuzzy theory from an engineering perspective	**On completion of this course, Students will be able to** **CO1:** Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks. **CO2:** Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches **CO3:** Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks **CO4:** Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.

UNIT-1:
Crisp sets: An overview, Fuzzy sets: Basic types, basic concepts, basic properties of α-cuts, representation of fuzzy sets, and extension principle of fuzzy sets

(8 Hours)

UNIT-2:
Operations on fuzzy sets, Fuzzy numbers, Arithmetic operations on intervals, arithmetic operations on fuzzy numbers, fuzzy equations

(7 Hours)

UNIT-3 :
Fuzzy controllers: an overview with applications, applications of fuzzy logic

(8 Hours)

UNIT-4:
Fundamental concepts of ANN: Basic building blocks of artificial neural networks, network architectures, activation functions, McCulloch-Pitt's neuron model, Learning rules: Hebbian learning rule, Perceptron learning rule, Delta learning (Widrow- Hoff and LMS)rule, Competitive learning rule, Boltzmann learning

(7 Hours)

UNIT-5:
Brief introduction to single layer and multilayer perceptions, ADALINE and MADALINE, feed-forward networks, back propagation networks and applications.

(8 Hours)

UNIT-6:
Radial basis function network, Self organizing feature map and applications

(7 Hours)

Text books:				
1	Fuzzy sets and Fuzzy logic	2008	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks: A comprehensive Foundation'	2nd Edition, 2005	Simon Haykin	Pearson publications

VI Semester
EE2381- OE III : Fuzzy Logic & Neural Network

Reference books:				
1	Fuzzy sets: Uncertainty & information	1988	Klir and Folger	PHI
2	Introduction of Artificial Neural Networks	1999	Jacek Zurada	Pws Pub Co
3	Fuzzy Logic with engineering applications,	3rd Edition	Timothy Ross,	Wiley Publication
4	Principles of Soft Computing	2nd Edition	S. N. Sivanandanam and S. N. Deepa,	Wiley Publication

VI Semester
EE2382- OE III : Basics of Analog and Digital Communication Systems

Objective	Outcome
➢ To Study different analog and digital modulation techniques. ➢ To understand transmitter & receivers in communication systems.	Students will be able to 1. Understand different modulation and demodulation schemes for analog communication with the concept of noise 2. Understand different pulse analog and digital modulation techniques. 3. Understand different digital modulation schemes 4. Understand the different coding techniques for communication systems.

Unit I: Basic block diagram of Analog communication system, Modulation techniques: Need for modulation, Basic concepts of AM, FM, PM, Transmitters.

Unit II: Receivers: Basic receiver (TRF), Super heterodyne receiver, AM detectors, FM Detectors, Noise Types of Noise, Definition of Noise figure, signal to noise ratio, calculation of noise figure.

Unit III: Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing, Basic digital Modulation System- PCM.

Unit IV: Channel capacity, DPCM, Delta Modulation, ADM, ADPCM, Adaptive sub-band coding, applications.

Unit V: Digital Modulation techniques: ASK, FSK, PSK, BPSK, QPSK, MSK, DPSK, BFSK, M-ary PSK, FSK, and QAM.

Unit VI: Source coding and channel coding, Information theory, Huffman coding, LZ coding, Basic concept of convolution code.

Text books:				
1	Electronic Communication System	Fourth Edition, 1999	Gorge Kennedy	Tata McGraw-Hill
2	Digital Communications		SymonHykin	Wiley, 1988
Reference books:				
1	Electronic Communication Systems	Second Edition, 1993	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition, 2007	Louis Frenzel	McGraw-Hill
3	Digital and analog communication systems	Fifth Edition,2003	K. Sam Shanmugam	John Wiley & Sons

VI Semester
EE2383-OE III: Biomedical Instrumentation

Objective	Outcome
➢ This course is intended for introducing the students to evolution and development of biomedical instrumentation. ➢ The purpose of this course is to develop a strong foundation of use of transducers in biomedical measurements. ➢ Understand concepts of working principle of various biomedical instruments and analysis their output graphs like ECG,EEG,EMG, X-rays, plethysmograph and spirogram ➢ Understand the fundamentals of Telemedicine like Teleradiology, Telecardiology, Telepsychiatry and Medical Informatics	Students will be able to 1. Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation 2. Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram 3. Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care. 4. Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.

UNIT-1:

Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.

UNIT-2:

Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers

UNIT-3 :
The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers

UNIT-4:

Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG

UNIT-5 :

Patient care and monitoring, the elements of intensive care monitoring , instrumentation for monitoring patient, pacemakers, defibrillators. Physiological effects of electrical current, shock hazards from electrical equipments.

UNIT-6:

Telemedicine concept, Telemedicine applications, video conferencing, digital communication in telemedicine Teleradiology, Tele Cardiology, Telepsychiatry.

Text Books

SN	Title	Edition	Authors	Publisher
1	Biomedical Instrumentation & Measurement	19 Jan 2010	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	Prentice Hall
2	Biomedical Instrumentation	1 Jan 2010	Mandeep Singh	Prentice Hall

VI Semester
EE2383-OE III: Biomedical Instrumentation

Reference books:				
1	Handbook of Biomedical Instrumentation	1987	R.S.Khandpur	TMH
2	Bioelectronics Measurement	1983	Dean A Dmane, David Michaels	Prentice Hall
3	Medicine and Clinical Engineering	1 August 2008	Jacobson and Webster	PHI

VI Semester
EE2391- OE IV : Data Acquisition & Signal Conditioning

Objective	Outcome
The course gives an overview about the data acquisition methods, to acquaint students with ADCs and DACs and various data acquisition techniques	After study through lectures and assignments, Students will be able to: 1. Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning 2. Identify the various types of data acquisition hardware and the serial data communication standards. 3. Distinguish different standards for connection of different programmable instruments like GPIB and SCPI 4. Define use of Ethernet, Medium Access control and USB

UNIT-1:
Definition of data acquisition and control, Fundamentals of data acquisition**,** Signal conditioning, Data acquisition and control system configuration, Computer plug-in I/O, Distributed I/O, Stand-alone or distributed loggers/controllers, Analog and digital signals: Classification of signals, Sensors and transducers, Transducer characteristics, Resistance temperature detectors (RTDs), Thermistors, Thermocouples, Strain gauges, Wheatstone bridges.

(8 Hours)

UNIT-2:
Signal conditioning: Types and classes, Field wiring and signal measurement, Noise and interference, Minimizing noise, Shielded and twisted-pair cable.

(7 Hours)

UNIT-3
Plug-in data acquisition boards, A/D Boards, Single ended Vs differential signals, Resolution, dynamic range and accuracy of A/D boards, Sampling rate and the Nyquist theorem, Sampling techniques, D/A boards, Digital I/O boards.

(7 Hours)

UNIT-4:
Serial data communications, Transmission modes – simplex and duplex, RS-232-C interface standard, RS-485 interface standard, Comparison of the RS-232 and RS-485 standards, Serial interface converters, Protocols, Error detection.

(8 Hours)

UNIT-5
IEEE 488 Standard, Introduction, Electrical and mechanical characteristics, Physical connection configurations, Device types, Bus structure, GPIB handshaking, Device communication, Requirements of IEEE 488.2 controllers, Standard commands for programmable instruments (SCPI).

(7 Hours)

UNIT-6:
Ethernet and field buses for data acquisition, Physical layer, Medium access control, Difference between 802.3 and Ethernet, The universal serial bus (USB), USB overall structure, Topology.

(8 Hours)

Text books:		
1	Data Acquisition for Instrumentation and Control Systems	John Park and Steve Mac

Reference books:				
1	Electronic Analog Digital Conversion	1st Edition	H. Schmid	Tata McGraw Hill
2	Data Converters	1st Edition , 1993	B. S. Sonde	Tata McGraw Hill

VI Semester

EE2392- OE IV : Microprocessor Programming

Objective	Outcome
▪ To understand the architecture, programming and addressing modes of Intel 8085 ▪ To study the instruction set and programming of 8085 ▪ To understand various interfacing of devices for various applications.	Students 1. Will be able to understand the architecture of 8085. 2. Will demonstrate the ability to identify, Formulate and design Program for an assigned task. 3. Will be able to interface Peripheral devices. 4. Will apply the knowledge of microprocessor in their respective field. .

Unit I: Concept of bit, byte & word, Micro Computer organization with I/O devices and memory. Microprocessor, address, data & control bus, RAM / ROM memory.

Unit II: Architecture of 8085 Intel microprocessor, Flag Register ,Addressing mode, pins diagram of 8085, Demultiplexing of Address & Data Bus, Generation of various control signals for I/O & Memory Organization

Unit III: Basic Instruction set, Subroutine instructions like CALL, PUSH, POP, XTHL instructions and their uses,Programs based on instructions.

Unit IV: Delay Program,Memory Interfacing - ROM, RAM With 8085, Absolute and Linear decoding techniques.

Unit V: MICROPROCESSOR APPLICATIONS - Programmable peripheral IC (8255)- Pin functions, Different Modes & Block Diagram, ADC interfacing , DAC interfacing .

Unit VI: USART 8251, PIT 8253, Interrupt Structure, Interrupt Controller 8259

Text books:

SN	Title	Edition	Authors	Publisher
1	Microprocessor Architecture ,Programming& Interfacing 8085	1 Dec 2000	Ramesh Gaonkar	Penram Publication

Reference books:

SN	Title	Edition	Authors	Publisher
1	8085 Microprocessor	2014	Ajit Pal	Tata Mc-Graw Hill ,
2	Microprocessors & interfacing	2005	D. V. Hall	Tata McGraw-hill

VI Semester
EE2393- OE IV : Consumer Electronics

Objective	Outcome
➢ To give knowledge and competencies regarding consumer electronic equipments.	Students will be able to 1. Understand the knowledge of the safety aspects in the field of Electrical and Electronics products. 2. Analyze the basics of Audio and Video Systems. 3. Know about recent trends in Processors and computer peripherals, mobile and wireless technologies. 4. Understand the basics of refrigeration cycle and cooling system.

Unit -I
Standards and Safety norms: Electronics and Electrical safety norms and standards, Electronic products covered under compulsory registration

Unit -II
Audio Systems: Sound Recording and reproduction, Hi-Fi Sound System, Audio Mixers, Graphics Equalizers, Public Address System.

Unit -III
Video Systems: Color fundamentals, Luminance and Chrominance signal , Color camera, digital television systems.

Unit IV
Wireless Technology & Mobile phones: Mobile Phones, various wireless technologies, Introduction to 3G, WiFi Technology, GSM

Unit -V
Air conditioner and Refrigerators: Fundamentals, Refrigeration cycles, compressors, home automation

Unit –VI
Computers: Recent microprocessor, Pentium family architecture and salient features , Recent Memories technologies (RAM, HDD), Computer peripherals , RISC Processor.

Text books:

SN	Title	Edition	Authors	Publisher
1	Consumer Electronics	First Edition	S.P. Bali	Pearson Education
2	Consumer Electronics",	2000	B. R. Gupta, Vandana Singhal	S. K. Kataria& Sons,

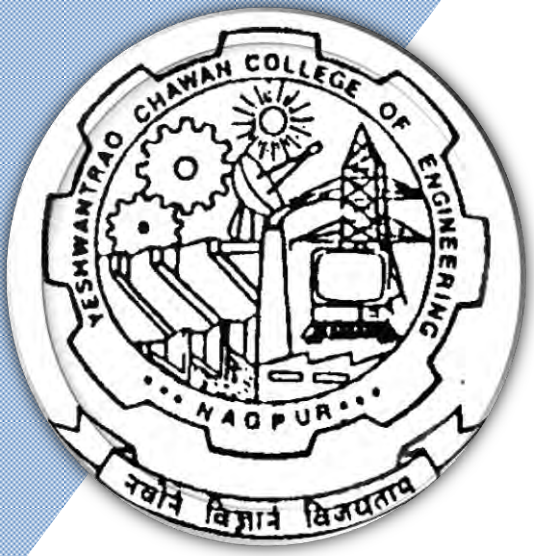
Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology
SoE & Syllabus 2020
77th & 8th Semester
Electronics Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	EE2401	Digital System Design	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	EE2402	**Lab.**: Digital System Design	**P**	0	0	2	2	1		60	40	
3	7	PE		Professional Elective-III	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE		Professional Elective-IV	**T**	3	0	0	3	3	30	20	50	3 Hours
5	7	PE		Lab. : Professional Elective-IV	**P**	0	0	2	2	1		60	40	
6	7	PE		Professional Elective-V	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		Professional Elective-VI	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	EE2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	EE2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -III

1	7	PE III	EE2411	PE III: Switching Theory & Finite Automata
2	7	PE III	EE2412	PE III :Power Electronics
3	7	PE III	EE2413	PE III: Wireless Sensor Network
4	7	PE III	EE2414	PE III: VLSI Signal Processing

Professional Electives -IV

1	7	PE IV	EE2421	PE IV: Wireless Communication
	7	PE IV	EE2422	**Lab:** PE IV:Wireless Communication
2	7	PE IV	EE2423	PE IV: RF and Microwave
	7	PE IV	EE2424	**Lab:** PE IV: RF and Microwave
3	7	PE IV	EE2425	PE IV: Analog VLSI Design
	7	PE IV	EE2426	**Lab. :** PE IV: Analog VLSI Design
4	7	PE IV	EE2427	PE IV: Operating Systems
	7	PE IV	EE2428	**Lab:** PE IV:Operating Systems

Professional Electives -V

1	7	PE V	EE2431	PE V: Industrial Automation
2	7	PE V	EE2432	PE V: Nano Electronics
4	7	PE V	EE2433	PE V: Optical Communication
5	7	PE V	EE2434	PE V: RF Circuit Design

Professional Electives -VI

1	7	PE-VI	EE2441	PE-VI: E-Commerce and Data Analytics
2	7	PE-VI	EE2442	PE-VI: Micro Electro Mechanical Systems (MEMS)
3	7	PE-VI	EE2443	PE-VI: Biomedical Instrumentation
4	7	PE-VI	EE2444	PE-VI: Computer Organization
5	7	PE-VI	EE2445	PE VI : Introduction to Remote Sensing and Image Analysis

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2020	**1.04**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2020-21 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. EE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	EE2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	EE2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**84**	**2**	**46**	**132**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	June 2022	1.05
		Date of Release	Version

Applicable for AY 2022-23 Onwards

VII Semester
EE2401 -Digital System Design

Objective	Outcome
Students should be able to 1. Expose students to the advanced design techniques and methodology and industrial standard EDA tools in Digital Circuits and Systems design	Students will be able to 1. Understand hardware description language and able to design and simulate digital systems using different abstraction levels 2. Design and analyse combinational and sequential logic circuits. 3. Understand and apply timing issues in multiple contexts and design the circuit. 4. Understand programmable devices and able to design digital systems using modern design tools

UNIT-1: HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modelling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module ,Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Constants, Parameter, Verilog Data Operators.

UNIT-2:, Data Flow Modeling, Delay, Continuous Assignment, Delayed Continuous assignment Design entry in Verilog & Test bench, Combinational blocks design, Compilation and synthesis, Timing analysis resolving signal values

UNIT-3:, Structural Modeling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives.

UNIT-4: Behavioral Modeling, Initial, Always, Procedural Assignment, Blocking and Non- Blocking assignments, Sequential & Parallel Blocks, Timing Control, Procedural Statements, Conditional Statements if case loop repeat forever etc, Zero Delay Control, Event Based Timing Control, State Machine Coding ,Moore and Mealy Machines.

UNIT-5 :Combinational & sequential system Design examples like Shift Registers, Counters, LFSR, Latches and Flip Flops , Multi bit Adders examples like Ripple Carry Adder, Carry look ahead adder ,two bit and three bit Multiplier, CPU, Design Verification.

UNIT-6: Introduction to programmable devices, PLA, PAL, PROM, Structure of CPLDs, Introduction to FPGA, Architecture, CLB, IOB, Programmable Interconnect Points, Different type of programmable switches used in PLDs.

Text Books:

	Title	Edition	Author	Publisher
1	Verilog HDL : A Guide to Digital Design and Synthesis	2nd Edition	Samir Palnitkar	2003

Reference Book:

	Title	Edition	Author	Publisher
1	Verilog Digital System Design	Second Edition	Zainalabedin Navabi	Tata McGraw Hill , 2009

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
EE2402 – Lab.: Digital System Design

Objectives	Outcomes
Students should be able to 1. Expose students to the advanced design techniques and methodology and industrial standard EDA tools in Digital Circuits and Systems design	Students will be able to 1. Understand hardware description language and able to design and simulate digital systems using different abstraction levels 2. Design and analyse combinational and sequential logic circuits. 3. Understand and apply timing issues in multiple contexts and design the circuit. 4. Understand programmable devices and able to design digital systems using modern design tools

Expt. No.	Name of Experiment
1	Write Verilog Codes of basic gates using Bitwise Operator .Test it with test stimuli generated by test bench.
2	Write Verilog Codes of 2:1 and 4:1 Multiplexer using Bitwise Operator .Test it with test stimuli generated by test bench.
3	Write Verilog Codes of 2:4 and 3:8 Decoder using Bitwise Operator .Test it with test stimuli generated by test bench.
4	Write Verilog Codes of half and full adder using Bitwise Operator .Test it with test stimuli generated by test bench.
5	Write verilog code using conditional assignment statement. Test it with test stimuli generated by test bench.
6	Write a Structural Verilog code of full adder using half adder. Test it with test stimuli generated by test bench.
7	Write a Structural Verilog code of 4:1 multiplexer using 2:1 multiplexer. Test it with test stimuli generated by test bench.
8	Write a Structural Verilog code of 4-bit Ripple carry Adder using full adder. Test it with test stimuli generated by test bench.
9	Write a Behavioural Verilog code of multiplexers using if statements. Test it with test stimuli generated by test bench.
10	Write Verilog code for Mealy and Moore sequence detector.(using overlapping allowed and not allowed)

Text Books:

	Title	Edition	Author	Publisher
1	Verilog HDL : A Guide to Digital Design and Synthesis	2nd Edition	Samir Palnitkar	2003

Reference Book:

	Title	Edition	Author	Publisher

1	Verilog Digital System Design	Second Edition	Zainalabedin Navabi	Tata McGraw Hill , 2009

VII Semester
EE2411 – PE III: Switching Theory & Finite Automata

Course Objective	**Course Outcomes**
Students should be able to 1) Understand various sequential logic design methods, Analysis of logic circuits and optimization techniques to minimize gate count. 2) Learn fault diagnosis, Threshold logic, analysis and design of sequential machines.	Students will be able to 1. Design and Analyze multilevel logic Network and Threshold logic for nanotechnologies. 2. Analyze testing of combinational circuits, Fault Models 3. Design and analyze the synchronous and asynchronous sequential circuits. 4. Identify and test the sequential machines with experiments.

UNIT-1

Multi-level logic synthesis, Technology-independent synthesis: Factoring, Decomposition, Extraction, Substitution, and Technology mapping: steps in technology mapping**(06 Hours)**

UNIT-2:

\Threshold logic for nanotechnologies, threshold elements, synthesis of threshold networks: Unate function, Identification & Realization of threshold function. **(06 Hours)**

UNIT-3:

Testing of combinational circuits, Fault models, Structural testing, IDDQ testing, Delay fault testing, Synthesis for testability, Testing for nanotechnologies. **(06 Hours)**

UNIT 4:

Synchronous sequential circuits and iterative networks, memory elements and their excitation functions, synthesis of synchronous sequential circuits, Moore and Mealy machines, finite state machine flow charts, tables **(06 Hours)**

Unit 5:

Asynchronous sequential circuits, Modes of operation, Hazards, Synthesis of SIC fundamental-mode circuits. **(06 Hours)**

Unit 6:

State-identification experiments and testing of sequential circuits, Experiments, Homing experiments, Distinguishing experiments, Machine identification, Checking experiments, Built-in self-test (BIST). New topic to be announced time to time. **(06 Hours)**

Text books:				
1	Switching & Finite Automata Theory	ZviKohavi, Niraja K. Jha	Third Edition 2010	Cambridge University Press
2	Fundamentals of Digital Logic With VHDL Design	Stephen Brown	Second Edition, 2007	TMH

Reference books:				
1	Modern Switching Theory and	Lee S.C		PHI Edition

	Digital Design			
2	Digital Logic and Computer Design	M.Morris Mano		PHI Edition

VII Semester
EE2412 – PE III :Power Electronics

Objective	Outcome
➢ To make familiar with the SCR & other power devices. ➢ To study power controller, various techniques of improving power factor, different methods of commutation. ➢ To understand uncontrolled and controlled converters. ➢ To describe function of various types of an inverter. ➢ To explain operation of choppers.	Students will be able to 1. Understand basic semiconductor physics and properties of power devices for circuit analysis using linear and non -linear operations. 2. Design and Analyze power invertor circuits and learn to select suitable power electronic devices by assessing the requirements of application fields. 3. Formulate analyze and design the converters for various load types. 4. Identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry grade apparatus.

UNIT-1:
Power Semiconductor Diodes and Circuits, control Characteristics of power devices, power modules, power diodes, reverse recovery, series, shunt connected diodes, Diode Rectifiers-single phase, three phase rectifiers, bride rectifiers, design of rectifiers.

(8 Hours)

UNIT-2:
Power Transistors, Switching characteristics of BJT, Power MOSFETs, IGBTs, limitations, Power Thyristors.

(7 Hours)

UNIT-3
Pulse-width Modulated Inverters: Principle, single phase, multiple phase, PWM Forced commuted inverters, current source inverters, design of inverter, DC-DC Converters, Step up, stepdown, SMPS, thyrister Choppers, design of choppers.

(8 Hours)

UNIT-4:
Resonant Pulse Inverters-Series, parallel, resonant inverters, Class E resonant inverter, Zero voltage/current Switching resonant inverter, Multilevel Inverters.

(7 Hours)

UNIT-5
Controlled Rectifiers: phase control converter, single phase, three phase converters, power factor improvement, AC Voltage Controllers. Principle of ON-OFF control, Phase control, Single phase controllers, three phase controllers, cyclo-converters.

(8 Hours)

UNIT-6:
\Power Supplies, SMPS, SMAC power supplies, power factor conditioning Gate Drive Circuits- Protection of Devices and Circuits Snubber, reverse recovery transients, protection devices varisters, Introduction to AC and DC drives.

(7 Hours)

Text books:

1	Power Electronics: Circuits, Devices and Applications	2nd edition 1993	M. Rashid	PHI
Reference books:				
1	Power Electronics and its application	2nd Edition 2004	Alok Jain	Penram International Publishing Pvt Ltd

VII Semester
EE2413 – PE III: Wireless Sensor Network 7th Semester

Unit I: Introduction & architecture: Motivation of Wireless Sensor Nodes, Challenges, constraints for WSN, applications, single node architecture, Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments

Unit II: Network architecture: Sensor network scenarios, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts

Unit III: communication protocols: Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , Contention based Protocols, Schedule based protocols

Unit IV: link layer Protocols: Fundamental, Error Control, Framing, Link Management, Naming And Addressing – Fundamentals, Assignment of MAC Address, Distributed assignment of locally unique addresses, Content based and geographic addressing

Unit V: Naming and addressing, Time synchronization: Properties of Localization and positioning procedures, single hop localization, positioning in multihop environments, and impact of anchor placement. Clustering

Unit VI :Data centric and content based networking:Data centric routing, Data aggregation, Data centric storage, Topology control-controlling topology in a flat network, Hirarical network by dominating set, Hierarchical network by clustering, transport layer and Quality of sevice.

Textbook:

1) Protocols and Architectures for Wireless Sensor Networks. H. Karl and A. Willig. John• Wiley & Sons, June 2005.
2) Fundamentals of wireless sensor networks: Theory and Practice. Waltenegus Dargie,Christian Poellabauer, Wiley & sons, 2010,

Reference books:

1) Wireless Sensor Networks: Technology, Protocols, and Applications. K. Sohraby, D. Minoli, and T. Znati. John Wiley & Sons, March 2007.

VII Semester
EE2414 – PE III: VLSI Signal Processing

Objective	Outcome
Objectives: 1. To learn pipelining & parallel processing techniques. 2. To understand folding & unfolding techniques. 3. To address folding techniques used to design time multiplexed architecture.	**Course Outcome:** By the end of the course, the students shall be able to 1. Design architectures for DSP algorithms. 2. Apply the optimisation concept in terms of area, speed and power on DSP systems. 3. Optimize DSP arithmetic 4. Design of algorithm structure for DSP algorithms based on algorithm transformation.

Unit I: Representations of DSP algorithms: Block diagram, SFG, DFG,DFGrepresentations Loop bound and iteration bound, Algorithms for computing Iteration bound.

Unit II: Pipelining and Parallel Processing: Introduction, pipelining of FIR Digital filters, parallel processing, Pipelining and parallel processing for low power.

Unit III: Retiming:Introduction, Definition and properties, solving system of inequalities, retiming techniques.

Unit IV: Unfolding: Introduction, algorithms for unfolding, Properties of unfolding, Critical path, unfolding and retiming.

Unit V: Folding: Introduction Folding Transformation,Register minimization techniques, Register minimization in folded architectures.

Unit VI: Fast Convolution, Introduction, Cook- Toom algorithm, Winogard algorithm.

Text Books:

1. Keshab K. Parhi. "VLSI Digital Signal Processing Systems" Wiley-Inter Sciences. 1999
2. Mohammed Ismail, Terri, Fiez, "Analog VLSI signal and information processing", McGraw Hill ,1994.
3. Keshab. Parthi, "VLSI Digital signal processing system Design and implementation" Wiley-Inter science, 1999.
4. kung. S.Y., H.J. While house T.Kailath "VLSI and Modern singal processing", prentice hall, 1985.
5. Jose E. France, Yannis Tsividls "Design of Analog Digital VLSI circuits for telecommunications and signal processing" prentice Hall, 1994.

VII Semester
EE2421 – PE V : Wireless Communication

Objective	Outcome
1. To introduce the concepts and techniques associated with Wireless Cellular Communication systems. 2. To provides a comprehensive overview and advanced knowledge of modern mobile and wireless communication systems. 3. To familiarize with state of art standards used in wireless cellular systems.	Students will be able to 1. Describe generations of wireless standard and understand cellular concepts to evaluate the signal reception performance in a cellular network and traffic analysis with given quality of service constraints. 2. Determine the type and appropriate model of wireless fading channel based on the system parameters and the property of the wireless medium. 3. Describe Equalization & Diversity techniques, compare various wireless systems standards. 4. Understand the importance of wireless networking and its applications.

UNIT-1: The Cellular Concept: Evolution of Mobile Radio Communications, Comparison of common wireless communication systems, Examples of wireless communication system,Generations of cellular Networks, Cellular telephone system, frequency reuse, channel assignment and handoff strategies, interference and system capacity, Trunking & grade of service, improving capacity in cellular system.

UNIT-2: Mobile Radio Propagation-large scale path loss : Introduction to Radio Wave Propagation, free space propagation model, Reflection, Diffraction, Scattering, Signal Penetration into Buildings, Ray Tracing & Site Specific Modeling

UNIT-3 : Small Scale fading & Multipath: Multipath Propagation, Small Scale Multipath Measurements, Parameters of Mobile Multipath Channels, Types Of Small Scale Fading, Rayleigh &Rician Distribution.

UNIT-4: Equalization & Diversity: Fundamentals of equalization, space polarization, frequency and time diversity techniques, space diversity, polarization diversity, frequency and time diversity. RAKE Receiver.

UNIT-5 : Wireless Systems and Standards: GSM- global system for mobile: services and features, GSM system architecture, GSM radio subsystem, GSM channel types, GSM frame structure, signal processing in GSM, introduction to CDMA digital cellular standard (IS-95).

UNIT-6: Wireless Networking: Introduction to wireless networks, Differences Between Wireless & Fixed Telephone Networks, Development of wireless networks, Traffic routing in wireless networks, Wireless data services, Common channel signalling, Signalling System No. 7.An Example of SS7-Global Cellular Network Interoperability.

Text books:				
1	Wireless Communication – Principles and practice	2nd edition, 2002	T S. Rappaport	Prentice Hall PTR, upper saddle river, New Jersey
2	Mobile Communications – Design fundamentals	2nd edition, 1997	William C. Y. Lee	John Willey

Reference books:				
1	Wireless digital communication : modulation & spread spectrum applications	1995.	KamiloFeher	Prentice Hall PTR; Har/Dis edition
2	Wireless and Cellular Communication	3rd Edition,2005	W .C .Y. Lee	McGraw Hill
3	The Mobile Radio Propagation channel	2nd Edition, 2000	J.D. Parson	John Willey

VII Semester
EE2422 – Lab: PE IV: Wireless Communication

Expt. No.	Name of Experiment
1	Calculation of frequency reuse ratio
2	Design Path loss model
3	To compute the propagation delay for specified source and receiver distance
4	Design frequency selective fading channel characteristic
5	Plot Rayleigh & Rician Distribution
6	Design Equalization model
7	Design of Propagation in transmitter and receiver using ray tracing
8	Data transmission and reception using Time multiple access technique

VII Semester
EE2423 – PE IV: RF and Microwave

UNIT-1: Microwave linear beam tubes (O type): High frequency limitations of conventional microwave devices, Two cavity Klystron Amplifier – Mechanism and mode of Operation, Power output and Efficiency, Applegate diagram, applications, Reflex Klystron Oscillator – Mechanism and mode of Operation Power output, efficiency, mode curve, Electronic Admittance, Modulation of Reflex Klystron; Applications, Helix TWT, BWO. Slow wave structures. **(8 Hours)**

UNIT-2: Microwave cross-field tubes (M Type): Magnetron Oscillator – Hull cut-off voltage, Mechanism of Operation, Mode separation, Phase focusing effect, Power output and Efficiency, Cylindrical magnetron, parallel plate magnetron, split anode magnetron, Types of strapping, Tuning of magnetron. Applications. **(7 Hours)**

UNIT-3 Microwave passive Devices (Reciprocal and non reciprocal):Wave guide Tees - E plane Tee, H plane Tee, Magic Tee and their applications, Directional couplers, Wave guide Corners, Bends and Twists ,Attenuators, Isolators, Gyrators, Circulators, Phase shifter, Rectangular cavity resonator, Transmission line resonators. **(8 Hours)**

UNIT-4: Microwave Network Analysis: Introduction, Symmetrical Z and Y matrices for reciprocal network, Scattering matrix representation of multi port networks, comparison between [S], [Z] and [Y] matrices, Inter relationship between impedance matrix, admittance matrix and Scattering matrix, properties of scattering matrix, Scattering matrix of transmission lines, ABCD parameters with S parameters, Scattering matrix derivation for all components, Numerical Problems. **(8 Hours)**

UNIT-5 Microwave measurement: Introduction, Tunable detector, Slotted line Carriage, VSWR meter, Power measurements sensor, Bolo meter sensor, power sensor, Low and High power measurement, Insertion loss and Attenuation measurement, VSWR measurement – Low and High VSWR, Impedance measurement. Frequency measurement, Measurement of cavity Q, Dielectric measurement, Antenna Measurement – radiation pattern, Phase and gain. Types of Microwave filters: Image parameter method, Insertion loss method. **(7 Hours)**

UNIT-6 Microwave solid state devices and circuits: Microwave diodes – Gun diode – Mode of operation, Crystal diode, PIN diode , Application as Oscillator and Amplifiers, Strip lines: Micro strip lines, parallel strip lines. Coplanar, shielded , Basics of Microwave systems: Radar, RF ID, microwave imaging, modern trends in microwave engineering, effect of microwave on human body. **(8 Hours)**

Text books:				
1	RF Circuit Design Theory And Application	2nd edition, 2011	Ludwig	Pearson Education India
2	Microwave Devices and Circuits	1990	Samueal Liao	Pearson

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester
EE2424 – Lab. : PE IV: RF and Microwave

Expt. No.	Name of Experiment
1	Introduction to Microwave Components.
2	To find the frequency of reflex klystron & Determine electronic and mechanical tuning range.
3	To verify power verses repeller voltage characteristics of reflex klystron.
4	To verify frequency verses repeller voltage characteristics of reflex klystron.
5	To find attenuation of fixed attenuator and To verify the calibration of variable attenuators.
6	To verify the performance of wave-guide tees i) E-plane tee ii) H-plane tee.
7	To verify the performance of E-H plane tee (magic tee).
8	To verify the relationship among free space wavelength, cut off wavelength, guide wavelength
9	To find the Q-factor of absorption type frequency meter and it's insertion loss.
10	To verify the performance of directional coupler i) multi hole ii) cross directional coupler.
11	To determine coupling and isolation of a three port circulator.
12	To determine the gain of pyramidal horn antenna, plot the beam pattern and find the lobe width.
13	To verify characteristics of Gunn diode.
14	To measure the small V.S.W.R. and large V.S.W.R.
15	To measure the V.S.W.R. of an unknown load, and determine impedance using smith chart.
16	To verify various MIC Components.

Text books:				
1	RF Circuit Design Theory And Application	2nd edition, 2011	Ludwig	Pearson Education India
2	Microwave Devices and Circuits	1990	Samueal Liao	Pearson

VII Semester
EE2425 – PE IV: Analog VLSI Design

Objectives	Outcomes
• To understand small signal modeling of MOS Transistor. • Perform analysis of single stage amplifier • Analyze amplifier based on frequency response calculation and working principle of one stage, two stage operational amplifier.	Students will be able to 1. Understand small signal model of MOS transistor and Design using SPICE modeling 2. Analyze single stage and differential amplifier with frequency response. 3. Analyze and Design basic analog circuits such as current mirrors, active load, biasing circuits. 4. Illustrate performance parameter of operational amplifier.

Unit I:Basic MOS Device Physics:
Threshold voltage, Derivation of I/V characteristics, second order effects, MOS device capacitance, MOS small signal models, MOS SPICE models.

(6 hours)

Unit II:Single stage amplifiers:
Basic concept, common source, common source stage with resistive load, CS stage with source degeneration, source follower, common gate.

(7 hours)

Unit III: Differential amplifiers:
Single ended & differential operation, Basic differential pair, qualitative and quantitative analysis, Common mode response

(6 hours)

Unit IV:
Passive and active current mirrors:
Basic current mirror,Cascode current mirror, Active current mirror,common mode properties

(6 hours)

Unit V: frequency response of amplifiers:
Miller effect, association of poles with node, common source stage , source follower, common gate stage

(7 hours)

Unit VI: Operational amplifiers:
Performance parameters, one stage op amp, Two stage op amp, Gain boosting, Noise in op amp

(6 hours)

Text books:				
1	Design of Analog CMOS Integrated circuits	Ninteenth reprint 2010	BehzadRazavi	Mc-graw-Hill

Reference books:				
1	CMOS circuit design, layout, and Simulation'	Second edition, reprint 2009.	Jacob Baker	WSE
2	CMOS Analog Circuit Design	second edition, 2010	P.E.Allen, D.R.Holdberg	Oxford univ. press
3	Analysis and Design of Analog Integrated Circuits	fifth edition, reprint 2010	Paul B Gray , Hurst , Lewis, Meyer	John Wiley & sons

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VII Semester

EE2426 – Lab. : PE IV: Analog VLSI Design

OBJECTIVES	OUTCOMES
➢ To introduce the students to the fundamentals of CMOS circuits. ➢ To learn the modeling of circuits, circuit characterization and performance extraction. ➢ To understand basic electrical properties of MOS circuits and the design process at gate level and subsystem level. ➢ To give basic understanding of various analyses of differential amplifiers. ➢ To give basic understanding of non linear circuits such as comparator design.	Students will be able to 1. Understand small signal model of MOS transistor and Design using SPICE modeling 2. Analyze single stage and differential amplifier with frequency response. 3. Analyze and Design basic analog circuits such as current mirrors, active load, biasing circuits. 4. Illustrate performance parameter of operational amplifier.

Expt. No.	Name of Experiment
1	NMOS characteristic :- VdsVs ID for various values of Vgs.
2	PMOS characteristic :- VdsVs ID for various values of Vgs.
3	Current source using current mirror :- DC analysis
4	Common Source amplifier:- AC analysisTransientanalysis
5	Common Drain amplifier:- AC analysisTransientanalysis
6	Differential Amplifier :- AC analysis Transfer curve (Vin VsVout, DC condition)
7	Op-Amp Design: AC analysis Transient analysis DC analysis
8	SPICE simulation of basic analog circuits, Analog Circuit simulation Verification of layouts.
9	Basic CMOS Comparator Design
10	Source Coupled Pair Differential Amplifier

Text books:				
1	Design of Analog CMOS Integrated circuits	Ninteenth reprint 2010	BehzadRazavi	Mc-graw-Hill

Reference books:				
1	CMOS circuit design, layout, and Simulation'	Second edition, reprint 2009.	Jacob Baker	WSE
2	CMOS Analog Circuit Design	second edition, 2010	P.E.Allen, D.R.Holdberg	Oxford univ. press
3	Analysis and Design of Analog Integrated Circuits	fifth edition, reprint 2010	Paul B Gray , Hurst , Lewis, Meyer	John Wiley & sons

VII Semester
EE2427 – PE IV: Operating Systems

Objective	Outcome
1. To have an overview of different types of operating systems 2. To know the components of Operating systems 3. To have through knowledge of process management 4. To have through knowledge of storage management	1. Understand the concepts of operating systems and processes 2. Learn processes, threads and memory management and storage structures 3. Evaluate the algorithms and solutions for operating system management 4. Analyze the security issues in operating systems

UNIT-1:
Computer System organization ,Architecture, Structure, Operations, Process Management, Memory Management, OS Services, User Operating System Interface, System Calls, System Programs

(8 Hours)

UNIT-2:
Process Concept, Scheduling, Operations, Scheduling Criteria, Scheduling Algorithms, Tread Scheduling, Multiple Processor Scheduling

(7 Hours)

UNIT-3 :
Synchronization, Critical Section Problem, Semaphores, Deadlocks, System Models, Characterization, Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance

(8 Hours)

UNIT-4:
Memory Management Strategies, Swapping, Continuous Memory Allocation, Paging, Segmentation , Virtual Memory Management, Demand Paging, Page Replacement, Trashing,

(7 Hours)

UNIT-5 :
File System Concept, Access Methods, Directory and Disk Structure, Mounting, Sharing, Mass Storage Structure, Disk Attachment, Scheduling, RAID Structure

(8Hours)

UNIT-6:
Protection and Security , Domain of Protection, Access Matrix, Access Control, Language based Protection, Security Problem, System and Network Threats, Cryptography as Security Tool

(7 Hours)

Text books:				
1	Operating System Concepts	Eigth Edition, 2012	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne	John Wiley & Sons (ASIA) Pvt. Ltd
2	Modern Operating Systems	2003.	Andrew S. Tanenbaum	Prentice Hall of India Pvt. Ltd
Reference books:				
1	Operating Systems	2002	Harvey M. Deitel	Pearson Education Pvt. Ltd
2	Operating System	4th Edition, 2003	William Stallings	Prentice Hall of India
3	An Introduction to Operating Systems, Concepts and Practice	2003	Pramod Chandra P. Bhatt	PHI,

VII Semester
EE2428 – PE IV: Lab.: Operating Systems

Objective	Outcome

1. To have an overview of different types of operating systems 2. To know the components of Operating systems 3. To have through knowledge of process management 4. To have through knowledge of storage management	1. Understand the concepts of operating systems and processes 2. Learn processes, threads and memory management and storage structures 3. Evaluate the algorithms and solutions for operating system management 4. Analyze the security issues in operating systems

Expt. No.	Name of Experiment
1	Implement process system calls
2	Thread management
3	Thread synchronization
4	Deadlock Avoidance Using Semaphores
5	Linux Kernel configuration, compilation and rebooting from the newly compiled kernel.
6	Inter process communication in Linux
7	Implementing a CPU scheduling
8	Implementing a file system
9	Implement process system calls

Text books:				
1	Operating System Concepts	Eigth Edition, 2012	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne	John Wiley & Sons (ASIA) Pvt. Ltd
2	Modern Operating Systems	2003.	Andrew S. Tanenbaum	Prentice Hall of India Pvt. Ltd
Reference books:				
1	Operating Systems	2002	Harvey M. Deitel	Pearson Education Pvt. Ltd
2	Operating System	4th Edition, 2003	William Stallings	Prentice Hall of India
3	An Introduction to Operating Systems, Concepts and Practice	2003	Pramod Chandra P. Bhatt	PHI,

VII Semester
EE2431 – PE V: Industrial Automation

Objective	Outcome

Unit -1

Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems

Unit-II

Automation components: Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

Unit-III

Computer aided measurement and control systems: Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking,

Unit-IV

Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation

Unit-V

Programmable logic controllers: Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

Unit-VI

Distributed Control System: Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS

Text Book

- Industrial Instrumentation and Control By. S.K. Singh The McGraw Hill Companies

VII Semester
EE2432 – PE V: Nano Electronics

Objective	Outcome

Unit -1

Introduction to Nanoelectronics, CMOS Technology scaling issues, Short channel effects, sub-threshold conduction, Drain Induced Barrier Lowering, Design techniques for nanoscale transistor

Unit-II

MOS Electrical Characterization, Ideal MOS C-V Characteristics, Effects on non idealities on C-V, MOS Parameter extraction, Overview of Non Classical MOSFETs and carrier transport in Nano MOSFETs, Ballistic Transport

Unit-III

Silicon on Insulator (SOI) MOSFET, SOI technology comparison with bulk silicon CMOS Technology, Partially Depleted (PD) and Fully Depleted (FD) SOI-MOSFETs, Metal Semiconductor contacts and Metal-Source / Drain Junction MOSFETs

Unit-IV

Germanium and Compound semiconductor Nano MOSFETs, Germanium as alternative to silicon , Compound semiconductors, GaAs MESFETs types, Introduction to Nanomaterials

Unit-V

Quantum Mechanics and Quantum Statistics for considering nanomaterials, Basic principles of quantum mechanics , Energy bands in crystalline solids, Synthesis / Fabrication of Nanomaterials / structures, nanowires

Unit-VI

Chemical vapor deposition (CVD) and atomic layer deposition (ALD) , Carbon nanostrucutes, Characterization of Nanomaterials and Nanostructures

Text Book

- Fundamentals of Modern VLSI Devices, Y. Taur and T. Ning, Cambridge University Press

VII Semester
EE2433 – PE V: Optical Communication

Objective	Outcome
➢ To learn the basic elements of optical fiber transmission link, fiberglass modes configurations and structures. ➢ To understand different kinds of losses, signal attenuation in optical fibers & other dispersion factor. ➢ To learn various optical sources, LED/LASER structures, receivers (PIN, APD), and noise performance. ➢ Understanding of optical network system components, variety of networking aspects, SONET/SDH and operational principles WDM.	This course enables the students to: 1. Understand the fundamental principles of optics and light wave to design optical fiber communication systems. 2. Differentiate the types of losses in optical fiber link. 3. Analyze different types of sources & detectors in fiber optics. 4. Explore different methods of loss measurement in fiber optics.

UNIT-1: INTRODUCTION TO OPTICAL FIBERS

Evolution of fiber Optic system. Principle of optical communication-Attributes and structures of various fibers such as step index, graded index mode and multi modefibers. Propagation in fibers-Ray mode, Numerical aperture and multipath dispersion in step index and graded index fibers structure.

(8 Hours)

UNIT-2:SIGNAL DEGRADATION IN OPTICAL FIBERS

Attenuation, Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Group Delay, Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers, Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers, Mode Coupling, Design Optimization of SM fibers, RI profile and cut-off wavelength.

(7 Hours)

UNIT-3 : FIBER OPTICAL SOURCES

Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency and LED power, Modulation of a LED, Laser Diodes , Modes and Threshold condition, Rate equations, External Quantum efficiency, Resonant frequencies, Laser Diodes structures and radiation patterns, Single Mode lasers, Modulation of Laser Diodes, Temperature effects, Fabry Perot cavity Quantum laser

(8 Hours)

UNIT-4: FIBER OPTICAL RECEIVERS

PIN and APD diodes , Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise ,Comparison of Photo detectors, Fundamental Receiver Operation, Error Sources, Receiver Configuration, Probability of Error, The Quantum Limit, Noise Effects on System Performance, Eye diagram.

(7 Hours)

UNIT-5 : DIGITAL TRANMISSION SYSTEM

Introduction of fibers cables, Fiber Splicing and connectors, Operational Principals of WDM, SONET, LAN 1000 baseSX, LX and Passive Components, Optical TDM.

(8 Hours)

UNIT-6:MEASUREMENT IN OPTICAL FIBERS

Attenuation, Time domain dispersion and Frequency domain dispersion, OTDR, NA measurement Refractive index profile and optical source characteristic measurements.

(7 Hours)

Text books:				
1	Optical Fiber Communication	3rd edition, 1999.	Gerd Keiser	McGraw-Hill Science/Engineering /Math
2	Optical Communication, Principles and Practice	2nd Edition,1994	J.Senior	Prentice Hall of India

Reference books:				
1	Optical Communication System	2001	J.Gower	Prentice Hall of India
2	Fiber-Optic Communication System	Third Edition, 2009.	GovindAgrawal	John Willy & Sons

VII Semester
EE2434 – PE V: RF Circuit Design

Unit – I Introduction, Importance of Radio frequency Design, RF Behaviour of Passive Components, Chip Components, Transmission Line Analysis, Equivalent Circuit Representation, Circuit Parameters for a Parallel Plate Transmission Line, Microstrip Transmission Line, Terminated Lossless Transmission Line, Special Termination Conditions, Sourced and Loaded Transmission Line.

Unit – II The Smith Chart, From Reflection Coefficient to Load Impedance, Impedance Transformation, Admittance, Transformation, Parallel and Series Connections, Single- and Multiport Networks, Interconnecting Networks, Network Properties and Applications, Scattering Parameters.

Unit – III An Overview of RF Filter Design, Basic Resonator and Filter Configurations, Special Filter Realizations, Filter Implementation, Coupled Filter.

Unit – IV Matching and Biasing Networks: Impedance Matching Using Discrete Components, Microstrip Line Matching Networks, Amplifier Classes of Operation and Biasing Networks.

Unit – V RF Transistor Amplifier Designs: Characteristics of Amplifiers, Amplifier Power Relations, Stability Considerations, Constant Gain, Noise Figure Circles, Constant VSWR Circles, Broadband, High-Power, and Multistage Amplifiers

Unit – VI Oscillators, Basic Oscillator Model, High-Frequency Oscillator Configuration, Oscillators describing functions, Colpitt"s oscillators Resonators, Tuned Oscillators, Negative resistance oscillators, Phase noise Basic Characteristics of Mixers. Non-linear based mixers, Quadratic mixers, Multiplier based mixers, Single balanced and doubles balanced mixers, sub sampling mixers.

Text book

1. "RF Circuit Design – Theory and Applications", Reinhold Ludwig and Pavel Bretchko, 2nd Edition, Pearson Education, 2000.

Reference books:

1. T.Lee, "Design of CMOS RF Integrated Circuits", Cambridge, 2004.
2. B.Razavi, "RF Microelectronics", Pearson Education, 1997. 4. B.Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2001

VII Semester
EE2441 – PE-VI: E-Commerce and Data Analytics

Objective	Outcome
The student should be able to 1) To understand the scope of e-commerce in the realm of modern Business. 2) To learn the marketing methods& Business strategies used in e-commerce. 3) To know how the electronic data interchange and how to manage commerce solutions 4) Understand the security threats &electronic payment system	On completion of this course, the student will be able to 1. Understand of contemporary ecommerce concepts and terminology, and the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web. 2. Analyze and understand the human, technological and business environment associated with e-commerce. 3. Define and analyze the concept of electronic data interchange and its legal, social and technical aspects. 4. Define and analyze the security issues over the web, the available solutions, future aspects of e-commerce security, concept of E-commerce and electronic payment system

UNIT I:

Internet &Introduction to Electronic Commerce: Introduction to Traditional commerce and E commerce The basics of internet access, email, FTP, TELNET, Introduction to WWW: The basics of WWW & browsing working of Web Browser & Web Server, Web Browser architecture. Introduction to Electronic Commerce: The scope of Electronic Commerce, Definition of Electronic Commerce, Electronic Commerce and the Trade Cycle, Electronic Markets, Electronic Data Interchange, Internet Commerce, Advantage and disadvantages of e-Commerce.

UNIT II:

Business Models of e – commerce and Strategy: Model Based on Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C. Strategic Methods for developing E -commerce, the Value Chain System. Porters value chain Model.

UNIT III:

E-commerce Payment Systems (EPS) :- Payment through card systems, E – Cheque, E – Cash, E – Payment Threats & Protections. e-credit accounts, e-money, marketing on the Web, Marketing strategies, Advertising on the Web, Customer service and support, Introduction to m-commerce, Case study: e-commerce in passenger air transport.

UNIT IV:

E – Marketing And Electronic Data Interchange (EDI): Home –shopping, E-Marketing, Tele-marketing. Electronic Data Interchange (EDI): Concepts, Benefits and Applications; EDI Model, EDI Protocols (UN EDI FACT).

UNIT V:
The Elements of e-Commerce& e-Business: Elements, e-Visibility, The e-shop, Online Payments, Delivering the Goods, After-Sales Service. e-Business: Introduction, Internet Bookshops, Software Supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the Net.

UNIT VI:
Overview, Security for E – Commerce, Security Standards, secure electronic payment protocols, Password Systems, Digital certificates, Digital signatures

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	E-Commerce	2001	David Whiteley	McGrew Hill Pub
2.	Electronic Commerce	2nd Edition	Gary P. Schneider & James T. Perry	Course Technology

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Teach Yourself Web Technologies -Part 1	2003	Ivan Bayross	BPB Publications
2	Web Technologies TCP/IP Architecture, and Java Programming	2nd Edition	Achyut S. Godbole and Atul Kahate	McGraw-Hill Education (India)

VII Semester
EE2442 – PE-VI: Micro Electro Mechanical Systems (MEMS)

Objective	Outcome
➢ Standard micro fabrication techniques and the issues surrounding them ➢ Major classes, components, and applications of MEMS devices/systems and to demonstrate an understanding of the fundamental principles behind the operation of these devices/systems ➢ Micro fabrication techniques and applications to the design and Manufacturing of an MEMS device or a Microsystems ➢ Foster interest for further study	Students will be able to: 1. Understand working principles of MEMS technology. 2. Learn the basic principles and applications of Micro fabrication and micromachining processes. 3. Discuss various applications of RF MEMS. 4. Classify types of microsensors and micro actuators used in Micro systems

UNIT I

Introduction to MEMS: Benefits of Miniaturization, Types of MEMS: Optical MEMS, Bio- MEMS, RF- MEMS, Microfludics, Success Stories, Pressure sensor, Accelerometer, Micro-mirror TV Projector

UNIT II

Microfabrication and Micromachining: Integrated Circuit Processes, Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding, High Aspect-Ratio Processes (LIGA), MEMS Device fabrication using Bulk Micromachining

UNIT III

Surface Micromachining: One or two sacrificial layer processes, Surface micromachining requirements, Device fabrication using Surface Micromachining example, Microcantilever fabrication

UNIT IV

RF MEMS Devices: Capacitor, Inductor, Switches, and antennas, RF MEMS components in communications, space and defense applications

UNIT V

Physical Micro sensors: Classification of physical sensors, Integrated, Intelligent, or Smart sensors, Sensor Principles and Examples: Thermal sensors, Electrical Sensors, Mechanical Sensors, Chemical and Biosensors

UNIT VI

Microactuators: Classification of microactuators, Electrostatic, Electromagnetic and Thermal microactuation, Mechanical design of microactuators, Microactuator examples, microvalves, micropumps, micromotors.

Text Books:

1. Micro and Smart Systems: Ananthasuresh, G. K., Vinoy, K. J., Gopalakrishnan, S., Bhat, K. N., and Aatre, V. K., Wiley-India,NewDelhi, 2010.

Reference Books:

1. VLSI Technology, Sze S.M. (ed),McGraw Hill
2. RF MEMS and Their Applications: Vijay Varadan, K. J. Vinoy, K. A. Jose, Wiley, 2002.

VII Semester
EE2443 – PE-VI: Biomedical Instrumentation

Objective	Outcome
➢ This course is intended for introducing the students to evolution and development of biomedical instrumentation. ➢ The purpose of this course is to develop a strong foundation of use of transducers in biomedical measurements. ➢ Understand concepts of working principle of various biomedical instruments and analysis their output graphs like ECG,EEG,EMG, X-rays, plethysmograph and spirogram ➢ Understand the fundamentals of Telemedicine like Teleradiology,Telecardiology, Telepsychiatry and Medical Informatics	Students 1. Will be able to understand the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation 2. Will be able to understand cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram 3. Will be able to understand various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care. 4. Will be able to understand concept of Telemedicine, its applications and use of internet resource for hospital management system.

UNIT-1:
Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system

UNIT-2:
Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers

UNIT-3 :
The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement. Principles of ultrasonic diagnosis, temperature measurement.

UNIT-4:
Electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers.

UNIT-5:
Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG pacemakers, defibrillators. Physiological effects of electrical current, shock hazards from electrical equipment, Methods of accident prevention. Tomograpghy, MRI.

UNIT-6:
Telemedicine, Telemedicine applications, video conferencing, digital communication in telemedicine, Teleradiology, Tele Cardiology, Telepsychiatry, Hospital Information System, Computer Networks in Health care.

Text books:				
1	Biomedical Instrumentation & Measurement		By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	PHI
Reference books:				
1	Handbook of Biomedical Instrumentation		R.S.Khandpur	TMH
2	Bioelectronic Measurement		Dean A Dmane, David Michaels	Prentice Hall
3	Medicine and Clinical Engineering		Jacobson and Webster	PHI
4	Introduction to Biomedical Equipment Design		Carr and Brown	John Wiley
5	Biomedical Digital Signal Processing		Tompkins	

VII Semester
EE2444 – PE VI : Computer Organisation

Objective	Outcome
➢ Acquire knowledge of various Computer architecture. ➢ To understand Processor level design, controller design of processor. ➢ To understand memory organization of computer. ➢ To Learn about DMA operation, parallel processing architecture.	After study through lectures and assignments, Students will be able to: 1. Understand design levels of a computer system, System organization, memory hierarchy and virtual memory concept 2. Understand the operation of fixed- and floating-point arithmetic units. 3. Analyze hierarchical design of processor and control unit modules. 4. Apply the concepts of pipelining and multiprocessing for computer system design.

UNIT-1:
Register Level Design – General characteristics, Description, Languages, Combinational and sequential components, Design methods, Processor Level design- components, design techniques. (7 Hours)

UNIT-2:
Processor Design- Processor organization, information representation, number Formats. Instruction sets – Instruction formats, instruction types, multiplication & division ALU design, Floating Point arithmetic, IEEE 754 floating point formats. (8 Hours)

UNIT-3
Control design – Instruction sequencing, interpretation, Hard-wired control-Design methods, multiplier and CPU control unit, Micro programmed control – Basic concepts, minimizes microinstruction size, multiplier control unit, Micro programmed Computers – CPU control unit,.(8 Hours)

UNIT-4:
Memory organization – Device characteristics, RAM, Serial access memories, virtual memory, concept of cache & associative memories. (7 Hours)

UNIT-5
System Organization – Local and long distance communication input-output systems, Interrupt, DMA, introduction to parallel processing. (8 Hours)

UNIT-6:
Concept of parallel processing, Pipelining, vector processors, introduction of RISC architecture, Date Flow architecture. (7 Hours)

1	Computer Architecture and organization	Third Edition, 1997	Jhon.P. Hayes	McGraw-Hill Companies
Reference books:				
1	Computer organization	Fifth edition, 2001	Carl Hammacher	McGraw-Hill Science
2	Structured computer and Organization	Fifth edition, 2005	Andrew S. Tanenbaum	PHI
3	computer organization and microprogramming	First edition, 1972.	CHU, YAOHAN	Prentice Hall
4	Computer System Architecture	Third Edition ,1992	M.Morris Mano	Prentice Hall

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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BE SoE and Syllabus 2018

ELECTRONICS ENGINEERING

Nagar Yuwak Shikshan Sanstha's

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ELECTRONICS ENGINEERING

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Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University) **(Accredited 'A++' Grade by NAAC with a score of 3.6)**

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology
SoE & Syllabus 2020
3rd To 8th Semester
Electronics & Telecommunication Engineering

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. ET-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	**T**	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	ET2201	Electronic Devices and Circuits	**T**	3	1	0	4	4	30	20	50	3 Hours
3	3	PC	ET2202	Lab: Electronic Devices and Circuits	**P**	0	0	2	2	1		60	40	
4	3	PC	ET2203	Digital Circuits and Fundamentals of Microprocessor.	**T**	3	0	0	3	3	30	20	50	3 Hours
5	3	PC	ET2204	**Lab:** Digital Circuits and Fundamentals of Microprocessor.	**P**	0	0	2	2	1		60	40	
6	3	PC	ET2205	Electronic Measurement and Instrumentation	**T**	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	ET2206	Lab: Electronic Measurement and Instrumentation	**P**	0	0	2	2	1		60	40	
8	3	PC	ET2207	Network Analysis	**T**	3	0	0	3	3	30	20	50	3 Hours
				TOTAL THIRD SEM		**15**	**1**	**6**	**22**	**19**				

Fourth Semster														
1	4	BS	GE2204	Advance Mathematical Techniques	**T**	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	ET2251	Electromagnetic Fields	**T**	3	1	0	4	4	30	20	50	3 Hours
3	4	PC	ET2252	Microcontroller and Interfacing	**T**	3	0	0	3	3	30	20	50	3 Hours
4	4	PC	ET2253	Lab: Microcontroller and Interfacing	**P**	0	0	2	2	1		60	40	
5	4	PC	ET2254	Analog Communication	**T**	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	ET2255	Lab: Analog Communication	**P**	0	0	2	2	1		60	40	
7	4	PC	ET2256	Control Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	ET2257	Lab.: Control Systems	**P**	0	0	2	2	1		60	40	
				TOTAL FOURTH SEM		**15**	**1**	**6**	**22**	**19**				

List of Audit Courses														
1	3	HS	GE2121	Env Studies for 3 Sem. EL,ET,CT	**A**	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
3	4	HS	AU2125	YCCE Communication Aptitude Preparation (YCAP4.2) for EL,EE,ET	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

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Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	ET2301	Analog Integrated circuits	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	ET2302	Lab: Analog Integrated circuits	**P**	0	0	2	2	1		60	40	
4	5	PC	ET2303	Fields & Radiating Systems	**T**	3	1	0	4	4	30	20	50	3 Hours
5	5	PC	ET2304	Signals & Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
6	5	PC	ET2305	Lab. :Signals & Systems	**P**	0	0	2	2	1		60	40	
7	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3 Hours
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5		ET2306	Lab.: Electronics Workshop	**P**	0	0	2	2	1		60	40	
10	**5/6**	**STR**	**ET2310**	**Industry Visit and its report**	**P**	0	0	0	0	1		100		
				TOTAL FIFTH SEM		**18**	**1**	**6**	**25**	**23**				

Audit Courses														
1	5	HS	AU2127	YCCE Communication Aptitude Preparation (YCAP5.2) for EL,EE,ET	**A**	3	0	0	3	0				

Open Electives -I

1	5	OE 1	ET2311	OE I : Microcontroller & Embedded Systems
2	5	OE 1	ET2312	OE I : Principles of Communication Engineering
3	5	OE 1	ET2313	OE I : Fundamentals of Image Processing
4	5	OE 1	ET2314	OE I : Fundamentals of IoT

Open Electives -II

1	5	OE 2	ET2321	OE II : Soft computing
2	5	OE 2	ET2322	OE II : Industrial Instrumentation
3	5	OE 2	ET2323	OE II : Medical Electronics
4	5	OE 2	ET2324	OE II : Display Technology & Applications
5	5	OE 2	ET2325	OE II : PLCs and SCADA

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SoE No. ET-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamental of Management	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	ET2351	Digital Signal Processing	**T**	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	ET2352	Lab: Digital Signal Processing	**P**	0	0	2	2	1		60	40	
4	6	PE		Professional Elective I	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PE		Lab. : Professional Elective I	**P**	0	0	2	2	1		60	40	
6	6	PE		Professional Elective II	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PE		Lab. : Professional Elective II	**P**	0	0	2	2	1		60	40	
8	6	OE		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	OE		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3 Hours
TOTAL SIXTH SEM						**18**	**0**	**6**	**24**	**21**				

Professional Electives -I

1	6	PE I	ET2361	PE I : Object Oriented Programming
2	6	PE I	ET2362	PE I : Lab. Object Oriented Programming
3	6	PE I	ET2363	PE I : Discrete Structures
4	6	PE I	ET2364	PE I : Lab. Discrete Structures
5	6	PE I	ET2365	PE I : Microprocessors and Peripherals
6	6	PE I	ET2366	PE I : Lab. Microprocessors and Peripherals
7	6	PE I	ET2367	PE I : Electronic Instrumentation
8	6	PE I	ET2368	PE I :Lab Electronic Instrumentation
9	6	PE I	ET2371	PE I : Fundamentals of Computing
10	6	PE I	ET2372	PE I : Lab Fundamentals of Computing
11	6	PE I	ET2373	PE I : Algorithms and data structures
12	6	PE I	ET2374	PE I :Lab Algorithms and data structures

Professional Electives -II

1	6	PE II	ET2377	PE II : Antenna Theory & Design
2	6	PE II	ET2378	PE II : Lab. Antenna Theory & Design
3	6	PE II	ET2379	PE II : Digital system Design
4	6	PE II	ET2380	PE II : Lab. Digital system Design
5	6	PE II	ET2381	PE II : Internet of Things (IoT)
6	6	PE II	ET2382	PE II : Lab. Internet of Things (IoT)
7	6	PE II	ET2383	PE II : Optical Communication
8	6	PE II	ET2384	PE II : Lab. Optical Communication
9	6	PE II	ET2385	PE II :Principles of image processing
10	6	PE II	ET2386	PE II : Lab. Principles of image processing
11	6	PE II	ET2387	PE II : TV & Video Engineering
12	6	PE II	ET2388	PE II : Lab. TV & Video Engineering

Open Electives -III

1	6	OE 3	ET2391	OE III : Microcontroller & Embedded Systems
2	6	OE 3	ET2392	OE III : Principles of Communication Engineering
3	6	OE 3	ET2393	OE III : Fundamentals of Image Processing
4	6	OE 3	ET2394	OE III : Fundamentals of IoT

Open Electives -IV

4	6	OE 4	ET2396	OE IV : Soft computing
5	6	OE 4	ET2397	OE IV : Industrial Instrumentation
6	6	OE 4	ET2398	OE IV : Medical Electronics
7	6	OE 4	ET2399	OE IV : Display Technology & Applications
7	6	OE 4	ET2400	OE IV : PLCs & SCADA

Audit Courses											
1	6	HS	AU2129	YCCE Communication Aptitude Preparation (YCAP6.2) for ME, EE, ETC	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

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Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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SoE No. ET-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	ET2401	RF & Microwave	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	ET2402	Lab: RF & Microwave	**P**	0	0	2	2	1		60	40	
3	7	PC	ET2403	Digital Communication	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PC	ET2404	Lab: Digital Communication	**P**	0	0	2	2	1		60	40	
5	7	PE		Professional Elective III	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		Professional Elective IV	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		Professional Elective V	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	PE		Professional Elective VI	**T**	3	0	0	3	3	30	20	50	3 Hours
9	7	STR	ET2409	Mini Project	**P**	0	0	4	4	2		60	40	
10	7	STR	ET2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
				TOTAL SEVENTH SEM		**18**	**0**	**8**	**26**	**24**				

Professional Electives -III

1	7	PE	ET2411	PE III : Power Electronics
2	7	PE	ET2412	PE III : Data Compression & Encryption
3	7	PE	ET2413	PE III : Analog VLSI
4	7	PE	ET2414	PE III : Error Correcting Codes
5	7	PE	ET2415	PE III : Wireless Mobile Communication Systems

Professional Electives -IV

6	7	PE	ET2421	PE IV : Satellite Communication & RADAR Engineering
7	7	PE	ET2422	PE IV : Embedded System
8	7	PE	ET2423	PE IV : Switching Theory
9	7	PE	ET2424	PE IV : Topics in Machine Learning
10	7	PE	ET2425	PE IV : Multimedia Communications

Professional Electives -V

11	7	PE	ET2431	PE V : Display Technology
12	7	PE	ET2432	PE V : Biomedical Instrumentation
13	7	PE	ET2433	PE V : Fuzzy Logic & Neural Network
14	7	PE	ET2434	PE V : Wireless Sensor Networks
15	7	PE	ET2435	PE V : RF Circuit Design

Professional Electives -VI

16	7	PE	ET2441	PE VI : CMOS VLSI Design
17	7	PE	ET2442	PE VI : Digital Image Analysis for Remote Sensing
18	7	PE	ET2443	PE VI : Microwave Integrated circuits
19	7	PE	ET2444	PE VI : Communication Networks
20	7	PE	ET2445	PE VI : Computer Architecture and Organization
21	7	PE	ET2446	PE VI : PLCs & SCADA

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TA = for Practical : MSPA will be 15 marks each**

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Electronics & Telecommunication Engineering

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						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	ET2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	ET2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**84**	**3**	**44**	**131**	**163**				

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TA = for Practical : MSPA will be 15 marks each**

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology
SoE & Syllabus 2020
3rd Semester
Electronics & Telecommunication Engineering

After 26#AC

III Semester
GE2201 - Engineering Mathematics-III

Course Objective Students should be able to	Course Outcomes Students will be able to
1. To find numerical solution of various mathematical equations 2. To introduce concept of Laplace transform, Z transform, Fourier transform 3. To express the periodic functions in the form of Fourier series 4. To solve partial differential equations	1. Estimate the Calculus of Numerical Function. 2. Determine the transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations. 3. Discuss the nature of periodic function and express it in terms of series. 4. Use appropriate method/s to solve partial differential equations.

UNIT-1: : Finite Differences **[8 hrs]**
Difference table; Operators E and Δ, Central differences, Factorials notation Numerical differentiation and integration, Difference equations with constant coefficients.

UNIT- 2 : Laplace Transform **[7 hrs]**
Laplace Transforms: Laplace transforms and their simple properties(with proof), Unit step function Heaviside unit step function and inverse, convolution theorem, , Applications of Laplace transform to solve ordinary differential equations including simultaneous equations.

UNIT-3 : Z-transform **[8 hrs]**
Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and redidue theorem, , Applications of Z-transform to solve difference equations with constant co-efficient.

UNIT-4 : Matrices **[9 hrs]**
Inverse of matrix by adjoint method and its use in solving simultaneous equations, rank of a matrix (by partitioning method) consistency of system of equation, Inverse of matrix by partitioning method Linear dependence, Linear and orthogonal transformations. Characteristics equations, eigen values and eigen vectors. Reduction to diagonal form, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester"s theorem, Association of matrices with linear differential equation of second order with constant coefficient.

UNIT-5 : Fourier Series and Partial Differential Equation **[8 hrs]**
Fourier Series – Periodic Function and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions.
Partial Differential Equations – PDE of first order first degree i.e. Lagrange"s form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve forst and second order partial differential equations.

UNIT-6 : Fourier Transform **[6 hrs]**
Definition : Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval"s Identity, convolution Theorem.

Text Books:

SN	Title	Authors	Edition	Publisher
1	Advance Engineering Mathematics	Kreyszig	9th Edition (September 2009)	Wiley
2	Higher Engineering Mathematics	B.S. Grewal	40th edition, (2010)	Khanna Publishers
3	Advanced Engineering Mathematics	H.K. Dass	8th revised edition, 2007	S.Chand and Company Limited

Reference Books:

SN	Title	Authors	Edition	Publisher
1	Mathematics for Engineers	Chandrika Prasad.	19th edition, (2007)	John Wiley & Sons
2	Advanced Mathematics for Engineers	Chandrika Prasad	4th edition, (2006)	John Wiley & Sons
3	Applied Mathematics for Engineers	L.A.Pipes and Harville	3rd edition, (1970)	McGraw Hill
4	A text Book of Applied Mathematics	P.N. and J.N. Wartikar	3rd edition, (2000)	Pune Vidyarthi Griha Prakashan

III Semester
ET2201 - Electronic Devices and Circuits

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1) Understand working principle of semiconductor Device and Learn the operation of the BJT. 2) Learn transistor biasing and stabilization techniques and the Understand the operation and characteristics of Field effect transistor. 3) Study low and high frequency analysis of transistors 4) Understand the characteristics of various electronic devices	1) Apply the knowledge of semiconductor diodes in circuit analysis 2) Analyze the transistor circuits for different configurations. 3) Design transistor circuit with suitable biasing and stabilization techniques. 4) Analyze the response of transistors at low and high frequency 5) Analyze power amplifier circuits.

Unit - I **7Hrs**

Semiconductor Diodes: PN junction diode and its application, Physics and structure of diodes, Diode small signal model, Zener diode, Rectifier circuits, Clipping and clamping circuits. Rectifier circuits, Zener shunt regulator.

Unit – II **7Hrs**

Bipolar Junction Transistors : Physical structure and operation modes, Active region operation of transistor, DC analysis of transistor circuits, Ebor-Moll model ,Current voltage characteristics of CE, CB, CC configuration Transistor as an amplifier, Biasing the BJT, Transistor as a switch.

Unit – III **6Hrs**

Transistor Biasing, The Operating Point, Bias Stability, Self-Bias, Fixed bias, collector to base bias, Emitter feedback bias, Stabilization against Variations in Ico, VBE, AND β, Collector-Current Stability, Thermal Runaway.

Unit – IV **7Hrs**

Field-effect Transistors -The Junction Field-effect Transistor, The Pinch-off Voltage Vp, The JFET Volt-Ampere Characteristics, MOSFET Device Structure and Physical Operation of MOSFET, Finite Output Resistance in Saturation, Characteristics of the MOSFET, Small Signal Equivalent Model, MOSFET Biasing by Fixing VGS, Biasing by Fixing VG and Connecting a Resistance in the Source, Biasing Using a Drain-to-Gate Feedback Resistor, Biasing Using a Constant-Current Source.

Unit – V **7Hrs**

Small signal operation of BJT, small signal operation of MOSFET using π model and T model, Internal capacitances and high frequency model of BJT and MOSFET.

Unit – VI **6Hrs**

Power Amplifier : Class A, Class B, Class AB and Class C, Power Efficiency, Power Dissipation, Cross-Over Distortion in Class AB Circuits, Class A Transformer Coupled Power Amplifier, Harmonic Distortion due to Large Signal operation

Text Books:

SN	Title	Authors	Edition	Publisher
1	Microelectronics Circuits	Sedra Smith	5th Edition 2010-01-07	Oxford Uni. Press
2	Integrated Electronics	MillMan Halkias	7th edition 2009	Tata McGraw Hills

Reference Books:

SN	Title	Authors	Edition	Publisher
1	Electronic Devices and Theory	BoyleStad, Nashelsky	9th. Edition May 2010	PHI
2	Electronic Devices and Circuits	S Salivahanan, N Suresh Kumar	3rd Edition	Tata McGraw Hills

III Semester
ET2202 - Lab: Electronic Devices and Circuits

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1) Understand working principle of semiconductor Device and Learn the operation of the BJT. 2) Learn transistor biasing and stabilization techniques and the Understand the operation and characteristics of Field effect transistor. 3) Study low and high frequency analysis of transistors 4) Understand the characteristics of various electronic devices	1) Apply the knowledge of semiconductor diodes in circuit analysis 2) Analyze the transistor circuits for different configurations. 3) Design transistor circuit with suitable biasing and stabilization techniques. 4) Analyze the response of transistors at low and high frequency 5) Analyze power amplifier circuits.

Expt. No.	Name of Experiment
1	To plot the V- I characteristics of PN junction diode (Silicon), Zener diode, LED.
2	To find the i) Voltage regulation ii) Load Regulation of a Zener shunt regulator
3	To Design Clipping and Clamping circuits.
4	To Design Half wave & Full Wave Rectifier with filter
5	To plot I/P & O/P Characteristics of Common Base Transistor
6	To plot I/P & O/P Characteristics of Common Emitter Transistor Configuration
7	To obtain Frequency Response of single stage CE Amplifier
8	To plot Drain and Transfer characteristics of Field Effect Transistor (FET)
9	To plot Drain and Transfer characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET)
10	To plot the frequency response of Common Source amplifier.
11	To Design Fixed Bias circuit and Self Bias circuit and observe the effect of temperature variation on transistor parameters
12	To Design Class B Amplifier with Cross Over Distortion .
13	Orcad based simulation of class AB power Amplifier.

III Semester
ET2203 - Digital Circuits and Fundamentals of Microprocessor

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Learn digital logic families and minimization method. 2. Understand the concept of Combinational circuits using MSI and LSI chips 3. Learn arithmetic circuits 4. Know Synchronous, and Asynchronous counters and flip flops 5. Study 8085 Microprocessor. 6. Study assembly language programming.	1. Illustrate logic families, BCD arithmetic. 2. Simplify the logic functions using various minimization techniques. 3. Design Combinational and sequential logic circuits. 4. Explain the architecture and instructions of 8085 5. Develop 8085 microprocessor programs

Unit - I **[6 Hrs]**

Introduction to Logic families & their characteristics. Fan-In, Fan-out, Propagation delay, Power dissipation, Noise Margin, CMOS inverter. BCD arithmetic, simplification of Boolean expressions, Implementations of Boolean expressions using logic gates, Karnaugh map, Quine Mcclauskey methods ,Formation of switching functions from word statements.

Unit - II **[5 Hrs]**

Functions & implementation using Multiplexer, Demultiplexer, Encoder, Decoder. Combinational circuit analysis, Combinational circuits design using MSI and LSI chips, Code Converters.

Unit - III **[5 Hrs]**

Design of Arithmetic circuits: Half & Full adders, Half & Full subtractors , Multibit parallel adders, Carry Propagate adder & Carry Look ahead adder, BCD Adder, Comparators, Multi bit Application designs, ALU

Unit - IV **[6 Hrs]**

Edge & Level triggers. Need for sequential circuits, Binary cell, Latches and flip-flops. RS-FF, D-FF, JK-FF, Master-Slave JK-FF & T-FF, Excitation & Truth Table, Flip-flop conversions, Shift registers, Synchronous and Asynchronous sequential Circuits. Counters Design, Ring counter.

Unit - V **[7 Hrs]**

Introduction to 8085 Microprocessor-Architecture, Addressing Modes, Instruction set, PIN configuration

Unit - VI **[7 Hrs]**

8085 Advanced instructions, Assembly language programming, Interrupts.

Text books:

SN	Title	Authors	Edition	Publisher
1	Digital Design	Morris Mano	3rd edition	Pearson PH
2	Microprocessor Architecture, Programming and Applications with the 8085	Ramesh Gaonkar	-	Penram International Publications

Reference books:

SN	Title	Authors	Edition	Publisher
1	Digital Circuits & Microprocessors	Hebert Taub	5th edition	Mc Graw Hill
2	Fundamentals of Digital Logic with VHDL Design	Stephen Brown & Zvonko Vranesic	2nd Edition	TMH
3	Engg Approach to Digital Design	W. Fletcher	1st edition	PHI

III Semester
ET2204 - Lab: Digital Circuits and Fundamentals of Microprocessor

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Learn digital logic families and minimization method. 2. Understand the concept of Combinational circuits using MSI and LSI chips 3. Learn arithmetic circuits 4. Know Synchronous, and Asynchronous counters and flip flops 5. Study 8085 Microprocessor. 6. Study assembly language programming.	1. Illustrate logic families , BCD arithmetic. 2. Simplify the logic functions using various minimization techniques. 3. Design Combinational and sequential logic circuits. 4. Explain the architecture and instructions of 8085 5. Develop 8085 microprocessor programs

Expt. No.	Name of Experiment
1	Design and Realize basic logic gates using Universal gates
2	Design of Adder
3	Design of Subtractor
4	Design of combinational logic circuits
5	Design of code converters
6	Design of Multiplexer
7	Design of Comparator
8	Design of Decoder
9	Implementation of flip flop
10	Design of Shift Resister
11	Design of Mod-N Up-Down Counter
12	Design of synchronous counter
13	Design of Asynchronous counter
14	Develop the programme using 8085Microprocessor
15	Mini Project

III Semester
ET2205 - Electronic Measurement & Instrumentation

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand basic measurement system with different types of standards and errors 2. Understand working of A.C. & D.C. bridges 3. Study different types of meters, display devices, generators ,analyzers ,sensor and transducers 4. Understand the concept of data conditioning system	1. Elaborate basic measurement and instrumentation system 2. Analyze the types of errors, bridge circuits and gauge factor of strain gauges 3. Explain the working of display devices, generators, and analyzers 4. Measure different physical parameters using suitable transducers

Unit - I **5Hrs**

Introduction, standards, Static & dynamic characteristics of measurement system, need of calibration, Types of errors & their sources, limiting errors & Statistical analysis

Unit – II **6Hrs**

AC & DC Bridges DC bridges - Wheatstone bridge, sensitivity of Wheatstone bridge, Kelvin's bridge.
AC bridges – Inductance measurement- Maxwell's Induction bridge, Maxwell's Induction capacitance bridge, Hays Bridge, Capacitance measurement- Schering bridge, Frequency measurement- Wien bridge.

Unit – III **6Hrs**

Amplified DC meters, AC Voltmeter, TRUE/RMS voltmeter, Electronic Multimeter, Digital Multimeter, Digital Voltmeter, Q-meter, LCR meter, dual trace CRO, Dual beam CRO, Digital Storage Oscilloscope, Introduction to instrumentation buses.

Unit – IV **6Hrs**

AF Generator, Pulse characteristics, Pulse Generators, Function Generator, Sweep Frequency Generator, Wave analyzer, Spectrum analyzer, Distortion analyzer.

Unit – V **7Hrs**

Definition, Classification of transducer, Selection of Transducer, Resistive transducer- Potentiometer, RTD, Thermistor, LM35 temperature sensor, Strain Gauges, strain gauge Load Cells, Inductive transducer- LVDT, capacitive transducers- Variable area, variable distance, Piezoelectric Transducer, thermoelectric (Thermocouple), photoelectric transducers, Digital optical encoder, Light sensor, Electromagnetic flow meter, Ultrasonic sensors, Hall Effect Sensor.

Unit – VI **6Hrs**

Signal conditioning and its necessity, Functions of Signal conditioning, AC/DC Conditioning systems, Instrumentation Amplifier, Data conversion: ADC & its types, DAC, Generalized data acquisition system: single channel, multi-channel and modular DAS.

Text books:

SN	Title	Authors	Edition	Publisher
1	Modern Electronic Instrumentation and Measurement Techniques	Albert D. Helfrick William D. Cooper	2007 Edition	PHI
2	Electrical and electronics Measurement and Instrumentation	A. K. Sawhney	4th Edition	Dhanpat Rai& Co

Reference books:

SN	Title	Authors	Edition	Publisher
1	Elements of Electronic Instrumentation and Measurement	Joseph J. Carr	3rd edition	Pearson Education
2	Electrical and electronic Measurement	R. K. Rajput	1st Edition	PHI Publication
3	Transducers &Inst	DVS Murthy	2nd Edition	PHI Publication

III Semester
ET2206 - Lab: Electronic Measurement & Instrumentation

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand basic measurement system with different types of standards and errors 2. Understand working of A.C. & D.C. bridges 3. Study different types of meters, display devices, generators ,analyzers ,sensor and transducers 4. Understand the concept of data conditioning system	1. Elaborate basic measurement and instrumentation system 2. Analyze the types of errors, bridge circuits and gauge factor of strain gauges 3. Explain the working of display devices, generators, and analyzers 4. Measure different physical parameters using suitable transducers

Expt. No.	Name of Experiment
1	Measure the value of unknown Resistance by using Wheatstone Bridge.
2	Measure the value of unknown Resistance by using Kelvin's Bridge.
3	Measure the value of unknown Inductance by using Maxwell's Inductance-Capacitance Bridge.
4	Measure the value of unknown Inductance by using Hay's Bridge.
5	Measure unknown capacitance using Shearing Bridge.
6	Measure unknown capacitance or frequency using Wien Bridge.
7	Measure unknown values of L,C,R using LCR-Q meter
8	Measure the unknown temperature & Plot Temperature Vs Resistance characteristics using RTD.
9	Plot the V-I characteristics of RTD
10	Measurement of Temperature using Thermocouple.
11	Measure the linear displacement using LVDT.
12	Plot the input output characteristics of LVDT
13	Measurement of Pressure using Bourdon tube.
14	Measurement of Strain using Strain Gauge or load cell.
15	Identify the additional functions of Dual trace CRO.
16	Measurement of various parameters using DSO
17	To Study concept behind Grounding and Shielding
18	Measurement of component values using Virtual DMM Instrumentation(beyond syllabus)
19	Generation & Measurement of voltage and Frequency using Virtual function generator and CRO (beyond syllabus)
20	Transient analysis using DSO
21	Study characteristic of Photo conductive cell
22	Measurement of Humidity using Humidity sensor
23	Speed measurement of DC motor using proximity speed sensor

III Semester
ET2207 - Network Analysis

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1) The fundamental principles of electrical circuit analysis using mesh - node method for problem solving in mathematics, science, and engineering 2) To appreciate the consequences of linearity using various network theorems. 3) To analyze analog circuits that include energy storage elements using Laplace transforms for circuit analysis. 4) To analyze and synthesize waveforms for different electrical parameters. 5) To analyze four terminal networks using two-port parameters	1) Analyze electrical circuits using nodal and mesh analysis 2) Evaluate electrical circuit parameters using network theorems 3) Estimate steady state and transient response of electrical circuits using initial and final conditions 4) Analyze waveforms using Laplace transform 5) Evaluate parameters of two – port networks.

UNIT-I: Nodal Analysis of Electric Circuits [6 Hrs]

Basics of electric circuits, circuit elements and their voltage – current relationship, classification of circuit elements, sources – their types and characteristics, concept of equivalent sources, source transformation , nodal analysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy. Series Circuit, Parallel Circuit, Source shifting, Principe of duality, concept of V-shift and I-shift.

UNIT-II:: Mesh Analysis of Electric Circuits [6 Hrs]

Mutual inductance, coefficient of coupling, dot convention, dot marking in coupled coils, meshanalysis of circuits containing resistors, inductors, capacitors, transformers, and both independent and dependent sources to determine current, voltage, power, and energy.

UNIT-III :Network Theorem [6 Hrs]

Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem.

UNIT-IV: Initial and Final Conditions, Impedance Functions and Circuit Analysis with Laplace Transform [6 Hrs]

Review of Laplace Transform, concept of complex frequency, transform impedance and admittance, s – domain impedance and admittance models for resistor, inductor and capacitor, series and parallel combinations of elements. Transformed network on loop and mesh basis, mesh and node equations for transformed networks, time response of electrical network with and without initial conditions by Laplace transform, Transient analysis.

UNIT-V : Transforms of other Signal Waveforms, Network Functions, Poles and Zeros of network functions [6 Hrs]

Unit step, ramp and impulse functions with and without time delay, their Laplace transform, waveform synthesis and its application to electrical networks.

Terminal pairs or ports, network functions for one port and two port networks, definition and physical interpretation of poles and zeros, pole-zero plot for network functions, restrictions on pole and zero locations for driving point and transfer functions, time domain 8ascade8r from the pole – zero plot, network synthesis using pole – zero plot.

UNIT-VI: Two Port Parameters [6 Hrs]

Standard reference directions for the voltages and currents of a two – port network, defining equations for open circuit impedance, short circuit admittance, transmission, inverse transmission, hybrid and inverse hybrid parameters, relationships between parameter sets, interconnections of two – port networks. Transistor as a two port network.

Text books:				
1	Network Analysis	3rd Edition	M. E. Van Valkenburg	PHI Learning Private Limited
2	Engineering Circuit Analysis	8th Edition	William H. Hayt, Jack E. Kemmerly, Steven M. Durbin	McGraw – Hill
3	Linear Circuit Analysis	2nd Edition	Decarlo, Lin	Oxford Univ. Press

Reference books:				
1	Schaum's 3000 Solved Problems In Electric Circuits Book 1 & 2	1st Edition	Syed A. Nasar	McGraw – Hill
2	Basic Circuit Theory	3rd Edition	Lawrence P. Huelsman	PHI Learning Private Limited
3	Problems and Solutions in Network Analysis		R. Gopal	CBS

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology
SoE & Syllabus 2018
4th Semester
Electronics & Telecommunication Engineering

After 26# AC

IV Semester
GE2204 - Advanced Mathematical Techniques

Course Objectives Students should be able to	Course Outcomes Students will be able to
1. To introduce various Numerical Methods to solve algebraic and differential equations 2. To understand the concept of Probability distribution 3. To introduce the concept of Fuzzy Set theory and functions 4. To make aware of different optimization techniques	1. Utilize numerical techniques to obtain approximate solutions of mathematical equations 2. Measure the Statistical parameters for random variables 3. Explain the basic concept of fuzzy sets, Relations and fuzzy logic. 4. Design and determine the solution of linear programming problems

UNIT-1: **[9 hrs]**

NUMERICAL METHODS FOR ALGEBRAIC AND TRANSCENDENTAL EQUATIONS: Errors in numerical calculation, Errors in series approximation. Rounding of error solutions of algebraic and transcendental equations. Iteration method, Bisection method, False position method, Newton Rapphson method and their convergence NUMERICAL METHODS SYSTEM OF ALGEBRAIC EQUATIONS: Solution of System of linear equation, Gauss elimination method, Gauss -Jordan method, Gauss- Seidel method, Crouts method & relaxation method.

UNIT-2: **[8 hrs]**

NUMERICAL METHODS FOR DIFFERENIAL EQUATIONS: Numerical solution of ordinary differential equation by Taylor"s series method, Picard's method, Runge"s second and third order method, Runge-Kutta 4th order method, Euler"s method, Euler"s modified method, Milne"s Predictor and Corrector method. Numerical methods of solving 1st order simultaneous ordinary differentials equations

UNIT-3 : Optimization Techniques **[6 hrs]**

Definition of basic concepts of LPP, Formulation of LPP and its Solution by graphical, simplex methods and Big M method,

UNIT-4 **[7 hrs]**

Random variable and probability distribution: Random variable: discrete and continuous; probability density function; Probability distribution function for discrete, and continuous random variable Joint distributions, conditional distributions.

UNIT-5: **[8 hrs]**

Mathematical Expectation: Definition of mathematical expectation, functions of random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

UNIT-6 **[6 hrs]**

FUZZY SETS AND FUZZY LOGIC ; Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.

IV Semester
GE2204 - Advanced Mathematical Techniques

SN	Title	Edition	Authors	Publisher
1	Computer based Numerical and Statistical Techniques	Paperback First Edition 2003	M. Goyal	Laxmi Publication
2	Numerical Methods	4th Edition (2004)	S.S. Sastri	PHI Publishers
3	Fuzzy Engineering	Softcover edition (2005)	Bari Kosko	Prentice Hall PTR
4	Optimization Techniques	1st Edition Year-2009.	C.Mohan and Kasum Deep	New Age International Publication

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
2	Advanced Engineering Mathematics	9th Edition-2007	Kreyszig	JOHN WILEY & SONS
3	Mathematics for Engineers	19th edition 2007	Chandrika Prasad.	JOHN WILEY & SONS
4	Advanced Mathematics for Engineers	4th edition 2006	Chandrika Prasad	JOHN WILEY & SONS
5	Higher Engineering Mathematics	40 edition 2010	B S Grewal	Khanna Publishers

IV Semester
ET2251 - Electromagnetic Fields

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Learn different types of co-ordinate systems 2. Understand different laws applicable for electric field and magnetic field. 3. Understand Maxwell's equations in static and time varying fields 4. Study different principles of wave propagation theory.	1. Use appropriate co-ordinate systems for solving electromagnetic fields problems 2. Apply the principles of electrostatics & magneto-statics for the solution of problems relating to electric and magnetic field 3. Analyze static and time varying fields using Maxwell's equations 4. Examine wave propagation in different medium.

UNIT-1: **6 Hrs**

Orthogonal coordinate systems: Cartesian, cylindrical, spherical and transformations, Gradient of a Scalar Field . Divergence of a Vector Field , Curl of a Vector Field , Laplacian Operator, Irrotational and solenoidal field .

UNIT-2: **7 Hrs**

Coulomb's law , Electric field intensity for different charge distribution : point , line surface , volume , Concept of electric flux , Gauss's law and it's application to field computation in symmetric structures and non symmetric structures , Divergence theorem.

UNIT-3: **7 Hrs**

Concept of energy & work done in moving a point charge : linear and circular path , Electric scalar potential :Absolute Potential and potential difference , Conservative property of Potential field , Potential field of a system of charges : circular ring and disk Dipole moment, electric field at a distant point due to electric dipole, Electrostatic energy density. Poisson's and Laplace's equation and its examples of solutions, Uniqueness of electrostatic solution

UNIT-4: **6 Hrs**

Biot –Savart law and applications to infinite and finite current filament, Ampere's Circuital law and applications to line charge, coaxial transmission cables, uniform current sheet charge, solenoid, toroid , Stoke's Theorem Magnetic flux and magnetic flux density , Scalar and vector magnetic potential, Nature of magnetic materials , boundary conditions at interface of two magnetic fields , Potential energy.

UNIT-5: **6 Hrs**

Time varying fields and Maxwell's equations: Faradays law, Displacement current, Maxwells equation in point form,Maxwells equations in integral form.

UNIT-6: **6 Hrs**

Uniform plane wave, wave propagation in free space, wave propagation in Dielectrics,Poyntings Theorem and wave equations.

Text books:

1	Engineering Electromagnetics	Seventh Edition	William H. Hayt	Tata McGraw – Hill.
2	Electromagnetics	4th edition1992	J D Kraus	McGraw – Hill
3	Field and Wave Electromagnetics	Second Edition 21 Jan 2010	David K. Cheng	Addison Wesley

Reference books:

1	Electromagetism Theory and application	2nd Edition2009	Ashutosh Pramanik	Prentice Hall
2	Elements of Electromagnetis		M. N. O. Sadku	Oxford Press

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV Semester
ET2252 - Microcontroller and Interfacing

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand the architecture and pin functions of 8 bit microcontroller. 2. Study the assembly language instruction set. 3. Understand programming microcontroller in C language. 4. Understand interfacing of on and off chip peripherals with 8051 microcontrollers.	1. Elaborate 8051 microcontroller architecture. 2. Develop assembly language programs. 3. Develop embedded C language program. 4. Interface peripherals with 8051 microcontroller to solve real life problems.

UNIT-1: **5 Hrs.**
Overview of 8051 Microcontroller family, Introduction to MCS 51 family, Architecture, Memory organization, Internal RAM, Flag Register, Register Banks, SFRs , Functional pin description and various resources of MCS 51. Hardware Overview.

UNIT-2: **6 Hrs**
Addressing modes, Instruction set and Assembly language programming Programs using look up table, Bit manipulation, 8051 I/O programming, Delay Programs.

UNIT-3: **6 Hrs**
I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming, 8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access.

UNIT-4: **8 Hrs**
Timer programming in assembly and C: Various modes of operation, SFR related to timer operation. Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs..

UNIT-5: **6 Hrs**
8051 interrupts, Interrupts programming in assembly and C, programming timer interrupt, external interrupt, serial interrupt Interfacing and programming for LCD, Interfacing RTC

UNIT-6: **7 Hrs**
Interfacing of ADC, DAC, stepper motor, Brushless DC motors, interfacing of peripherals 8255, 8259.

Resources :

Text books:

1	The 8051 Microcontroller and Embedded systems using assembly & C	2nd edition	Muhammad Ali Mazidi	Pearson Education Asia LPE
2	Programming and Customizing the 8051 Microcontroller		Myke Predko	McGraw-Hill
3	The 8051 Microcontroller	3rd edition	Kenneth Ayala	CENGAGE Learning

Reference books:

1	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets	Douglas V Hall	Tata McGraw Hill
2	Microprocessor & Interfacing	A. K. Ray, K. M. Bhurchandi.	Tata McGraw Hill

IV Semester
ET2253 - Lab: Microcontroller and Interfacing

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand the architecture and pin functions of 8 bit microcontroller. 2. Study the assembly language instruction set. 3. Understand programming microcontroller in C language. 4. Understand interfacing of on and off chip peripherals with 8051 microcontrollers..	1. Explain 8051 microcontroller architecture. 2. Develop assembly language program. 3. Develop embedded C language program. 4. Interface 8051 microcontroller to solve real life problems.

Expt. No.	Name of Experiment
1	Add data bytes in a internal RAM
2	Data block transfer
3	Find the maximum data byte in a block
4	Count even numbers present in a data block
5	Convert packed BCD number to its equivalent Hexadecimal number
6	To find average of numbers
7	Toggle LED connected to port pin of micro-controller 8051
8	Display BCD no. on seven segment display
9	Display character on LCD.
10	Rotate stepper motor into clockwise /counter clockwise direction
11	Generate sawtooth waveform using DAC
12	Send string of characters serially
13	Toggle LED connected to port P0.4 of microcontroller 8051.Genrate time delay using internal timer.
14	Read Analog signal from channel 2 of ADC and store it to internal RAM
15	Interfacing of RTC DS12887 with 8051 microcontroller & display current date & time serially
16	Interfacing of matrix keyboard with 8051 microcontroller
17	Interfacing of servo motor with 8051
18	Programming external interrupt using 8051 microcontroller
19	Program to count number of pulses using timer as event counter
20	**Mini-project**

IV Semester
ET2254 - Analog Communication

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand the fundamental s of amplitude and angle modulation schemes. 2. Learn AM and FM receivers 3. Know the fundamentals of TV transmission and reception techniques. 4. Study the concept of Pulse modulation techniques, noise and wave propagation	1. Analyze different modulation techniques 2. Analyze different parameters of communication receivers. 3. Elaborate the concept of television transmission and reception 4. Estimate noise in communication system 5. Select appropriate techniques for wave propagation of signals.

UNIT-1: **[06hrs]**
Amplitude Modulation: Need for modulation, Amplitude Modulation (AM), DSB-SC, SSB, VSB transmissions, mathematical Analysis, modulation index, frequency spectrum, power requirement of these Systems, AM Transmitter.

UNIT-2: **[06hrs]**
Angle Modulation: Frequency Modulation (FM), mathematical Analysis, modulation index, frequency spectrum, narrowband & wideband FM, noise triangle in FM, pre-emphasis & de-emphasis techniques, phase modulation, power contents of the carrier & the sidebands in angle modulation, FM Transmitter block diagram.

UNIT-3: **[06hrs]**
Receivers: Basic receiver (TRF), Super heterodyne receiver, performance parameters for receiver such as sensitivity, selectivity, fidelity, image frequency rejection etc., AM detectors, FM discriminators, AGC technique.

UNIT-4: **[06hrs]**
TV Fundamentals, Color Composite Video Signal, Horizontal sync and blanking pulses, Vertical sync and blanking pulses, color burst signal, Interlaced and Sequential scanning, Resolutions, CCIR-B Standards, TV Transmitter and Receiver Block diagram.
HDTV introduction and definition, digital satellite television, digital TV receiver, Merits of digital TV receiver

UNIT-5: **[06hrs]**
Noise: Sources of noise, shot noise, thermal noise, noise calculations, equivalent noise bandwidth, noise figure of an amplifier, effective noise temperature, calculation of noise figure for cascaded stages.

UNIT-6: **[06hrs]**
Pulse Modulation Techniques: Generation and Demodulation of PAM, PWM, PPM.
Radiation & Propagation of signals: Basics of Radiation, Mechanisms of propagation, Ground wave, space wave and sky wave propagation, duct propagation, troposphere propagation, fading, diversity reception.

Text books:

1	Electronic Communication System	4thEdition-(Year: 1999)	Gorge Kennedy	Tata McGraw-Hill.
2	Digital and analog communication systems	1stedition 1979	K. Sam Shanmugam	John Wiley & Sons
3	Modern Television Practice	3rdEdition 2006	R.R.Gulati	New Age International publishers.

Reference books:

1	Electronic Communication Systems	Third Edition 1998	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition 2001	Frenzel	MGH.
3	Television and Video Engineering	2ndEdition MAY 2001	Dhake.A.M	Tata McGraw Hill

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV Semester
ET2255 - Lab: Analog Communication

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Understand the fundamental s of amplitude and angle modulation schemes. 2. Learn AM and FM receivers 3. Know the fundamentals of TV transmission and reception techniques. 4. Study the concept of Pulse modulation techniques, noise and wave propagation	1. Analyze different modulation techniques 2. Analyze different parameters of communication receivers. 3. Elaborate the concept of television transmission and reception 4. Estimate noise in communication system 5. Select appropriate techniques for wave propagation of signals.

Expt. No.	Name of Experiment
1	To study the Generation of Amplitude Modulation. Calculate Modulation Index, Bandwidth and plot its frequency spectrum.
2	To study Amplitude Demodulation.
3	To study the Generation of DSB-SC AM using Diode ring modulator. Calculate Bandwidth and plot its frequency spectrum.
4	To study the Generation of Frequency Modulation. Calculate Modulation Index, Bandwidth and plot its frequency spectrum.
5	To study Frequency Demodulation.
6	To study the Phase modulation and Plot the signal waveform.
7	To study Composite Video Signal (CVS) at the output of VIF section.
8	To study Composite Colour Video Signal (CCVS) at the output of VIF section.
9	To study the signal analysis at the different stages of CTV.
10	To study LCD/LED TV receiver and observe the waveform at various test point.
11	To study Time Division Multiplexing (TDM).
12	To study generation of Pulse Amplitude Modulation and Demodulation
13	To study generation of Pulse position Modulation and Demodulation
14	To study generation of Pulse Amplitude Modulation and Demodulation
15	Mini Project

IV Semester
ET2256 - Control Systems

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Apply the knowledge gained in basic mathematics and engineering courses to derive mathematical models 2. Understand different characteristics of negative feedback system and time response of first and second order system also the basic concepts of proportional, integral, and derivative (PID) control. 3. Learn the importance of stability and state space models in control systems and the various methods to determine it. 4. construct root locus plot and frequency response plots such as polar plot, Bode plot etc.	1. Evaluate transfer function of a system 2. Analyze the characteristics of feedback control system 3. Estimate time response of first and second order control systems for different test signals 4. Determine the stability of linear control system 5. Assess frequency domain parameters of linear control system

UNIT-I **[07 hrs]**

Introduction to Control Systems: Basic Components of Control System, Open loop control and close loop control with examples, classification of control systems. Transfer Function, Order of a system, block diagram algebra & reduction techniques, signal flow graph, its constructions and Mason's gain formula.

UNIT-II **[05 hrs]**

Mathematical modelling of physical system such as – electrical, mechanical, electro-mechanical systems.
Characteristics of Feedback Control Systems: Effect of negative feedback compared to open loop system such as – sensitivity to parameter variation, speed of time response, bandwidth, disturbance rejection and linearizing effect, Effect of positive feedback

UNIT-III **[06 hrs]**

Time Domain Analysis of Control Systems: Concept of transient response, Steady state response and time response, standard test signals, system type, dominant poles, steady state error (ess) analysis, static error constants, Time response of first order systems, Transfer function of second order system, Time response of second order system, Time response specifications of second order system, Relation between roots of characteristic equation, damping ratio and transient response.
Effect of proportional (P), Integral (I) and derivative (D) controllers on the time response concept of transportation lag

UNIT-IV **[07 hrs]**

Concept of stability, stable, unstable, marginally, Absolutely and conditionally stable system, Necessary conditions for stability, method to determine stability, Routh - Hurwitz stability criterion with special cases, relative stability analysis.
State Variable Analysis: Concept of state, state variables and state model, state model of linear systems, state model using physical variables, phase variables and canonical variables, state model from differential equations, block diagramand signal flow graph, transfer function from state model, stability of systems modeled in state variable form, solution of state equations, state transition matrix, its properties and computation.

UNIT-V **[07 hrs]**

Root Locus Technique: Definition, magnitude and angle criteria, properties of root locus, construction rules for root locus plot of negative feedback systems, determining the gain from root locus plot, effect of addition of poles and zeros of G(s)H(s)

IV Semester
ET2256 - Control Systems

UNIT-VI **[07 hrs]**

Frequency domain analysis of control systems: Concept of frequency response and sinusoidal transfer function, resonant frequency, resonant peak, cut off frequency, bandwidth, correlation between time and frequency response, polar plot, inverse polar plot, bode plot, all pass and minimum phase system, experimental determination of transfer function, log magnitude versus phase plot. Stability in Frequency domain: Principle of argument, Nyquist stability criterion, Assessment of relative stability using Nyquist criterion, concept of gain margin and phase margin and its computation using polar plot and log magnitude versus phase plot.

Resources :

Text books:

1	Control system engineering	5th Edition	I. J. Nagrath& M Gopal	New Age International
2	Modern control engineering	5th Edition	Katsuhiko Ogata	PHI Learning
3	Control system engineering	7th Edition	Norman S Nise	Wiley & sons

Reference books:

1	Sigma Series: Control Systems	1st Edition	Ashok Kumar	McGraw - Hill
2	Control systems: Principles and design	4th Edition	M. Gopal	McGraw - Hill
3	Automatic control systems	7th Edition	B. C. Kuo	PHI Learning Private ltd

IV Semester
ET 2257 - Lab: Control Systems

Course Learning Objectives Students should be able to	Course Outcomes Students will be able to
1. Apply the knowledge gained in basic mathematics and engineering courses to derive mathematical models 2. Understand different characteristics of negative feedback system and time response of first and second order system also the basic concepts of proportional, integral, and derivative (PID) control. 3. Learn the importance of stability and state space models in control systems and the various methods to determine it. 4. construct root locus plot and frequency response plots such as polar plot, Bode plot etc.	1. Evaluate transfer function of a system 2. Analyze the characteristics of feedback control system 3. Estimate time response of first and second order control systems for different test signals 4. Determine the stability of linear control system 5. Assess frequency domain parameters of linear control system

Expt. No.	Name of Experiment
1	Open loop and closed loop system
2	Effect of feedback on DC Servo system
3	a) Study of ON-OFF controller b) Study of P-I-D controller
4	TYPE 0, TYPE 1, TYPE 2 CONTROL SYSTEM
5	Time Response of a second order system
6	Stability analysis using routh- hurwitz method
7	Root locus from a Transfer function
8	Bode plot from a transfer Function
9	State from zeroes and Poles
10	Transfer function from State model and state model from Transfer function

Nagar Yuwak Shikshan Sanstha's

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Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2020

5th Semester

Electronics & Telecomunication Engineering

28 June 2019

VI Semester
GE2312 - Fundamental of Economics

Objectives	Outcome (Students will be able to)
Recognizes consumer's behavior and pricing.	Relate their buyer behaviour to particular product and the pricing in the market.
Extrapolates an operations in market with productions constrain.	Examine and classify various market structure and factors of production and its role in production process.
Describes the national income accounting and public finance.	Analyse the national income accounting and the various issues related to banking, taxation, and inflation.
Interprets international trade and institutions.	Elaborate about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institutions.

UNIT-1: Introduction to Economics and Consumers' Behaviors:
Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, exceptions to law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, exception to law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand. **(8 Hours)**

UNIT-2: Production and Costs
Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation. **(6 Hours)**

UNIT-3: Market structures - equilibrium output and price
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination. **(7 Hours)**

UNIT-4: National income accounting:
Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation. **(5 Hours)**

UNIT-5: Money, Banking and Public Finance
Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (GST, Import duties), Revenue and capital expenditure.

(7 Hours)

VI Semester
GE2312 - Fundamental of Economics

UNIT-6: International Trade and Institutions

Definitions of closed vs. open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions. **(5 Hours)**

Text Books:

1. Modern Economics: H. L. Ahuja, 13th Edition, S. Chand Publisher, 2009.
2. Modern Economic Theory: K. K. Devett, 3rd edition, S. Chand Publisher, 2007

Reference Books:

1. Advance Economic Theory: H. L. Ahuja, 17th Edition, S. Chand Publisher, 2009.
2. International Trade: M. L. Zingan, 12th edition, Vindra Publication, 2007.
3. Macro Economics: M. L. Zingan, 11th edition, Vindra Publication, 2007.
4. Economics: Samuelson,
5. Monitory Economics: M. L. Sheth, 1st Edition, Himayalaya Publisher, 1995.
6. Economics of Development and Planning: S. K. Misra and V. K. Puri, 12th edition, Himalaya Publishing House, 2006.

V Semester
ET 2301 - ANALOG INTEGRATED CIRCUITS

Course Learning Objectives	Course Outcomes
The student should be able to 1) Understand modern analog circuits using integrated bipolar and field effect transistor technologies. 2) Understand basic principles of analog integrated circuit for analog IC design. 3) Learn operational amplifier basics, its parameters and its applications. 4) Understand Data converters and waveform generators	**The student will be able to** 1) Design and analyze OP-AMP configurations. 2) Analyze OP-AMP circuit parameters and frequency response 3) Design linear and non- linear OP-AMP applications. 4) Explain special function ICs and design circuits using it.

Unit No.	Contents	Max. Hrs.
1	**OPERATIONAL AMPLIFIER FUNDAMENTALS** Ideal Op Amp, Basic Op Amp Configurations: Open loop, Feedback in OPAMP circuit: Inverting, Non-inverting, voltage follower	6
2	**OP AMP LIMITATIONS- STATIC and DYNAMIC** Simplified Op Amp Circuit Diagram, OPAMP parameters, Input Bias and Offset Current, Input Bias and Offset voltages, input offset error Compensation, open loop and closed loop Frequency response, Transient response, gain bandwidth product (GBP) & its effect, frequency compensation**.**	6
3	**LINEAR APPLICATIONS** Summer, difference amplifier, integrator, differentiator, Current-to-Voltage Converter, Voltage-to-Current Converter, Instrumentation Amplifiers and Transducer Bridge amplifiers.	6
4	**ACTIVE FILTERS** Transfer function, first order filter, standard frequency response, KRC Filters with variable gain and Unity Gain, Second order LPF & HPF Butterworth filter design, BPF and BRF	6
5	**NONLINEAR CIRCUITS** Precision Rectifiers, clipper, clamper, Voltage Comparators, Schmitt Triggers, Sample-and-Hold Circuits, Log/Antilog amplifiers **WAVEFORM GENERATORS** Sinusoidal Oscillators based on Wein bridge and RC Phase shift, Square wave generation, Triangular wave generator	6
6	**SPECIAL FUNCTION IC'S** PLL, Monolithic timers (IC 555), Performance Specifications, D-A Converters (DACs), A-D Converters (ADCs).Voltage reference circuits, DC Dual Regulated Power supply for OP-AMP circuit, **New topic to be announced time to time.**	6

V Semester
ET 2301 - ANALOG INTEGRATED CIRCUITS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Design with Operational Amplifiers and Analog Integrated Circuits	2002	Sergio Franco	McGraw-Hill
2	Linear Integrated Circuits	2015	D. Roy Chaudhuri, Shail Jain	New Age International
3	Op-Amps and Linear Integrated Circuits	2015	Ramakant A. Gayakwad	Pearson

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Linear Integrated Circuits	2010	S. Salivahanan, V. S. Bhaaskaran	McGraw-Hill

V Semester
ET 2302 – LAB: ANALOG INTEGRATED CIRCUITS

Course Learning Objectives	Course Outcomes
The student should be able to 1) Understand modern analog circuits using integrated bipolar and field effect transistor technologies. 2) Understand basic principles of analog integrated circuit for analog IC design. 3) Learn operational amplifier basics, its parameters and its applications. 4) Understand Data converters and waveform generators	**The student will be able to** 1) Design and analyze OP-AMP configurations. 2) Analyze OP-AMP circuit parameters and frequency response 3) Design linear and non- linear OP-AMP applications. 4) Explain special function ICs and design circuits using it.

Sr. No.	Name of Experiment
1.	Verify gain and frequency response of Inverting amplifier / Non-inverting amplifier using IC 741 and simulation
2.	Verify Op-amp parameters (a) CMRR (b) Slew Rate
3.	Design and verify op-amp application as adder and subs tractor
4.	Design and simulate gain and frequency response of Integrator and Differentiator circuit Using IC 741.
5.	Design and simulate Second Order low pass filter / high pass filter. Also verify its frequency response characteristics.
6.	A. Design and simulate Astable & Monostable Multivibrator circuits using IC 741 B. Design and verify Astable and Bistable Multivibrator circuits using IC 555
7.	A. Verify and simulate Schmitt Trigger circuits using IC 741 B. Design of a Half Wave and Full Wave Rectifier using IC 741
8.	To construct a RC Phase Shift oscillator and study its operation.
9.	To verify the operation of various types of clippers and clampers like positive and negative using opamp 741.
10.	To study and verify PLL using IC 565
11.	Verification of Digital to Analog converter using R- 2R ladder circuit.
12.	Mini Project

V Semester
ET 2303 – FIELDS & RADIATING SYSTEMS

Course Learning Objectives	Course Outcomes
The student should be able to	**The student will be able to**
1) Learn concept of Transmission lines and its parametric analysis 2) Understand the concept of parallel plane waveguide. 3) Understand the concept of rectangular waveguide 4) Understand the fundamentals of antenna and antenna arrays	1) Estimate transmission lines parameters 2) Illustrate parallel plane waveguides, and rectangular waveguides 3) Analyze antenna parameters 4) Explain various types of antennas

Unit No.	Contents	Max. Hrs.
1	**Transmission Lines** Introduction to transmission line theory, Transmission line parameters, Characterized impedance, Propagation constant, Phase constant, Attenuation constant, Waveforms distortion, Distortion less transmission lines, Loading of transmission lines, Reflection coefficient and VSWR, Equivalent circuits of transmission lines, Transmission lines at radio frequency. Open and short circuited lines, Smith chart.	6
2	**Parallel Planes Waveguide** Guided Waves between parallel planes, Derivation of TE wave, Derivation of TM wave Characteristics of TE and TM wave, TEM waves and its characteristics.	6
3	**Rectangular Waveguide** Introduction to rectangular waveguide, TM wave in rectangular waveguide, TE wave in rectangular waveguide, Characteristics of TE and TM wave in rectangular waveguide, Velocity, Guide wave length, Wave impedance, Field configurations. Introduction to Circular Waveguide	6
4	**Antenna Terminology** Retarded potentials, Field due to a current elements, Power radiated and radiation resistance, Far field due to a dipole, Reciprocity theorem applied to an antennas gain, Aperture of antenna, Radiation intensity, Directivity and antenna gain.	6
5	**Antenna Arrays** Two elements arrays and their directional characteristics, Linear arrays analysis, Broadside and End fire arrays, Pattern multiplication, Binomial arrays, Design of broadside array for a specific Pattern.	6
6	**Types of Antenna** Log –periodic antennas, horn antennas& Lens Antennas, New topic to be announced time to time	6

V Semester
ET 2303 – FIELDS & RADIATING SYSTEMS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Antenna Theory And Waveguide	3rd Edition	K.D.Prasad	Satya Prakashan ,New Delhi
2	Electromagnetic wave And Radiating System	2nd Edition	Jordan and Balmain	Prentice hall
3	Antenna Theory & Design	3rd Edition	C.A.Balanis	John Wiley & sons
4	Antennas	5th Edition	John D. Krauss	McGraw-Hill International edition

V Semester
ET 2304 – SIGNALS & SYSTEMS

Course Learning Objectives	Course Outcomes
The student should be able to	**The student will be able to**
1) Understand the fundamental characteristics of signals and systems. 2) Understand signals and systems in terms of both the time and transform domains. 3) Understand the process of sampling and interpolation. 4) Develop of the mathematical skills to solve problems involving convolution, transforms and sampling.	1) Classify systems based on their properties and determine the response of LTI system. 2) Analyze system properties based on impulse response and Fourier analysis. 3) Sample and reconstruct the signals. 4) Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems.

Unit No.	Contents	Max. Hrs.
1	**Signals and Systems.** Continuous-Time and Discrete-Time Signals. Transformations of the Independent Variable. Continuous-Time and Discrete-Time Systems. Basic System Properties. Discrete-Time LTI Systems: The Convolution Sum. Continuous-Time LTI Systems: The Convolution Integral. Properties of Linear Time-Invariant Systems. Causal LTI Systems Described by Differential and Difference Equations. Singularity Functions.	6
2	**Fourier Series Representation of Periodic Signals.** The Response of LTI Systems to Complex Exponentials. Fourier Series Representation of Continuous-Time Periodic Signals. Convergence of the Fourier series. Properties of Continuous-Time Fourier Series. Fourier Series Representation of Discrete-Time Periodic Signals. Properties of Discrete-Time Fourier Series. Fourier Series and LTI Systems. Filtering.	6
3	**Fourier Transform.** The Continuous-Time Fourier Transform. Representation of Aperiodic Signals: The Continuous-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Continuous-Time Fourier Transform. The Discrete-Time Fourier Transform. Representation of Aperiodic Signals: The Discrete-Time Fourier Transform. The Fourier Transform for Periodic Signals. Properties of the Discrete-Time Fourier Transform.	6
4	**Time & Frequency Characterization of Signals and Systems.** The Magnitude-Phase Representation of the Frequency Response of LTI Systems. Concept of Frequency Response, Group Delay and Phase Delay. Time-Domain Properties of Ideal Frequency-Selective Filters. Time- Domain and Frequency-Domain Aspects of Non ideal Filters. Representation of a Continuous-Time Signal by Its Samples: The Sampling Theorem. Reconstruction of a Signal from Its Samples Using Interpolation. Aliasing. Discrete-Time Processing of Continuous-Time Signals.	6
5	**The Laplace Transform.** The Laplace Transform. The Region of Convergence for Laplace Transforms. The Inverse Laplace Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the Laplace Transform. Analysis and Characterization of LTI Systems Using the Laplace Transform. System Function Algebra and Block Diagram Representations. The Unilateral Laplace Transform.	6

V Semester
ET 2304 – SIGNALS & SYSTEMS

6	**The Z-Transform.** The z-Transform. The Region of Convergence for the z-Transform. The Inverse z-Transform. Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot. Properties of the z-Transform. Analysis and Characterization of LTI Systems Using z-Transforms. System Function Algebra and Block Diagram Representations. The Unilateral z-Transform. **New topic to be announced time to time**	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Signals and Systems	2nd edition	Alan V. Oppenheim,Alan S. Willsky, with S. Hamid	Prentice Hall.
2	Schaum's Outline of Signals and Systems.	4th edition 2002	Hwei Hsu,	McGraw-Hill

Reference Books

SN	Title	Edition	Authors	Publisher
1	Principles of Signal Processing and Linear Systems	1st edition	B. P. Lathi	Oxford University Press
2	Signals & Systems	2nd Edition. 2005	Simon Haykin and Van Veen, Wiley	TMH
3	Signals & Systems Analysis Using Transformation Methods & MAT Lab	1st edition 2003.	Robert	McGraw-Hill Companies
4	Signals, Systems and Transforms	3rd Edition, 2004.	C. L. Philips, J.M.Parr and Eve A.Riskin	Pearson education

V Semester
ET 2305– LAB: SIGNALS & SYSTEMS

Course Learning Objectives	Course Outcomes
The student should be able to	**The student will be able to**
1) Understand the fundamental characteristics of signals and systems. 2) Understand signals and systems in terms of both the time and transform domains. 3) Understand the process of sampling and interpolation. 4) Develop of the mathematical skills to solve problems involving convolution, transforms and sampling.	1) Classify systems based on their properties and determine the response of LTI system. 2) Analyze system properties based on impulse response and Fourier analysis. 3) Sample and reconstruct the signals. 4) Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems.

Sr. No.	Name of Experiment
1.	Understanding the Basic Signals
2.	Properties of signals and their transformations
3.	Introduction to systems and their classification.
4.	Characterizations of System.
5.	Convolution of Continuous Time and Discrete Time Signals
6.	Implementation of Fourier series
7.	Implementation of Continuous time Fourier Transform
8.	Implementation of Discrete time Fourier Transform
9.	Implementation of Laplace Transform
10.	Implementation of z-Transform
11.	Sampling and reconstruction

V Semester
ET 2306– LAB: ELECTRONICS WORKSHOP

Course Learning Objectives	Course Outcomes
The student should be able to 1) Learn identifications, operation & testing of passive and active electronic components and devices. 2) Understand identification and Testing of wires, cables, connectors and interconnected components. 3) Understand PCB designing process, soldering process, testing and troubleshooting of electronic circuits	**The student will be able to** 1. Identify and test passive and active electronic components and devices. 2. Identify and Test wires, cables, connectors and interconnected components. 3. Develop mini project

Expt. No.	Experiments based on
01	To study Analog and Digital Multimeter.
02	To study Passive electronic components.
03	To study Active electronic components.
04	To identify and Test wires, cables and connectors.
05	To study Operation, Identification and Testing of Interconnected components.
06	To study Operation and Testing of microphones and speakers.
07	To construct a Fixed voltage regulated power supply.
08	To perform Bread board execution of the mini project.
09	PCB layout designing and fabrication.
10	Testing and Fault rectification in mini project.

V Semester
ET 2311– OE I: MICROCONTROLLER & EMBEDDED SYSTEMS

Course Learning Objectives	Course Outcomes
The student should be able to 1) To understand the architecture and pin functions of 8 bit microcontroller. 2) To study the assembly language instruction set. 3) To understand programming microcontroller in C language. 4) To understand interfacing of on and off chip peripherals with 8051 microcontrollers	**The student will be able to** 1) Elaborate 8051 microcontroller architecture. 2) Develop assembly and embedded C language program. 3) Interface 8051 microcontroller with different peripherals 4) Examine Arduino architecture

Unit No.	Contents	Max. Hrs.
1	Overview of 8051 Microcontroller family, Introduction to MCS 51 family, Architecture, Memory organization, Internal RAM, Flag Register, Register Banks, SFRs , Functional pin description and various resources of MCS 51. Hardware Overview	6
2	Addressing modes, Instruction set and Assembly language programming Programs using look up table, Bit manipulation, 8051 I/O programming, Delay Programs.	6
3	I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming, 8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access	6
4	Timer programming in assembly and C: Various modes of operation, SFR related to timer operation. Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs.	6
5	Interfacing of LCD, ADC, DAC, stepper motor and DC motor with 8051 microcontroller	6
6	Block diagram of Arduino, features of Arduino Architecture, Arduino pin description: digital pins, analog pins, Power pins and other pins, Interfacing of LED, 7-Segment display, LCD, Sensors, DC motor, switch and Serial communication. New topic to be announced time to time .	6

V Semester
ET 2311– OE I: MICROCONTROLLER & EMBEDDED SYSTEMS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	The 8051 Microcontroller and Embedded systems using assembly & C	2nd edition	by Muhammad Ali Mazidi	Pearson Education Asia LPE
2	Programming and Customizing the 8051 Microcontroller		By MykePredko	McGraw-Hill
3	The 8051 Microcontroller	3rd edition	By Kenneth Ayala	CENGAGE Learning
4	Arduino Development Cookbook		Cornel Amariei	PACKT Publishing

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets	Douglas V Hall	Tata McGraw Hill	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets
2	Microprocessor & Interfacing	A. K. Ray, K. M. Bhurchandi.	Tata McGraw Hill	Microprocessor & Interfacing

V Semester
ET 2312– OE I: PRINCIPLES OF COMMUNICATION ENGINEERING

Course Learning Objectives	Course Outcomes
The student should be able to 1) Understand various modulation and demodulation techniques of analog and digital modulation. 2) Describe and determine the performance of different error control coding schemes for the reliable transmission of digital representation of signals and information over the channel. 3) Understand various multiple access techniques in wire and wireless communication 4) To learn the basic of satellite communication and elements of optical fiber transmission	**The student will be able to** 1. Describe analog and digital communication systems and various modulation schemes. 2. Analyze error correcting codes, including block codes. 3. Illustrate multiple access techniques in wired and wireless communication. 4. Discuss the different applications of satellite communication and optical communications

Unit No.	Contents	Max. Hrs.
1	**ANALOG COMMUNICATION** Introduction to Communication Systems; Noise, Types of noise, sources of noise; Need for modulation, AM-Time domain representation, Frequency spectrum, power relations, DSB/SC, SSB Angle modulation**.**	6
2	**DIGITAL COMMUNICATION** Introduction Digital Communication System; Pulse modulations – concepts of sampling and sampling theorems, PAM, PWM, PPM; Waveform coding Techniques: Pulse code Modulation (PCM), Delta Modulation, Adaptive Delta modulation.	6
3	**Digital Modulation** Data formats; Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Phase Shift Keying (PSK) – BPSK – QPSK– Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM ; Bandwidth Efficiency; Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).	6
4	**SOURCE CODES, LINE CODES & ERROR CONTROL** Entropy, Properties of entropy; source coding: Huffman coding**;** error control codes and applications: convolutions & block codes.	6
5	**MULTIPLE ACCESS TECHNIQUES** FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits)	6
6	**SATELLITE, OPTICAL FIBER – POWERLINE, SCADA** types of satellites , frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat; fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications SCADA**,** New topic to be announced time to time	6

V Semester
ET 2312– OE I: PRINCIPLES OF COMMUNICATION ENGINEERING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Principles of Communication Systems	2007	Taub &Schiling	Tata McGraw Hill
2	Principles of Digital Communication	1986	J.Das	New Age International

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Electronic Communication Systems	4th Edition, 1993	Kennedy and Davis	Tata McGraw hill
2	Digital Communication Fundamentals and Applications	2001	Sklar	Pearson Education
3	Digital Communication	2004.	Bary le, Memuschmidt	Kluwer Publication

V Semester
ET 2313– OE I: FUNDAMENTALS OF IMAGE PROCESSING

Course Learning Objectives	Course Outcomes
The student should be able to 1) Learn the fundamentals of digital image processing algorithms. 2) Learn the algorithms of spatial and frequency domain filtering. 3) Learn segmentation of digital images through various algorithms 4) Learn representation and recognition of digital images through various algorithms	**The student will be able to** 1) Examine the concepts of image enhancement, segmentation, representation and recognition 2) Apply basic image processing algorithms and filtering techniques for image enhancement. 3) Apply the algorithms for image segmentation 4) Apply the techniques for image representation and recognition

Unit No.	Contents	Max. Hrs.
1	**Introduction** Origin of Digital Image processing, Fundamental Steps in image processing, Component of Image processing system, Sampling and quantization, Interpolation Techniques, Geometric transformation, Concept of gray levels, Relationship between pixels, Applications of Image Processing.	6
2	**Intensity Transformations** Background, Basic intensity transformation techniques: Image negative, log transformation, power law transformation, piecewise linear transformation, Histogram processing: Histogram Equalization, Histogram Matching, Local histogram processing.	6
3	**Spatial and Frequency Domain Filtering** Mechanics of Spatial filtering, Smoothing spatial filters: Linear and Order statistic filters, Sharpening filters: Foundation, Laplacian and Gradient, Filtering in frequency domain	6
4	**Image Segmentation** Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region based segmentation.	6
5	**Representation and Description** Representation, Boundary Descriptors, Regional Descriptor	6
6	**Object Recognition** Patterns and Pattern Classes, Recognition based on decision Theoretic Methods, Structural Methods, **New topic to be announced time to time**	6

V Semester
ET 2313– OE I: FUNDAMENTALS OF IMAGE PROCESSING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Digital Image Processing	2nd edition	R.C. Gonzalez & R.E. Woods	Addison Wesley/Pearson education publication 2002.
2	Digital Image Processing	4th edition	William K. Pratt	A John Wiley & Sons, Inc., Publication

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Digital Image Processing		Anil K. Jain	PHI
2	Digital Image Processing		S. Jayaraman, S. sakkirajan, T Veerakumar	McGraw-Hill

V Semester
ET2314 – OEI: Fundamentals of Internet of Things

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Explore the physical and Logical design of IoT.
2. Explore the M2M and NETCONF.
3. Explore python programming.
4. Apply basic skills of IoT to solve real life problems.
5. Illustrate IoT Security

Unit:1	Introduction & Concepts:	5 Hours

UNIT-1: Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels

Contemporary Issues related to Topic

Unit:2	Sensing & Actuation	6 Hours

Introduction to sensors & transducers, Introduction to electrodes & biosensors, Static and dynamic characteristics of sensors, Different types of sensors, Selection criteria's for sensors / transducers, Commercial IoT sensors / transducers, Signal conditioning modules of IoT system , Energy and power considerations, Introduction to actuators, Different types of actuators, Interfacing challenges, Modules of data acquisition system

Contemporary Issues related to Topic

Unit:3	M2M & System Management with NETCONF-YANG	7 Hours

M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG

Contemporary Issues related to Topic

Unit:4	Developing Internet of Things & Logical Design using Python	7 Hours

Introduction, IOT Design Methodology, Python Data Types & Data Structures, Control Flow, Functions , File Handling, Date/ Time Operations, IoT Device-Raspberry Pi, Programming Raspberry pi with Python

Contemporary Issues related to Topic

Unit:5	IoT Security	7 Hours

Effect of security threats on user, authentication using OTP validation, Security Requirements for the Internet of Secure Things, Secure Solutions, Secure Framework of the IoT Related to Perceptual Layer, Challenges in IoT Security

Contemporary Issues related to Topic

Unit :6	Domain Specific IOTs	7 Hours
Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style. **Contemporary Issues related to Topic**		
Total Lecture Hours		**39 Hours**

Textbooks	
1	Arshdeep Bahga and Vijay Madisetti , "Internet of Things, a hands on approach" , Universities Press (India)Pvt. Ltd. 2017, ISBN: 978-81-7371-954-7.
Reference Books	
1	Internet of Things : Technologies, Applications, Challenges and Solution B.K.Tripathy & J.Anuradha by CRC press publication
2	From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence: By Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 1 st Edition, Academic Press, 2014.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	
MOOCs Links and additional reading, learning, video material	
1	https://archive.nptel.ac.in/courses/106/105/106105166/
2	https://onlinecourses.nptel.ac.in/noc21_ee85/preview

V Semester
ET 2321-OE II: SOFT COMPUTING

Course Learning Objectives	Course Outcomes
The student should be able to 1) Familiarize with soft computing concepts. 2) Learn the concepts of Genetic algorithm 3) Learn the concepts of Fuzzy Logic and Neural networks	**The student will be able to** 1) Examine genetic algorithms, fuzzy logic and neural network techniques 2) Apply genetic operators and genetic algorithms for problem solving 3) Apply Neural Network algorithms in pattern recognition 4) Apply fuzzy logic to solve engineering problems

Unit No.	Contents	Max. Hrs.
1	**Genetic Algorithm** Basic terminologies used in Genetic Algorithm, Simple GA, General Genetic Algorithm, Encoding, Selection, Crossover, Mutation, Stopping Condition for GA, Constraint in GA	6
2	**Neural Networks** Biological Neurons and Their Artificial Models, Models of Artificial Neural Networks, Learning Methods, Activation Functions, McCulloch-Pitts Neuron Model, Neural Network Learning Rules, Application of NN	6
3	**Supervised Learning** Single Layer Perceptron, Back propagation algorithm, Associative Memory.	6
4	**Unsupervised Learning** Hamming and Max net, Competitive Learning, self-organizing feature maps, ART Networks, RBF	6
5	**Fuzzy Sets and Operations** Concepts of Fuzzy sets, extension principle Operation on fuzzy sets, Fuzzy numbers, arithmetic operations, Lattice, fuzzy equations	6
6	**Fuzzy logic and Systems** Fuzzy relations Fuzzy Logic, Approximate Reasoning, Fuzzy controllers, Defuzzification Methods, Fuzzy Inference Techniques, Applications, **New topic to be announced time to time**	6

V Semester
ET 2321-OE II: SOFT COMPUTING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fuzzy sets and Fuzzy logic	1995	By George Klir, Bo Yuan	PHI
2	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications	2003	By S. Rajsekharan, VijayalaxmiPai	PHI
3	Elements of Artificial Neural Network	1997	By K. Mehrotra	MIT Cognet

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Neural Networks, a comprehensive foundation	1999	By Simon Haykins	PHI
2	Artificial Neural Networks	2004	By B. Yegnanarayana	PHI
3	Fuzzy Logic & Applications	2003	By T. Ross	McGraw Hill
4	Soft Computing,	2011	Sivanandanam and Deepa	Wiley

V Semester
ET 2322– OE II: INDUSTRIAL INSTRUMENTATION

Course Learning Objectives	Course Outcomes
The student should be able to 1) Study the characteristics of Instruments. 2) Understand the Concepts of Pressure measurements and its calibration process 3) Understand the working principle of various active &passive temperature transducers. 4) Learn the working principle of various flow transducers. 5) Learn the working principle of various transducers like level, thickness speed, ph value etc. 6) Learn automation system components.	**The student will be able to** 1) Explain instrumentation system 2) Analyze pressure, temperature, parameters measured using transducers 3) Analyze flow, speed and level parameters measured using transducers 4) Elaborate automation system components.

Unit No.	Contents	Max. Hrs.
1	**INTRODUCTION** Block diagram of instrumentation system, static and dynamic characteristics of instruments, functions of instruments, Definition of Transducers- Role of transducers in instrumentation- Advantages of electrical transducers – Classification of transducers- Analog and Digital, Active and passive, Primary and Secondary transducers- Inverse transducer-Sensitivity and specification for transducers - Characteristics and Choice of transducer-Factors influencing choice of transducer. Need of transducers, Classification, selection criteria. Calibration Process.	6
2	**PRESSURE MEASUREMENT** Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms– Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezoresistive pressure sensor –Testing and calibration of pressure gauges – Dead weight tester.	6
3	**TEMPARATURE MEASUREMENT 1** Different types of filled in system thermometer , Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – Three lead and four lead RTDs.	6
4	**TEMPARATURE MEASUREMENT2: THERMOCOUPLES AND PYROMETERS** Thermocouples – Laws of thermocouple – Signal conditioning of thermocouples output –cold junction compensation –Response of thermocouple, Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two color radiation pyrometers.	6
5	**FLOWMETERS** Variable head type flow meters: – Orifice plate – Venturi tube – Pitot tube. Area flow meter: – Rotameter, Principle and constructional details of electromagnetic flow meter – Ultrasonic flowmeters flow measurements for gases	6
6	**MISCELLANEOUS MEASUREMENT** Electrical level gauge: – Resistive , Ultrasonic type, Radar type ,Speed measurement -D.C and A.C Tacho generators ,rotary encoder, Proximity sensors- Inductive and capacitive, Introduction to PLC, SCADA. **New topic to be announced time to time**	6

V Semester
ET 2322– OE II: INDUSTRIAL INSTRUMENTATION

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Industrial Instrumentation and Control	2003	S.K. Singh	Tata McGraw Hill, 2003.
2	Transducers and Instrumentation		D V S Murthy	prentice Hall of India Pvt. Ltd., New Delhi
3	Electrical and Electronic Measurements AND Instrumentation		A. K. Sawhney	Dhanpat Rai &Co

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Principles of Industrial Instrumentation ata		D. Patranabis T	McGraw Hill Publishing Company Ltd, 1996.
2	Programming for Industrial Automation		Kevin Collins	
3	Instrumentation Measurement & Analysis	2004.	B.C. Nakra & K.K.Chaudary	Tata McGraw Hill Publishing Ltd
4	Measurement Systems – Application and Design	2003	E.O. Doebelin	Tata McGraw Hill publishing company
5	Industrial Instrumentation		D.P. Eckman	Wiley Eastern Ltd.

V Semester
ET 2323– OE II: MEDICAL ELECTRONICS

Course Learning Objectives	Course Outcomes
The student should be able to 1) Know the physiology of heart , brain and skin, Understand the basic principles of physical parameters 2) Comprehend the working principles of measuring, monitoring and recording instruments. 3) Know the physical concepts of radiography related to X rays 4) Learn working principles of advanced medical imaging system	**The student will be able to** 1) Elaborate basic physiological systems of human body 2) Explain the physiological parameter measurement techniques. 3) Explain the working of measuring and recording instruments for physiological parameters. 4) Elaborate the working principles of modern imaging systems

Unit No.	Contents	Max. Hrs.
1	Cell as bio electric generator: Introduction of man instrumentation system, Heart and Circulatory system, Components of man instrumentation system , Brain and nervous system, Physiological system of the body.	6
2	**Physiological parameter Measurement:** Blood pressure and Flow, Heart rate and Heart sounds, Characteristics of blood flow, Respiration and Temperature	6
3	**Recording Instrumentation:** Electrodes, basic instrumentation, Electrocardiograph, Electroencephalograph, ,Electromyograph, Phonocardiograph	6
4	**Measuring Instrumentation:** Transducers, Blood Pressure, Blood flow and Pulse oximeters, Heart rate respiration rate and temperature meters, Audiometer and hearing Aid	6
5	**X-rays:** X-ray Physics, Fluoroscopy and radiography, X-ray tubes and X-ray Equipments, Biomedical computer application	6
6	**Advanced Imaging System:** Ultrasonic scanner, CT scan, MRI, Endoscope and Measurement of blood flow and cardiac Output **New topic to be announced time to time**	6

V Semester
ET 2323– OE II: MEDICAL ELECTRONICS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Medical Electronics	2003	Patil A. G	ISTE Excel book
2	Biomedical Instrumentation and Measurements	Second edition 2004	Leslie Cromweel, Fred J. Weibell, Erich A.	PHI

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Handbook of Biomedical Instrumentation	New Delhi, 2003.	Khandpur, R.S	TATA McGraw Hill
2	Introduction to Biomedical equipment Technology	New York,2004	Joseph J.Carr and John M.Brown	John Wiley and Sons

V Semester
ET 2324– OE II: DISPLAY TECHNOLOGY & APPLICATIONS

Course Learning Objectives	Course Outcomes
The student should be able to 1) To learn fundamental concepts of different display technologies related to manufacturing techniques and materials used for FPD selection. 2) To explore electrical, optical and physical specifications required for display technologies 3) To understand different displays and addressing of displays 4) To learn backplane technology and driver integration 5) To identify and comprehend materials and applications of display	**The student will be able to** 1) Identify different display technologies and manufacturing process. 2) Analyze characteristics of display devices and Luminescence materials. 3) Analyze addressing matrix, TFT backplane and backlight unit technologies. 4) Elaborate advanced display devices and Materials .

Unit No.	Contents	Max. Hrs.
1	Overview of display technologies, emmisive-nonemmisive displays, information capacity of displays, introduction to different flat panel display technologies, Display specifications, display manufacturing process overview	6
2	Characterization and performance of displays: Concepts of aspect ratio, color gamut, contrast and gradation, directional visibility, memory and storage, resolution, addressability, Fundamentals of Photometry, Colorimetry, CIE colorimetry	6
3	Luminescence and luminescent materials: Physical processes and interactions leading to emission of light, Mechanisms of Electron and Hole Recombination in Semiconductors, Recombination Rates of Excess Carriers and Excess-Carrier Lifetimes, Basics of matrix addressing of displays: active and passive matrix.	6
4	Technical discussion of display technologies: TFT, LEDs, OLEDs, LCDs, Active matrix TFT backplanes for OLED and LCD displays. Other displays and associated technologies.	6
5	Advanced TFT Backplane Technologies (IGZO, LTPS, etc.) and Driver Integration. Back Light Unit Technologies (CCFL, LED, QD, etc.)	6
6	Future and New Applications of Displays. Materials for Display – TFT, EL and LC Materials and Modes New topic to be announced time to time	6

V Semester
ET 2324– OE II: DISPLAY TECHNOLOGY & APPLICATIONS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Flat Panel Displays	2008	Jiun-Haw Lee, David N. Liu, Shin-Tson Wu	Wiley publications
2	Fundamentals of Solid-State Lighting: LEDs, OLEDs, and Their Applications in Illumination and Displays	2014	Vinod Kumar Khanna	CRC press

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Liquid crystal displays: fundamental physics and technology.	2011	R. H. Chen	John Wiley and Sons
2	Liquid crystal flat panel displays: manufacturing science & technology.	2012	W. Mara	Springer, Science & Business Media,

V Semester
ET2325– OE II: PLCs and SCADA

Course Learning Objectives	Course Outcomes
Students should be able to: 1) Understand the fundamentals of Automation and their applications, systems used in industry such as PLC, Memory devices, Input /Output system and Relays. 2) Learn PLC and SCADA programs for industrial automation. 3) Understand the concepts of HMI & SCADA 4) Understand the concepts in distributed control systems	**Students will be able to:** 1) Explain the basic building blocks of Programmable logic controller 2) Develop PLC and SCADA programs for industrial automation. 3) Illustrate the concepts involved in HMI & SCADA 4) Elaborate the concepts in distributed control systems

Unit No.	Contents	Max. Hrs.
1	**Introduction to Programmable Controllers** Definition , A Historical Background , Principles of Operation , PLCs Versus Other Types of Controls , PLC Product Application Ranges, Advantages of PLCs, PLC Sizes and Scopes of Applications, Overview of PLC System	6
2	**Introduction to Programming Languages** Types of PLC Languages, Ladder Diagram Format, Ladder Relay Instructions, Ladder Relay Programming, IEC 1131-3 Programming Languages – FBD/ST/IL/SFC **Programming Instructions** NO-NC & coil based instructions (Relay based Instructions), Timers, Counters, Compare, Mathematics, Jump and Subroutines	6
3	**Introduction to SCADA** Introduction and brief history of SCADA, Fundamental principles of modern SCADA systems, the components of a SCADA system, Types of SCADA **SCADA Programming** Graphics Building & Simulation, Tag types & Management, Tools, Programming techniques, Alarms & Trends Configuration, Screen Navigation	6
4	**Introduction to HMI** FOUNDATIONS OF HMI: The Human: History of User Interface Designing, Types, Features, General architecture , Conventional & current HMI systems, Difference between HMI & SCADA, HMI Hardware interfaces, Practical uses in Industries.	6
5	**Data comparison instructions & PLC sequencers** Data comparison instructions such as EQU, LES, and GRT, Introduction to the principles of Data Transfer, Move Instruction, Introduction to Shift Registers & Its types. Purpose and application of PLC Sequencers, Masking techniques and the various types of Sequencers, SQO and SQC instructions.	6
6	**Distributed Control System**: Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.	6

V Semester
ET2325– OE II: PLCs and SCADA

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Programmable Logic controllers		Gary Duning	Delmar Thomson Learning
2	SCADA: Supervisory Control and Data Acquisition	Fourth Edition	Stuart A Boyer	ISA 1999
3.	Programmable Logic Controllers	Fifth Edition	Frank Petruzella	McGraw-Hill Education

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Programmable logic controller		W. Bolton	Elsevier Publisher

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering

SoE & Syllabus 2020

6th Semester

Electronics & Telecomunication Engineering

28 June 2019

VI Semester
ET2351 - Digital Signal Processing

Prerequisites	Signals and System
Course Objectives Students should be able to 1) Learn discrete Fourier Transform and Computation of DFT. 2) Understand realization of digital filters in a variety of structures. 3) Study the design of IIR and FIR digital filters. 4) Learn the effects of Finite word length 5) Understand multi-rate discrete time system with unequal sampling rates.	**Course Outcomes** Students will be able to 1) Apply discrete Fourier transform and fast Fourier transform on signals. 2) Implement digital filters in a variety of structures. 3) Design digital IIR and FIR filter. 4) Analyze the effects of finite word length on discrete time system. 5) Analyze multi-rate discrete time system with unequal sampling rates.

UNIT-1 Discrete Fourier transform

Frequency domain sampling: DFT, DFT as Linear transformation, Properties of DFT, Circular convolution, Use of DFT in Linear Filtering, FFT algorithms: Decimation in time, Decimation in Frequency

(06 Hours)

UNIT-2: Digital filter structures

Block diagram representation, Signal Flow Graph, Basic IIR structures, Basic FIR structures, IIR lattice structures, Linear Phase FIR, FIR lattice structure

(07 Hours)

UNIT-3: IIR filter design

Bilinear transformation, Impulse invariant transformation, Low pass IIR digital filters, Butterworth and Chebyshev filter, Spectral transformations.

(06 Hours)

UNIT 4: FIR filter design

FIR filter design using windowing techniques (Rectangular, Hann, Hamm, Blackmann, Bartlett and Kaiser), Frequency sampling technique.

(06 Hours)

Unit 5: Finite Word length Effect

Quantization Process and Errors, Quantization of fixed point and floating points numbers, Analysis of coefficient quantization effects, A/D Conversion Noise analysis, Analysis of round off errors, Dynamic range scaling, Signal to Noise Ratio in Low order IIR Filters, Limit cycles in IIR digital Filters

(05 Hours)

Unit 6: Multirate Digital Signal Processing

Basic sample rate alternation devices, Multirate structure for sampling rate conversion, Multirate Design of Decimator and Interpolator, The Ployphase Decomposition, **New topic to be announced time to time**

(06 Hours)

VI Semester
ET2351 - Digital Signal Processing

Text books:				
1	"Digital Signal Processing - Principles, algorithms and applications"	4th edition, 2013	John G. Proakis	McGraw-Hill
2	"Discrete time Signal Processing"	3rd edition 2010	Alan Oppenheim, Ronald Schafer and Buch	Pearson
3	"Digital Signal Processing - A computer based approach," Publication.	4th edition, 2013	Sanjit K. Mitra,	McGraw-Hill

Reference books:				
1	Digital Signal Processing	3rd Edition 2017	S Salivahanan A Vallavraj C Gnanapriya	McGraw-Hill

VI Semester
ET2352 - Lab: Digital Signal Processing

Course Objectives	Course Outcomes
Students should be able to 1) Learn discrete Fourier Transform and Computation of DFT. 2) Understand realization of digital filters in a variety of structures. 3) Study the design of IIR and FIR digital filters. 4) Learn the effects of Finite word length 5) Understand multi-rate discrete time system with unequal sampling rates.	Students will be able to 1) Apply discrete Fourier transform and verify its properties. 2) Implement digital filters in a variety of structures. 3) Design and analyze digital IIR and FIR filter. 4) Analyze the effects of finite word length on discrete time system. 5) Analyze multi-rate discrete time system with unequal sampling rates

Expt. No.	Name of Experiment
1.	To find Discrete Fourier Transform and Inverse Discrete Fourier Transform of discrete time signals
2.	Verify the properties of DFT (Linearity, Time Reversal and Parsevals theorem)
3.	To find circular convolution of two discrete time signals
4.	To verify Circular time shift and Frequency shift Property
5.	To design Butterworth IIR filters.
6.	To design Chebyshev IIR filters.
7.	To design FIR filters using windowing techniques
8.	To Analyze Coefficient Quantization Effect
9.	To Design Decimator
10.	To design Interplotor

VI Semester

ET2361 - PE I : Object Oriented Programming

Course Objectives	**Course Outcomes**
Students should be able to 1. Learn the basic concepts of Object Oriented Programming. 2. Understand the concepts of function, class, object and operator overloading. 3. Understand the fundamentals of data structures: lists, stacks, queues, trees, graphs. 4. Learn concepts of file handling, template, exception handling and command line arguments.	Students will be able to 1. Elaborate the object oriented paradigm with concepts of streams, classes, functions, data and objects. 2. Demonstrate the use of various OOPs concepts with the help of C++ programs. 3. Develop C++ programs for implementing data structures using array and linked list. 4. Apply the knowledge of BFS,DFS and Dijkstra`s algorithm for traversal of Graph. 5. Develop C++ programs for implementing the concept of file handling, template and exception handling

UNIT-1:
Principles of Object Oriented Programming (OOP), Software Evaluation, OOP Paradigm, Basic Concepts of OOP, Benefits of OOP, Application of OOP. Introduction to C++, Tokens, Keywords, Identifiers, Variables, Operators, Manipulators. Expressions and Control Structures, Pointer, Arrays **06Hrs**

UNIT-2:

Functions, Function Prototyping Parameters Passing in Functions, Values Return by Functions, Inline Functions, Friend and Virtual Functions. Classes and Objects, Constructors and Destructors

06Hrs

UNIT-3:
Operator overloading, Function Overloading, Inheritance, Types of Inheritance, Polymorphism, Friend and Virtual Functions.

06 Hrs

UNIT-4:

Definition of a data structure, Primitive and Composite data types, Asymptotic notations, Operations of Arrays, Order lists, Stacks, Applications of Stack, Infix to Postfix Conversion, Queues, Operations of Queues.

06 Hrs

UNIT-5:
Singly linked list, Operations, Doubly linked list, Operations, Trees and Graphs: Binary tree, Tree traversal; Graph, Definition, Types of Graphs, Traversal (BFS & DFS), Dijkstra`s algorithm.

06Hrs

UNIT-6:
Files – classes for file stream operations – Opening, Closing and Processing files – End of file detection – File pointes – Updating a file – Error Handling during file operations – Command line arguments – Templates – Exception Handling.
New topic to be announced time to time

06 Hrs

Text books:				
1	Object Oriented programming with C++	3rd. Edition Year 2008	E. Balagurusamy	McGraw-Hill
2	Object Oriented Programming in Microsoft C++	4thedition 2002	Robert Lafore	Galgotia
Reference books:				
1	Fundamental of data structure in C++	5th edition,	Horowitz and S.Shani	Galgotia
2	Computer algorithms	2nd Edition	Horowitz, S.Shani and S.Rajasekaran	Galgotia

VI Semester
ET2362 - Lab.: PE I: Object Oriented Programming

Course Objectives	Course Outcomes
Students should be able to 1. Learn the basic concepts of Object Oriented Programming. 2. Understand the concepts of function, class, object and operator overloading. 3. Understand the fundamentals of data structures: lists, stacks, queues, trees, graphs. 4. Learn concepts of file handling, template, exception handling and command line arguments.	Students will be able to 1. Elaborate the object oriented paradigm with concepts of streams, classes, functions, data and objects. 2. Demonstrate the use of various OOPs concepts with the help of C++ programs. 3. Develop C++ programs for implementing data structures using array and linked list. 4. Apply the knowledge of BFS,DFS and Dijkstra`s algorithm for traversal of Graph. 5. Develop C++ programs for implementing the concept of file handling, template and exception handling

Sr.No.	Name of Experiment
1	To implement • Different Control Structures in C++ • Concept of type casting
2	To implement the concept of • Function • Function overloading
3	To implement concepts of Class, Object And Constructor.
4	To implement concepts of Inheritance and Virtual function
5	To implement concepts of operator overloading.
6	To implement concepts of friend function.
7	To implement Stack and Queue using array
8	To implement Stack and Queue using link list.
9	To implement the concepts of file handling and template.
10	To implement the concept of command line arguments and exception handling

VI Semester

ET2363 - PE I : Discrete Structures

Course Objectives	**Course Outcomes**
Students should be able to 1. Learn algorithms related to discrete mathematics. 2. Study encryption and decryption security algorithm. 3. Understand basic concepts of permutations and combinations. 4. Understand basic concepts of graphs. 5. Understand basic concepts of various tree traversal methods. 6. Study the fundamentals of network models.	Students will be able to 1. Examine logic and proof concepts. 2. Develop recursive algorithms and recurrence relations. 3. Use concepts of counting methods, and the pigeonhole principle 4. Design applications using graphs, tree, group theory in computer science 5. Apply transport network and pumping network models for problem solving

UNIT-1: LOGIC AND PROOFS, & Boolean Logic:

Propositions, conditional propositions and logical equivalence, quantifiers, proofs, resolution proofs, mathematical induction, sets, sequences and strings, relations, equivalence relations, matrices of relations, functions, Boolean algebra, Boolean functions and synthesis of circuits. **06 Hrs**

UNIT-2: ALGORITHMS:

Introduction, Notation for algorithms ,The Euclidean algorithm, Recursive Algorithms , Complexity of Algorithms, Design and Analysis of an Algorithm, Analysis of Euclidean Algorithm , Encryption and decryption, The RSA Public – Key Cryptosystem. **06 Hrs**

UNIT-3: COUNTING METHODS, AND THE PIGEONHOLE PRINCIPALE:

Basic Principles, Permutation and Combination, Algorithms for Generating Permutations and Combinations, Introduction to Discrete Probability, Discrete Probability Theory, Generalized Permutation and Combinations, Binomial Coefficients and Combinatorial Identities, The Pigeonhole Principle. **06 Hrs**

UNIT-4: RECURRENCE RELATIONS & GRAPH THEORY:

Introduction, Solving Recurrence Relations, Application to the Analysis of Algorithms, Paths and Cycles, Hamiltonian Cycle and the Traveling Salesperson Problem, A Shortest Path Algorithm,

Graphs: Representations of Graphs, Isomorphism's of Graphs, Planer Graphs . **06 Hrs**

UNIT-5: TREES:

Introduction, Terminology and Characterization of Trees, Spanning Trees, Minimal Spanning Trees, Binary Trees, Tree Traversal, Decision Trees and the minimum Time for Sorting, Isomorphisms of Trees, Game Trees. **06Hrs**

UNIT-6:

NETWORKS MODELS:

Introduction, A Maximal Flow Algorithm, The Max Flow, Min Cut Theorem, Matching, **Group & Ring Theory**: Definition and examples of groups, subgroups & rings.

New topic to be announced time to time **06 Hrs**

Text books:				
1	Discrete Mathamatics	5th Edition 2002,	Richard Johnsonbaugh.	Pearson Education
2	Elements of Discrete Mathematics: A Computer Oriented Approach	2017	C. L. Liu, D. P. Mohapatra	TMH

VI Semester

ET2364 - Lab. : PE I : Discrete Structures

Course Objectives	**Course Outcomes**
Students should be able to 1. Learn algorithms related to discrete mathematics. 2. Study encryption and decryption security algorithm. 3. Understand basic concepts of permutations and combinations. 4. Understand basic concepts of graphs. 5. Understand basic concepts of various tree traversal methods. 6. Study the fundamentals of network models.	Students will be able to 1. Examine logic and proof concepts. 2. Develop recursive algorithms and recurrence relations. 3. Use concepts of counting methods, and the pigeonhole principle 4. Design applications using graphs, tree, group theory in computer science 5. Apply transport network and pumping network models for problem solving

S.N.	Experiment Based on
1.	Propositional LOGIC
2.	PROOFS
3.	Boolean functions, implementation of combinational logic circuit
4.	The Euclidean algorithm, GCD Algorithm
5.	The RSA Public – Key Cryptosystem
6.	Permutation and Combination
7.	Recursive Algorithms
8.	Discrete Probability
9.	Second order homogeneous recurrence relation with initial conditions
10.	Sorting/searching Algorithms
11.	Experiment on Group theory & Rings concepts
12.	**Group Activity**

VI Semester

ET2365 - PE I : Microprocessors and Peripherals

Course Objectives	**Course Outcomes**
Students should be able to 1. Understand the architectural details & instruction set of 8085 2. Understand concept of timing diagrams, delay programs , interrupts & learn interfacing of memory ICs with the processor 3. Understand interfacing of various off chip peripherals with 8086 4. Understand the architectural details of 8086 5. Understand basics of assembly language programming using 8086 instructions	Students will be able to 1. Elaborate architecture and instructions of 8085 and 8086 microprocessor. 2. Analyze timing diagrams and interrupt structure of 8085 microprocessor. 3. Explain functioning of 8255, 8253 and 8257 peripheral ICs 4. Develop programs using 8085 and 8086 instruction sets. 5. Interface various off chip peripherals with 8085.

Unit I:-
8085 microprocessor architecture, instruction set & programming (6 hrs)

Unit II:
Timing diagrams, Delay programs, interrupts in 8085 (6 hrs)

Unit III:
Memory IC interfacing with 8085, interfacing of 8255 , 8253 with 8085 (6 hrs)

Unit IV:
Interfacing of ADC, DAC & 8257 with 8085 (6 hrs)

Unit V:
Introduction to 16 bit microprocessor family, architecture of 8086 ,segmentation, memory organization, pipelining, Signal description, fetch read &write cycle, minimum mode system, Maximum mode of 8086 (6 hrs)

Unit VI:
8086 Instruction set & programming, **New topic to be announced time to time** (6 hrs)

Text books:				
1	Microprocessor & interfacing		By Ramesh Gaonkar	New Age international
2	Advanced Microprocessors & Peripherals	Second Edition	By A.K Ray , K M Bhurchundi	McGraw Hill
Reference books:				
1.	8085 microprocessor & its applications	Third edition	A. NagoorKani	McGraw Hill
2.	8086/8088 family architecture, interfacing & programming		By D V Hall	McGraw Hill

VI Semester
ET2366 - PE I : Lab. Microprocessors and Peripherals

Course Objectives	Course Outcomes
Students should be able to 1. Understand the architectural details & instruction set of 8085 2. Understand concept of timing diagrams, delay programs , interrupts & learn interfacing of memory ICs with the processor 3. Understand interfacing of various off chip peripherals with 8086 4. Understand the architectural details of 8086 5. Understand basics of assembly language programming using 8086 instructions	Students will be able to 1. Elaborate architecture and instructions of 8085 and 8086 microprocessor. 2. Analyze timing diagrams and interrupt structure of 8085 microprocessor. 3. Explain functioning of 8255, 8253 and 8257 peripheral ICs 4. Develop programs using 8085 and 8086 instruction sets. 5. Interface various off chip peripherals with 8085.

S.N.	Experiments based on
01	Perform Basic arithmetic & logical operations
02	Transfer data bytes from one memory block to another
03	Find Smallest / Largest number from a data block
04	Sort /Count number of even & odd data bytes in a array
05	Convert BCD number to equivalent hex
06	Generate square wave using 8255
07	Interface DAC with 8085 & write program to generate sawtooth waveform
08	Solve equation using shift & add method
09	Convert data string to its equivalent 2's compliment
10	Transfer array of data bytes from source memory to destination memory using string instructions
11	Search a byte in an array of data bytes present in memory by using string instructions.
12	Compare two data blocks using string instructions

VI Semester
ET2367 - PE I : Electronic Instrumentation

Course Objectives	Course Outcomes
Students should be able to 1. Study the characteristics of Instruments. 2. Understand the Concepts of Pressure and temperature Measurements and its calibration process. 3. Learn the working principle of various flow & level transducers. 4. Learn the working principle of various transducers like level , thickness speed, ph value etc. 5. Learn Programmable logic controller and their programming language	Students will be able to 1. Explain electronic instrumentation system 2. Analyze pressure, temperature, parameters measured using transducers 3. Analyze flow, speed and level parameters measured using transducers 4. Develop PLC programs by using ladder diagram

UNIT-I INTRODUCTION
Block diagram of instrumentation system, functions of instruments, characteristic equation of instrument in general form, calibration process, cables and connectors and its analysis.
05 Hours

UNIT-II PRESSURE MEASUREMENT
Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezo resistive pressure sensor –Testing and calibration of pressure gauges – Dead weight tester.
06 Hours

UNIT-III TEMPARATURE MEASUREMENT, THERMOCOUPLES AND PYROMETERS
Different types of filled in system thermometer , Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – Three lead and four lead RTDs and their circuits. Thermocouples – Laws of thermocouple – Signal conditioning of thermocouples output –cold junction compensation – Response of thermocouple, Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two color radiation pyrometers.
07 Hours

UNIT-IV FLOWMETERS& LEVEL MEASUREMENT
Variable head type flow meters: – Orifice plate – Venturi tube – Pitot tube. Variable area flow meter: – Rotameter, Principle and constructional details of electromagnetic flow meter – Ultrasonic flow meters flow measurements for gases. Float type level indication, capacitive, ultrasonic level measurement
06 Hours

UNIT-V MISCELLANEOUS MEASUREMENT
Electrical level gauge: – Resistive , capacitive , Nuclear radiation , Radar type ,Speed measurement -D.C and A.C tacho generators ,rotary encoder, Proximity sensors- Inductive and capacitive, pH Measurement, measurement of AC current by Hall effect transducer.
06 Hours

UNIT- VI Data Logger & PLC
Data Logger, Introduction to PLC, PLC programming, ladder diagram logic for process control applications, Introduction to SCADA**.**
New topic to be announced time to time **06 Hours**

VI Semester
ET2367 - PE I : Electronic Instrumentation

Text books:				
1	Industrial Instrumentation and Control	2003	S.K. Singh	Tata McGraw Hill, 2003.
2	PLC Programming for Industrial Automation		Kevin Collins	
3	Electrical and Electronic Measurement and Instrumentation		A.K.Sawhney	DhanpatRai And Co.
4	Process Control Instrumentation Technology 8th Ed	2014	Curtis D. Johnson	Pearson
Reference books:				
1	Principles of Industrial Instrumentation		D. Patranabis	Tata McGraw Hill Publishing Company Ltd, 1996.
2	Transducers and Instrumentation		D V S Murthy	prentice Hall of India Pvt. Ltd., New Delhi
3	Measurement Systems – Application and Design	2003	E.O. Doebelin	Tata McGraw Hill publishing company
4	Industrial Instrumentation		D.P. Eckman	Wiley Eastern Ltd.

VI Semester

ET2368 - PE I : Lab Electronic Instrumentation

Course Objectives	**Course Outcomes**
Students should be able to 1. Study the characteristics of Instruments. 2. Understand the Concepts of Pressure and temperature Measurements and its calibration process. 3. Learn the working principle of various flow & level transducers. 4. Learn the working principle of various transducers like level , thickness speed, ph value etc. 5. Learn Programmable logic controller and their programming language	Students will be able to 1. Explain electronic instrumentation system 2. Analyze pressure, temperature, parameters measured using transducers 3. Analyze flow, speed and level parameters measured using transducers 4. Develop PLC programs by using ladder diagram

S. N.	Name of Experiment
01	Measure linear displacement and study input output characteristics of LVDT.
02	To study the temperature versus resistance and V-I characteristics of RTD.
03	Measure Temperature using Thermocouple.
04	Pressure measurement using pressure transducer
05	To measure Strain using Strain Gauge or load cell.
06	Measurement of parameters using different sensors
07	Experiments based on PLC and SCADA
08	Grounding & Shielding of Electronics Devices & Instruments, Human Safety.

VI Semester
ET2371 - PE I: Fundamentals of Computing

Course Objectives	Course Outcomes
Students should be able to 1. Understand the use of Python as a scripting language for programmers. 2. Learn Python programming and to design applications	Students will be able to 1. Explain Python framework 2. Develop Python programs using data types, operators and control structures 3. Apply strings, lists, tuples, Numpy and dictionaries for Python programs. 4. Develop Python programs using functions

UNIT-1
Introduction to Python ,Python syntax ,comments variables, basic programming **(06 Hours)**

UNIT-2:
Data types, numbers, Casting strings Booleans, python operators: basic, membership and bitwise **(06 Hours)**

UNIT-3:
Conditions, Control statements: if-else, loops, Use of while loops in python Loop manipulation using pass, continue, break and else **(06 Hours)**

UNIT 4
Python String Defining list and list slicing, Use of Tuple data Types **(06 Hours)**

UNIT 5:
List and Dictionary Manipulations Building blocks of python programs **(06 Hours)**

UNIT 6:
Numpy, Functions, recursion and advanced programming **(06 Hours)**

Text books:				
1	NPTEL material		Swayam.gov.in	NPTEL material
2	Complete Reference	Martin C Brown		TATA McGraw Hill
Reference books:				
1.	Core Python Programing	Wesley Chun,		Prentice Hall publications

VI Semester
ET2372 - Lab: PE I -Fundamentals of Computing

Course Objectives	Course Outcomes
Students should be able to 1. Understand the use of Python as a scripting language for programmers. 2. Learn Python programming and to design applications	Students will be able to 1. Explain Python framework 2. Develop Python programs using data types, operators and control structures 3. Apply strings, lists, tuples, Numpy and dictionaries for Python programs. 4. Develop Python programs using functions

Expt. No.	Name of Experiment
1.	Write, test, and debug simple Python Programs
2.	Develop Python programs using different data types and understand their use
3.	Implement Python programs with conditionals and loops
4.	Implement Python programs with strings
5.	Develop Python programs for Python lists and understand their use
6.	Develop Python programs for Python tuples and understand their use
7.	Develop Python programs step-wise by Python dictionaries for representing compound data.
8.	Develop Python programs step-wise by defining functions and calling them
9.	Read and write data from/to files in Python.
10.	Mini Project

VI Semester

ET2373 - PE I: Algorithms and data structures

Course Objective	**Course Outcome**
Students should be able to 1. Learn the concepts of object oriented programming using C++. 2. Understand the fundamentals of file handling, streams and formatting I/O operations. 3. Study various data structures and abstract data types. 4. Study concepts of dictionaries; skip list, hashing and search trees.	Students will be able to 1. Describe fundamental concepts of Object Oriented Programming 2. Develop C ++ programs to demonstrate the concepts of Object Oriented Programming 3. Develop programs for implementing data structures. 4. Analyze Skip-list, hashing and search trees.

UNIT-1

software evolution, need for OOP, Overview of OOP Principles- Encapsulation, Inheritance, Polymorphism. C++ class overview- class definition, objects, class members, access control, class scope, constructors and destructors, inline functions, static class members, this pointer, friend functions, dynamic memory allocation and deal location (new and delete) **(06 Hours)**

UNIT-2:

Function overloading, operator overloading, generic programming-function and class templates, Inheritance basics, single inheritance and multiple inheritance, base and derived classes, different types of inheritance, base class access control, virtual base class, function overriding, run time polymorphism using virtual functions, abstract classes. **(06 Hours)**

UNIT-3:

Streams basics, Stream classes hierarchy, console i/o, formatted I/O, manipulators, file streams, opening and closing of files, exception handling mechanism. **(06 Hours)**

UNIT 4

Algorithms, performance analysis-time complexity and space complexity, Review of basic data structures-the list ADT, stack ADT, queue ADT, implementation using template class in C++, implementation using template class, priority queues-definition, ADT, heaps, definition, insertion and deletion, application-heap sort, disjoint sets-disjoint set ADT, disjoint set operations. **(06 Hours)**

UNIT 5:

Skip lists and Hashing: Dictionaries, linear list representation, skip list representation, operations-insertion, deletion and searching, hash table representation, hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing, rehashing, extendible hashing, comparison of hashing and skip lists**.** **(06 Hours)**

UNIT 6:

Binary search trees, definition, ADT, implementation, operations- Searching, insertion and deletion, Balanced search trees- AVL trees, definition, height of an AVL tree, representation, operations-insertion, deletion and searching. Red –Black trees-representation, insertion, deletion, searching Splay trees- introduction, the splay operation . **(06Hours)**

VI Semester
ET2373 - PE I : Algorithms and data structures

Text books:				
1	Data structures, Algorithms and Applications in C++	2nd edition August 2004	S. Sahni	University press (India) pvtltd , Orient Longman pvt. ltd.
2	Data structures and Algorithms in C++	2nd Edition.	Michael T. Goodrich, R. Tamassia and D. Mount	John Wiley and Sons.
Reference books:				
1	Data structures and Algorithm Analysis in C++	second editio n.	Mark Allen Weiss	Pearson Education ltd
2	Data structures using C and C++	second editio n 2003	Langsam, Augenstein and Tanenbaum	PHI
3	C++ primer	3rd edition 2000	S.B.Lippman	Pearson education ltd.
4	Problem solving with C++, The OOP	Fourth edition	W.Savitch	Pearson education.
5	Data structures and algorithms in C++	3rd Edition	Adam Drozdek, Thomson	

VI Semester

ET2374 - PE I :Lab Algorithms and data structures

Course Objective	**Course Outcome**
Students should be able to 1. Learn the concepts of object oriented programming using C++. 2. Understand the fundamentals of file handling, streams and formatting I/O operations. 3. Study various data structures and abstract data types. 4. Study concepts of dictionaries; skip list, hashing and search trees.	Students will be able to 1. Describe fundamental concepts of Object Oriented Programming 2. Develop C ++ programs to demonstrate the concepts of Object Oriented Programming 3. Develop programs for implementing data structures. 4. Analyze Skip-list, hashing and search trees.

Expt. No.	Experiments based on
01	Study of control Structure & Statements
02	Study of If –else structure
03	Study of Case Statement
04	Study of Functions
05	Study of inheritance
06	Study of polymorphism
07	Study of Structures
08	Study of Linked List
09	Study of Stacks
10	Study of queues
11	Study of Trees

VI Semester
ET2377 - PE II : Antenna Theory & Design

Course Objective	Course Outcome
Students should be able to 1. Learn the basic principles and of antenna parameters. 2. Design and analyze dipole antennas. 3. Design and analyze loop antennas & Arrays. 4. Design and Analyze Travelling wave & Broadband Antennas. 5. Design & Analyze aperture, Reflector and Patch Antennas. 6. Study different antenna measurements.	Students will be able to 1. Evaluate various parameters of antennas. 2. Analyze performance parameters of various antennas & antenna array. 3. Perform antenna measurements using different antenna measurement techniques. 4. Design and Analyze various antennas

UNIT I : BASIC ANTENNA CONCEPTS:
Introduction to antenna , need of Antenna, Types of antennas, Radiation mechanism of single wire and two wire , Radiation Pattern, Antenna field zones, Beam solid angle, radiation power density , radiation intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Polarization, impedance, bandwidth, impedance, effective length and equivalent area

(6 Hours)

UNIT II : DIPOLE ANTENNA:
Vector potentials for electric current source , Vector potentials for Magnetic current source, Infinitesimal Dipole, Finite dipole, Half wavelength dipole.

(6 Hours)

UNIT III : LOOP ANTENNAS AND ARRAYS:
circular loop ,polygonal loop and ferrite loop antenna, Two element array, N-element linear array ,broad side, end fire, phase array , planar Array system.

(6 Hours)

UNIT IV : TRAVELING WAVE ANTENNA
Introduction to traveling wave antenna, long wire, V antenna, rhombic antenna, Helical antenna, Electric - Magnetic Dipole, Yagi - Uda array of linear Elements.

(6 Hours)

UNIT V: SPECIAL ANTENNAS:
Babinet's principle, Rectangular Horn antenna, conical horn, corrugated Horn, plane reflector antenna, corner reflector antenna, parabolic reflector antenna, Cassegrain reflector antenna, Patch Antenna, antenna feeding techniques.

(6 Hours)

UNIT VI: ANTENNA MEASUREMENTS
Antenna reflection Ranges, Antenna Free space Ranges, Anechoic Chamber, Near field to farfield method, instrumentation system for measurement, Gain Measurement, Impedance Measurement, Current Measurement, Polarization Measurement. **New topic to be announced time to time**

(06 Hours)

VI Semester
ET2377 - PE II : Antenna Theory & Design

Text books:				
1.	Antenna Theory Analysis and Design Technology	2009 Third edition	Balanis C.A	Wiley India
2.	Antennas	Second edition 1988	John D.Krauss	McGraw - Hill International edition
Reference books:				
1.	Electromagnetic waves and Radiating systems	1993	Edward C.Jordan, Keith G.Balmain	Prentice Hall of India.
2.	Antennas and Radio Propagation	1985	R.E. Collins	McGraw-Hill

VI Semester

ET2378 - PE II : Lab. Antenna Theory & Design

Course Objective	Course Outcome
Students should be able to 1. Learn the basic principles and of antenna parameters. 2. Design and analyze dipole antennas. 3. Design and analyze loop antennas & Arrays. 4. Design and Analyze Travelling wave & Broadband Antennas. 5. Design & Analyze aperture, Reflector and Patch Antennas. 6. Study different antenna measurements.	Students will be able to 1. Evaluate various parameters of antennas. 2. Analyze performance parameters of various antennas & antenna array. 3. Perform antenna measurements using different antenna measurement techniques. 4. Design and Analyze various antennas

SN	List of Experiment
1	To measure radiation Pattern of Yagi-Uda Antenna and its Characteristic using Antenna trainer Kit.
2	To measure radiation Pattern of Log Periodic Antenna and its Characteristic using Antenna trainer Kit.
3	To measure radiation Pattern of λ/2 Dipole Antenna and its Characteristic using Antenna trainer Kit.
4	To measure radiation Pattern of 3λ/2 Dipole Antenna and its Characteristic using Antenna trainer Kit.
5	To design and Simulate Patch Antenna with Probe Feed using Simulation software.
6	To design and Simulate Patch Antenna with Microstrip Feed line using Simulation software.
7	To Study parametric analysis of Patch Antenna using Simulation software.
8	To design and Simulate Lambda/2 Dipole Antenna using Simulation software and study it's Characteristic.
9	To design and Simulate Yagi-Uda Antenna using Simulation software and study it's Characteristic.
10	To design and Simulate Horn Antenna using Stimulation software and study it's Characteristic.
11	To design and Simulate Parabolic reflector Antenna using Stimulation software and study it's Characteristic.
12	Study the fabrication process of Antenna
13	Measurement of Antenna Parameter Using Vector Network Analyzer.
14	Mini Project on antenna.

VI Semester
ET2379 - PE II : Digital System Design

Course Objectives	Course Outcomes
Students should be able to 1. Understand programmable devices and discuss the architecture of CPLD and FPGA 2. Learn basics of Hardware description Language, design flow and design Methodology. 3. Understand the concept of modeling digital systems. 4. Understand the concept of generic, generate and attributes. 5. Comprehend combinational and sequential circuit design approaches.	Students will be able to 1. Explain digital system design principles 2. Implement digital circuits using discrete gates and programmable logic devices. 3. Develop Verilog programs for combinational, sequential circuits and test pattern generation. 4. Design a system using CAD tools.

UNIT-1:
Digital Design Fundamentals, Combinational & Sequential design issues, Introduction to finite state machines, Moore & Mealy Machine, Introduction to programmable devices, PLA, PAL, PROM, Structure of CPLDs, Introduction to FPGA, Architecture, CLB, IOB, Programmable Interconnect Points, Different type of programmable switches used in PLDs **(06 Hours)**

UNIT-2:
HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modelling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module **(06 Hours)**

UNIT-3
Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Physical & Abstract, Constants, Parameter, Verilog Data Operators, Design entry in Verilog & Testbench, Compilation and synthesis, Timing analysis **(06 Hours)**

UNIT-4:
Data Flow Modelling , Delay, Continuous Assignment, Delayed Continuous assignment, Structural Modelling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives

(06 Hours)

UNIT 5:
Behavioural Modelling, Initial, Always, Procedural Assignment, Blocking and Non-Blocking assignments, Sequential & Parallel Blocks, Race around Condition, Timing Control, Procedural Statements, Conditional Statements if case loop repeat forever etc, Zero Delay Control, Event Based Timing Control, Compiler Directives, Assign De-assign, Force Release, Latch Models, FF Models, State Machine Coding ,Moore and Mealy Machines

(06 Hours)

Unit 6: Advanced feature:
Combinational & sequential system Design examples like Shift Registers, Counters, LFSR, Stacks and Queues, Multi bit Adders & Multiplier, Huffman Coding, Processor and Memory Model, CPU, System Tasks and Functions, Design Verification, **New topic to be announced time to time (06 Hours)**

VI Semester
ET2379 - PE II : Digital System Design

Text books:				
1	Verilog Digital System Design"	Zainalabedin Navabi	Second Edition, Tata McGraw Hill ,	2009
2	Verilog HDL : A Guide to Digital Design and Synthesis	Samir Palnitkar	2nd Edition , Prentice Hall India,	2003
Reference books:				
1	A Verilog HDL Primer"	J. Bhaskar,	2nd Edition, Star Galaxy Press	1997

VI Semester

ET2380- PE II : Lab. Digital system Design

Course Objectives	**Course Outcomes**
Students should be able to 1. Understand programmable devices and discuss the architecture of CPLD and FPGA 2. Learn basics of Hardware description Language, design flow and design Methodology. 3. Understand the concept of modeling digital systems. 4. Understand the concept of generic, generate and attributes. 5. Comprehend combinational and sequential circuit design approaches.	Students will be able to 1. Explain digital system design principles 2. Implement digital circuits using discrete gates and programmable logic devices. 3. Develop Verilog programs for combinational, sequential circuits and test pattern generation. 4. Design a system using CAD tools.

Expt. No.	Experiments based on
1	Write a VERILOG code for Basic gates.
2	Write a VERILOG Dataflow code for Half Adder, Half Subtractor.
3	Write a VERILOG Dataflow code for 4:1 MUX, 2:4 Decoder, 1:4 DEMUX.
4	Write a VERILOG Dataflow code for 1-bit, 2-bit Comparator
5	VERILOG code for Full Adder
6	write VERILOG code for Full Subtractor
7	Write Behavioral VERILOG code for SR latch.
8	Write Behavioral VERILOG code for D latch
9	Write Behavioral VERILOG code for 4-bit Shift register, 4-bit counter.
10	Write VERILOG code for 8 Bit Carry Look Ahead Adder using FA.
11	Write VERILOG Code for 4 bit Sequence Detector MEALY M/C, Overlapping allowed
12	Write VERILOG Code for 4 bit Sequence Detector MOORE M/C, Overlapping allowed

VI Semester
ET2381- PE II : Internet of Things (IoT)

Course Learning Objectives	Course Outcomes
Students should be able	Students will be able to
1. To understand the physical and Logical design of IoT.	1. Illustrate the physical and Logical design of IoT.
2. To study the M2M and NETCONF.	2. Explain the M2M and NETCONF.
3. To understand python programming.	3. Develop python programs for IoT applications.
4. To understand physical servers and cloud offerings.	4. Design IoT based systems.

UNIT-1: **5 Hrs.**
Introduction & Concepts: Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels.

UNIT-2: **6Hrs**
Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style.

UNIT-3: **7Hrs**
M2M & System Management with NETCONF-YANG: M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG.

UNIT-4: **6Hrs**
Developing Internet of Things & Logical Design using Python: Introduction, IOT Design Methodology, Installing Python, Python Data Types & Data Structures, Control Flow, Functions,

UNIT-5: **6Hrs**
Python Modules, Packages, File Handling, Date/ Time Operations, Classes, Python Packages, Iot Device-Raspberry Pi, Programming Raspberry pi with Python

UNIT-6: **7Hrs**
IoT physical servers and cloud offerings, Introduction to cloud storage models and communication APIs, Python web application frame work-Django, Amezon web service for IoT
New topic to be announced time to time

Text books:				
1	Internet of Things: A Hands-On Approach	1st edition 2015	by Arshdeep Bahga, Vijay Madisetti	Orient Blackswan Private Limited - New Delhi
Reference books:				
1	Designing the Internet of Things	1st edition	By Adrian McEwen	Wiley
2	Python for Everybody		Charles R. Severance	

VI Semester

ET2382- PE II : Lab. Internet of Things (IoT)

Course Learning Objectives	**Course Outcomes**
Students should be able 1. To understand the physical and Logical design of IoT. 2. To study the M2M and NETCONF. 3. To understand python programming. 4. To understand physical servers and cloud offerings.	Students will be able to 1. Illustrate the physical and Logical design of IoT. 2. Explain the M2M and NETCONF. 3. Develop python programs for IoT applications. 4. Design IoT based systems.

Expt. No.	**Name of Experiment**
01	Add ten natural numbers in python
02	Experiment on functions in python
03	Experiment on string manipulation in python
04	Interfacing LED with Raspberry pi.
05	Interfacing DHT11 sensor with Raspberry pi.
06	File handling using Python.
07	Reading data from server.
08	Experiment on python Django.
09	Experiment on python Django.
10	Preparing complete IoT system using AWS server
11	Mini-project

VI Semester
ET2383- PE II : Optical Communication

Course Objectives	Course Outcomes
Students should be able to 1. Learn the principles of step index and graded index optical fiber. 2. Know the types of losses in optical fiber. 3. Understand Transceiver systems in optical communication. 4. Learn concept of active, passive devices and measurements in optical communication.	Students will be able to 1. Elaborate the concepts of optical communication system. 2. Analyze Optical Communication Systems with different types of losses. 3. Select appropriate types of optical fibers and receivers. 4. Elaborate different methods of loss measurements in fiber optics

UNIT I : INTRODUCTION TO OPTICAL FIBERS

Introduction of fiber Optic system. Principle of optical communication-Attributes and structures of various fibers such as step index, graded index mode and multi mode fibers. Propagation in fibers-Ray mode, Numerical aperture and multipath dispersion in step index and graded index fibers structure, Electromagnetic wave equation in step index and graded index fibers ,Modes and Power flow in fibers . **06Hrs**

UNIT II : SIGNAL DEGRADATION IN OPTICAL FIBERS Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides Group Delay – Material Dispersion, Wave guide Dispersion, Intermodal dispersion, Pulse Broadening in GI fibers – Mode Coupling **06Hrs**

UNIT III : FIBER OPTICAL SOURCES

Direct and indirect Band gap materials – LED structures – Light source materials – Quantum efficiency and LED power, Modulation of a LED, Laser Diodes – Rate equations – External Quantum efficiency –Laser Diodes structures and radiation patterns – Single Mode lasers – Modulation of Laser Diodes, Fabry Perot cavity Quantum laser **06Hrs**

UNIT IV : FIBER OPTICAL RECEIVERS

PIN and APD diodes – Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise – Comparison of Photo detectors – Fundamental Receiver Operation – pre-amplifiers - Receiver Configuration- The Quantum Limit . **06Hrs**

UNIT V: POWER LAUNCHING AND COUPLING IN DIGITAL TRANSMISSION SYSTEM

Source to fiber power launching –Fiber to Fiber Joints-Fiber Splicing and connectors, Mechanical Misalignment, line coding –error correction- Noise Effects on System Performance , Wavelength division Multiplexing. **06Hrs**

UNIT VI: Measurement in optical fibers

Attenuation, Time domain dispersion and Frequency domain dispersion, NA measurement Refractive index profile and optical source characteristic measurements, OTDR, Eye pattern, **New topic to be announced time to time**

06Hrs

VI Semester
ET2383- PE II : Optical Communication

Text books:				
1	Optical Fiber Communication	2008	Gerd Keiser,	McGraw-Hill International,
2	Optical Communication, Principles and Practice.		J.Senior	Prentice Hall of India
Reference books:				
1	Optical Communication System		J. Gower	Prentice Hall of India
2	Fiber-Optic Communication System	Third Edition	GovindAgrawal	John Willy & Sons

VI Semester
ET2384- PE II : Lab. Optical Communication

Course Objectives	Course Outcomes
Students should be able to 1. Learn the principles of step index and graded index optical fiber. 2. Know the types of losses in optical fiber. 3. Understand Transceiver systems in optical communication. 4. Learn concept of active, passive devices and measurements in optical communication.	Students will be able to 1. Elaborate the concepts of optical communication system. 2. Analyze Optical Communication Systems with different types of losses. 3. Select appropriate types of optical fibers and receivers. 4. Elaborate different methods of loss measurements in fiber optics

Sr. No.	Experiments based on
1	Optical analog and digital transmission
2	Numerical Aperture
3	Losses in Fiber optics
4	Optical detector Characteristics
5	Fiber Bandwidth/ Data Rate
6	Optical Sources Characteristics
7	Multiplexing in Optical Fiber
8.	Optical Time domain Reflectrometry. (OTDR)
9.	Voice transmission in optical fiber.
10.	Modulation in Optical fiber.
11	Eye Pattern

VI Semester
ET2385- PE II: Principles of image processing

Course Objective	Course Outcome
Students should be able to 1) Learn the fundamentals of digital image processing algorithms. 2) Learn the algorithms of spatial and frequency domain filtering. 3) Learn segmentation and restoration of digital images through various algorithms 4) Understand the process of image representation and description	Students will be able to 1) Examine the concepts of image enhancement, restoration, segmentation, representation and description. 2) Apply basic image processing algorithms and filtering techniques for image enhancement. 3) Apply the algorithms for image restoration and segmentation 4) Extract the features for image representation and description

UNIT I: Digital Image fundamental
Digital Image fundamental steps and components of an image processing system, elements of visual perception, Image formation and acquisition, Image sampling and quantization, some basic relationship between the pixels, mathematical tools used in digital image processing. **06Hrs**

UNIT II: Intensity Transformation and Histogram Processing
Image Negative, Log Transformation, Power Law transformation, Linear Piecewise transformation, Histogram Equalization, Histogram Specification, Histogram Statistics **06Hrs**

UNIT III: Filtering in spatial and frequency domain
Fundamentals of Spatial Filtering, Smoothing spatial filtering, Sharpening Spatial Filtering, Unsharp masking and High boost filtering, filtering in Frequency Domain: Introduction to Fourier transform and frequency domain, Smoothing frequency domain filters, and sharpening frequency domain filters **06Hrs**

UNIT IV: Image Restoration
Image Restoration Image degradation/restoration process, noise model, restoration in presence of noise, periodic noise reduction, linear, position invariant degradation, estimating degradation function, Inverse filtering, Wiener filtering **06Hrs**

UNIT V : Image Segmentation
Fundamentals, Detection of discontinuities: Point, Line and Edge, Thresholding, Region based segmentation: Region Growing, Split and Merge, Clustering

06Hrs

UNIT VI : Feature Extraction
Boundary Pre-processing: Chain Code, MPP, Signatures, Skeleton; Boundary Descriptors: Simple Descriptor, Shape Number, Fourier Descriptor, Statistical Moments; Region Feature descriptor: Basic descriptor, Topological Descriptor, Texture Descriptor **06Hrs**

Text books:				
1	Digital Image Processing	2nd edition 2002	R.C. Gonzalez & R.E. Woods	Addison Wesley/Pearson education publication
2	Fundamentals of Digital Image processing	2nd edition.	A. K. Jain	PHI publication
Reference books:				
1	Digital Image processing using MATLAB	2004	R.C. Gonzalez & R.E. Woods	Addison Wesley/Pearson education publication
2	Digital Image processing	3rd Edition 2004	William K. Pratt	John Wiley

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

VI Semester
ET2386- PE II: Lab. Principles of image processing

Course Objective	Course Outcome
Students should be able to 1) Learn the fundamentals of digital image processing algorithms. 2) Learn the algorithms of spatial and frequency domain filtering. 3) Learn segmentation and restoration of digital images through various algorithms 4) Understand the process of image representation and description	Students will be able to 1) Examine the concepts of image enhancement, restoration, segmentation, representation and description. 2) Apply basic image processing algorithms and filtering techniques for image enhancement. 3) Apply the algorithms for image restoration and segmentation 4) Extract the features for image representation and description

Sr. No.	Experiments are based on
1	Basic Operations on Digital Images
2	Image enhancement using Gray level Transformation
3	Image Enhancement Using Piecewise linear transformation
4	Image Enhancement Using Histogram Processing
5	Spatial Domain Filtering Techniques for Image Enhancement
6	Frequency Domain Filtering Techniques for Image Enhancement
7	Noise modeling and Basic Restoration Techniques
8	Image Segmentation
9	Image Compression
10	Image Representation and Description

VI Semester
ET2387- PE II: TV & Video Engineering

Course Objectives	Course Outcomes
Students should be able to 1. Introduce the basic principles of T.V. 2. Study different television systems and standards 3. Learn to elaborate video amplifiers and luminance channel. 4. Explore different types of color T. V. receivers. 5. Describe cable television and video disc-recording and playback. 6. Study digital television-transmission and reception.	Students will be able to 1. Describe basic concept of monochrome and color TV. 2. Describe and troubleshoot Video Amplifier & luminance circuits. 3. Explain and compare PAL, NTSC and SECAM systems. 4. Explain and compare analog and digital television-transmission and reception.

UNIT-1: COLOUR SIGNAL GENERATION AND ENCODING:
Introduction monochrom T V system ,Colour TV camera , Desired Composition of Video Signal, Freq. interleaving, PAL colour TV standards ,Luminance Signal (Y),,Colour Difference Signals, Encoding of Colour Difference Signals, generation of U and V signals, PAL Encoder, Chrominance Signal for Colour Bar Pattern, colour TV Transmitter Block diagram **06 Hrs**

UNIT-2:TELEVISION SYSTEMS AND STANDARS:
NTSC Colour T V standards, generation of I and Q signals, NTSC encoder, NTSC colour T V system ,SECAM colour TV standards, ,Transmission of colour difference signal in SECAM system, SECAM encoder SECAM colour TV system .

06Hrs

UNIT-3VIDEO AMPLIFIERS AND LUMINANCE CHANNEL
Desired Composition of colour Video Signal, Video Amplifier, Problems of DC Coupling, Consequences of AC Coupling, DC Reinsertion, Contrast and Brightness Control Methods, Video Amplifier Circuits Luminance or Y Channel, Trouble shooting Video Amplifier circuits

06Hrs

UNIT-4: COLOUR TELEVISION RECEIVERS
PAL-D Decoder, Separation of U and V Signals, U and V demodulators Colour Burst Separation, Colour Killer Circuits, Colour Signal Matrixing, PAL Colour RGB Drive Amplifiers, Sync Separation, Noise in Sync Pulses, Separation of Frame (Vertical) and Line (Horizontal) Sync Pulses, NTSC decoder, SECAM decoder.

06Hrs

UNIT-5:CABLE TELEVISION, VIDEO DISC-RECORDING
Cable Signal Sources, Cable Signal Processing, Cable Signal Distribution, Bi -Directional Networks, Scrambling of TV Signals, Cable Signal Converters, Disc Recording and Playback Technology, Single layer and multilayer Discs, DVD Player.

06Hrs

UNIT-6:DIGITAL TELEVISION-TRANSMISSION AND RECEPTION

Digital System Hardware, Signal Quantization and Encoding, Digital Satellite Television, Direct-to-Home Satellite Television, Digital TV Receiver, Merits of Digital TV Receivers, Extended Definition Television (EDTV),High Definition Television (HDTV), LCD Technology, LCD Matrix Types and Operation

06 Hrs

VI Semester
ET2387- PE II: TV & Video Engineering

Text books:				
1	Modern Television Practice, Principles and Servicing	3rd edition Publishing Date : 2010	by R.R. Gulati	New Age International Publishers, Delhi.
2	Television and Video Engineering	2nd Edition MAY-2001	Dhake.A.M	Tata McGraw-Hill
Reference books:				
1	Basic television and video systems	2nd Edition PublishingDate :1999	Grob. B, Herndon. C.E	McGraw-Hill,

VI Semester
ET2388- PE II : Lab. TV & Video Engineering

Course Objective	Course Outcome
Students should be able to 1. Learn the fundamentals of digital image processing algorithms. 2. Learn the algorithms of spatial and frequency domain filtering. 3. Learn segmentation, restoration and compression of digital images through various algorithms 4. Understand the process of image representation and description	Students will be able to 1. Examine the concepts of image enhancement, , restoration, segmentation, representation and description. 2. Apply basic image processing algorithms and filtering techniques for image enhancement. 3. Apply the algorithms for image restoration , compression and segmentation 4. Apply the techniques for image representation and description

Expt. No.	Experiments based on
1	To study block diagram of CTV Receiver.
2	To study in detail, circuit of RF tuner section through various test points and step-by-step fault finding.
3	To observe the composite video signal at the output of VIF section
4	To study in detail, circuit of SIF and VIF section through various test points, and step-by-step fault finding.
5	To study the Horizontal oscillator section through various test points and step-by-step fault finding.
6	To study the Vertical oscillator section through various test points and step-by-step fault finding.
7	To study the detail circuit of video and chroma section through various test points and step-by-step Faultfinding.
8	To study in details, of audio section through various test points
9	To study power supply section through various test points.
10	To study CCVS signal for color bar pattern using pattern generator.
11	To study the chrominance signal, which represents colour saturation and Hue of a scene or picture.

VI Semester

ET 2391- OE III: MICROCONTROLLER & EMBEDDED SYSTEMS

Course Learning Objectives	Course Outcomes
The student should be able to 1) To understand the architecture and pin functions of 8 bit microcontroller. 2) To study the assembly language instruction set. 3) To understand programming microcontroller in C language. 4) To understand interfacing of on and off chip peripherals with 8051 microcontrollers	**The student will be able to** 1) Elaborate 8051 microcontroller architecture. 2) Develop assembly and embedded C language program. 3) Interface 8051 microcontroller with different peripherals 4) Examine Arduino architecture

Unit No.	Contents	Max. Hrs.
1	Overview of 8051 Microcontroller family, Introduction to MCS 51 family, Architecture, Memory organization, Internal RAM, Flag Register, Register Banks, SFRs , Functional pin description and various resources of MCS 51. Hardware Overview	6
2	Addressing modes, Instruction set and Assembly language programming Programs using look up table, Bit manipulation, 8051 I/O programming, Delay Programs.	6
3	I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming, 8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access	6
4	Timer programming in assembly and C: Various modes of operation, SFR related to timer operation. Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs.	6
5	Interfacing of LCD, ADC, DAC, stepper motor and DC motor with 8051 microcontroller	6
6	Block diagram of Arduino, features of Arduino Architecture, Arduino pin description: digital pins, analog pins, Power pins and other pins, Interfacing of LED, 7-Segment display, LCD, Sensors, DC motor, switch and Serial communication. New topic to be announced time to time .	6

VI Semester
ET 2391- OE III: MICROCONTROLLER & EMBEDDED SYSTEMS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	The 8051 Microcontroller and Embedded systems using assembly & C	2nd edition	by Muhammad Ali Mazidi	Pearson Education Asia LPE
2	Programming and Customizing the 8051 Microcontroller		By MykePredko	McGraw-Hill
3	The 8051 Microcontroller	3rd edition	By Kenneth Ayala	CENGAGE Learning
4	Arduino Development Cookbook		Cornel Amariei	PACKT Publishing

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets	Douglas V Hall	Tata McGraw Hill	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets
2	Microprocessor & Interfacing	A. K. Ray, K. M. Bhurchandi.	Tata McGraw Hill	Microprocessor & Interfacing

VI Semester

ET 2392–OE III: PRINCIPLES OF COMMUNICATION ENGINEERING

Course Learning Objectives	Course Outcomes
The student should be able to 1) Understand various modulation and demodulation techniques of analog and digital modulation. 2) Describe and determine the performance of different error control coding schemes for the reliable transmission of digital representation of signals and information over the channel. 3) Understand various multiple access techniques in wire and wireless communication 4) To learn the basic of satellite communication and elements of optical fiber transmission	**The student will be able to** 1. Describe analog and digital communication systems and various modulation schemes. 2. Analyze error correcting codes, including block codes. 3. Illustrate multiple access techniques in wired and wireless communication. 4. Discuss the different applications of satellite communication and optical communications

Unit No.	Contents	Max. Hrs.
1	**ANALOG COMMUNICATION** Introduction to Communication Systems; Noise, Types of noise, sources of noise; Need for modulation, AM-Time domain representation, Frequency spectrum, power relations, DSB/SC, SSB Angle modulation**.**	6
2	**DIGITAL COMMUNICATION** Introduction Digital Communication System; Pulse modulations – concepts of sampling and sampling theorems, PAM, PWM, PPM; Waveform coding Techniques: Pulse code Modulation (PCM), Delta Modulation, Adaptive Delta modulation.	6
3	**Digital Modulation** Data formats; Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Phase Shift Keying (PSK) – BPSK – QPSK– Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM ; Bandwidth Efficiency; Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).	6
4	**SOURCE CODES, LINE CODES & ERROR CONTROL** Entropy, Properties of entropy; source coding: Huffman coding**;** error control codes and applications: convolutions & block codes.	6
5	**MULTIPLE ACCESS TECHNIQUES** FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits)	6
6	**SATELLITE, OPTICAL FIBER – POWERLINE, SCADA** types of satellites , frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat; fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications SCADA**,** New topic to be announced time to time	6

VI Semester
ET 2392–OE III: PRINCIPLES OF COMMUNICATION ENGINEERING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Principles of Communication Systems	2007	Taub &Schiling	Tata McGraw Hill
2	Principles of Digital Communication	1986	J.Das	New Age International

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Electronic Communication Systems	4th Edition, 1993	Kennedy and Davis	Tata McGraw hill
2	Digital Communication Fundamentals and Applications	2001	Sklar	Pearson Education
3	Digital Communication	2004.	Bary le, Memuschmidt	Kluwer Publication

VI Semester

ET 2393–OE III: FUNDAMENTALS OF IMAGE PROCESSING

Course Learning Objectives	Course Outcomes
The student should be able to 1) Learn the fundamentals of digital image processing algorithms. 2) Learn the algorithms of spatial and frequency domain filtering. 3) Learn segmentation of digital images through various algorithms 4) Learn representation and recognition of digital images through various algorithms	**The student will be able to** 1) Examine the concepts of image enhancement, segmentation, representation and recognition 2) Apply basic image processing algorithms and filtering techniques for image enhancement. 3) Apply the algorithms for image segmentation 4) Apply the techniques for image representation and recognition

Unit No.	Contents	Max. Hrs.
1	**Introduction** Origin of Digital Image processing, Fundamental Steps in image processing, Component of Image processing system, Sampling and quantization, Interpolation Techniques, Geometric transformation, Concept of gray levels, Relationship between pixels, Applications of Image Processing.	6
2	**Intensity Transformations** Background, Basic intensity transformation techniques: Image negative, log transformation, power law transformation, piecewise linear transformation, Histogram processing: Histogram Equalization, Histogram Matching, Local histogram processing.	6
3	**Spatial and Frequency Domain Filtering** Mechanics of Spatial filtering, Smoothing spatial filters: Linear and Order statistic filters, Sharpening filters: Foundation, Laplacian and Gradient, Filtering in frequency domain	6
4	**Image Segmentation** Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region based segmentation.	6
5	**Representation and Description** Representation, Boundary Descriptors, Regional Descriptor	6
6	**Object Recognition** Patterns and Pattern Classes, Recognition based on decision Theoretic Methods, Structural Methods, **New topic to be announced time to time**	6

VI Semester

ET 2393–OE III: FUNDAMENTALS OF IMAGE PROCESSING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Digital Image Processing	2nd edition	R.C. Gonzalez & R.E. Woods	Addison Wesley/Pearson education publication 2002.
2	Digital Image Processing	4th edition	William K. Pratt	A John Wiley & Sons, Inc., Publication

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Digital Image Processing		Anil K. Jain	PHI
2	Digital Image Processing		S. Jayaraman, S. sakkirajan, T Veerakumar	McGraw-Hill

VI Semester
ET2394 – OEIII: Fundamentals of Internet of Things

Course Outcomes:		
Upon successful completion of the course the students will be able to 1. Explore the physical and Logical design of IoT. 2. Explore the M2M and NETCONF. 3. Explore python programming. 4. Apply basic skills of IoT to solve real life problems. 5. Illustrate IoT Security		
Unit:1	**Introduction & Concepts:**	**5 Hours**
UNIT-1: Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels **Contemporary Issues related to Topic**		
Unit:2	**Sensing & Actuation**	**6 Hours**
Introduction to sensors & transducers, Introduction to electrodes & biosensors, Static and dynamic characteristics of sensors, Different types of sensors, Selection criteria's for sensors / transducers, Commercial IoT sensors / transducers, Signal conditioning modules of IoT system , Energy and power considerations, Introduction to actuators, Different types of actuators, Interfacing challenges, Modules of data acquisition system **Contemporary Issues related to Topic**		
Unit:3	**M2M & System Management with NETCONF-YANG**	**7 Hours**
M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG **Contemporary Issues related to Topic**		
Unit:4	**Developing Internet of Things & Logical Design using Python**	**7 Hours**
Introduction, IOT Design Methodology, Python Data Types & Data Structures, Control Flow, Functions , File Handling, Date/ Time Operations, IoT Device-Raspberry Pi, Programming Raspberry pi with Python **Contemporary Issues related to Topic**		
Unit:5	**IoT Security**	**7 Hours**
Effect of security threats on user, authentication using OTP validation, Security Requirements for the Internet of Secure Things, Secure Solutions, Secure Framework of the IoT Related to Perceptual Layer, Challenges in IoT Security **Contemporary Issues related to Topic**		

Unit :6	Domain Specific IOTs	7 Hours
Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style. **Contemporary Issues related to Topic**		
Total Lecture Hours		**39 Hours**

Textbooks	
1	Arshdeep Bahga and Vijay Madisetti , "Internet of Things, a hands on approach" , Universities Press (India)Pvt. Ltd. 2017, ISBN: 978-81-7371-954-7.
Reference Books	
1	Internet of Things : Technologies, Applications, Challenges and Solution B.K.Tripathy & J.Anuradha by CRC press publication
2	From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence: By Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 1 st Edition, Academic Press, 2014.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	
MOOCs Links and additional reading, learning, video material	
1	https://archive.nptel.ac.in/courses/106/105/106105166/
2	https://onlinecourses.nptel.ac.in/noc21_ee85/preview

VI Semester

ET 2396–OE IV: SOFT COMPUTING

Course Learning Objectives	Course Outcomes
The student should be able to 1) Familiarize with soft computing concepts. 2) Learn the concepts of Genetic algorithm 3) Learn the concepts of Fuzzy Logic and Neural networks	**The student will be able to** 1) Examine genetic algorithms, fuzzy logic and neural network techniques 2) Apply genetic operators and genetic algorithms for problem solving 3) Apply Neural Network algorithms in pattern recognition 4) Apply fuzzy logic to solve engineering problems

Unit No.	Contents	Max. Hrs.
1	**Genetic Algorithm** Basic terminologies used in Genetic Algorithm, Simple GA, General Genetic Algorithm, Encoding, Selection, Crossover, Mutation, Stopping Condition for GA, Constraint in GA	6
2	**Neural Networks** Biological Neurons and Their Artificial Models, Models of Artificial Neural Networks, Learning Methods, Activation Functions, McCulloch-Pitts Neuron Model, Neural Network Learning Rules, Application of NN	6
3	**Supervised Learning** Single Layer Perceptron, Back propagation algorithm, Associative Memory.	6
4	**Unsupervised Learning** Hamming and Max net, Competitive Learning, self-organizing feature maps, ART Networks, RBF	6
5	**Fuzzy Sets and Operations** Concepts of Fuzzy sets, extension principle Operation on fuzzy sets, Fuzzy numbers, arithmetic operations, Lattice, fuzzy equations	6
6	**Fuzzy logic and Systems** Fuzzy relations Fuzzy Logic, Approximate Reasoning, Fuzzy controllers, Defuzzification Methods, Fuzzy Inference Techniques, Applications, **New topic to be announced time to time**	6

VI Semester

ET 2396–OE IV: SOFT COMPUTING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fuzzy sets and Fuzzy logic	1995	By George Klir, Bo Yuan	PHI
2	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications	2003	By S. Rajsekharan, VijayalaxmiPai	PHI
3	Elements of Artificial Neural Network	1997	By K. Mehrotra	MIT Cognet

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Neural Networks, a comprehensive foundation	1999	By Simon Haykins	PHI
2	Artificial Neural Networks	2004	By B. Yegnanarayana	PHI
3	Fuzzy Logic & Applications	2003	By T. Ross	McGraw Hill
4	Soft Computing,	2011	Sivanandanam and Deepa	Wiley

VI Semester

ET 2397–OE IV: INDUSTRIAL INSTRUMENTATION

Course Learning Objectives	Course Outcomes
The student should be able to 1) Study the characteristics of Instruments. 2) Understand the Concepts of Pressure measurements and its calibration process 3) Understand the working principle of various active &passive temperature transducers. 4) Learn the working principle of various flow transducers. 5) Learn the working principle of various transducers like level, thickness speed, ph value etc. 6) Learn automation system components.	**The student will be able to** 1) Explain instrumentation system 2) Analyze pressure, temperature, parameters measured using transducers 3) Analyze flow, speed and level parameters measured using transducers 4) Elaborate automation system components.

Unit No.	Contents	Max. Hrs.
1	**INTRODUCTION** Block diagram of instrumentation system, static and dynamic characteristics of instruments, functions of instruments, Definition of Transducers- Role of transducers in instrumentation- Advantages of electrical transducers – Classification of transducers- Analog and Digital, Active and passive, Primary and Secondary transducers- Inverse transducer-Sensitivity and specification for transducers - Characteristics and Choice of transducer-Factors influencing choice of transducer. Need of transducers, Classification, selection criteria. Calibration Process.	6
2	**PRESSURE MEASUREMENT** Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms– Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezoresistive pressure sensor –Testing and calibration of pressure gauges – Dead weight tester.	6
3	**TEMPARATURE MEASUREMENT 1** Different types of filled in system thermometer , Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – Three lead and four lead RTDs.	6
4	**TEMPARATURE MEASUREMENT2: THERMOCOUPLES AND PYROMETERS** Thermocouples – Laws of thermocouple – Signal conditioning of thermocouples output –cold junction compensation –Response of thermocouple, Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two color radiation pyrometers.	6
5	**FLOWMETERS** Variable head type flow meters: – Orifice plate – Venturi tube – Pitot tube. Area flow meter: – Rotameter, Principle and constructional details of electromagnetic flow meter – Ultrasonic flowmeters flow measurements for gases	6
6	**MISCELLANEOUS MEASUREMENT** Electrical level gauge: – Resistive , Ultrasonic type, Radar type ,Speed measurement -D.C and A.C Tacho generators ,rotary encoder, Proximity sensors- Inductive and capacitive, Introduction to PLC, SCADA. **New topic to be announced time to time**	6

VI Semester

ET 2397–OE IV: INDUSTRIAL INSTRUMENTATION

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Industrial Instrumentation and Control	2003	S.K. Singh	Tata McGraw Hill, 2003.
2	Transducers and Instrumentation		D V S Murthy	prentice Hall of India Pvt. Ltd., New Delhi
3	Electrical and Electronic Measurements AND Instrumentation		A. K. Sawhney	Dhanpat Rai &Co

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Principles of Industrial Instrumentation ata		D. Patranabis T	McGraw Hill Publishing Company Ltd, 1996.
2	Programming for Industrial Automation		Kevin Collins	
3	Instrumentation Measurement & Analysis	2004.	B.C. Nakra & K.K.Chaudary	Tata McGraw Hill Publishing Ltd
4	Measurement Systems – Application and Design	2003	E.O. Doebelin	Tata McGraw Hill publishing company
5	Industrial Instrumentation		D.P. Eckman	Wiley Eastern Ltd.

VI Semester

ET 2398–OE IV: MEDICAL ELECTRONICS

Course Learning Objectives	Course Outcomes
The student should be able to 1) Know the physiology of heart , brain and skin, Understand the basic principles of physical parameters 2) Comprehend the working principles of measuring, monitoring and recording instruments. 3) Know the physical concepts of radiography related to X rays 4) Learn working principles of advanced medical imaging system	**The student will be able to** 1) Elaborate basic physiological systems of human body 2) Explain the physiological parameter measurement techniques. 3) Explain the working of measuring and recording instruments for physiological parameters. 4) Elaborate the working principles of modern imaging systems

Unit No.	Contents	Max. Hrs.
1	Cell as bio electric generator: Introduction of man instrumentation system, Heart and Circulatory system, Components of man instrumentation system , Brain and nervous system, Physiological system of the body.	6
2	**Physiological parameter Measurement:** Blood pressure and Flow, Heart rate and Heart sounds, Characteristics of blood flow, Respiration and Temperature	6
3	**Recording Instrumentation:** Electrodes, basic instrumentation, Electrocardiograph, Electroencephalograph, ,Electromyograph, Phonocardiograph	6
4	**Measuring Instrumentation:** Transducers, Blood Pressure, Blood flow and Pulse oximeters, Heart rate respiration rate and temperature meters, Audiometer and hearing Aid	6
5	**X-rays:** X-ray Physics, Fluoroscopy and radiography, X-ray tubes and X-ray Equipments, Biomedical computer application	6
6	**Advanced Imaging System:** Ultrasonic scanner, CT scan, MRI, Endoscope and Measurement of blood flow and cardiac Output **New topic to be announced time to time**	6

VI Semester

ET 2398–OE IV: MEDICAL ELECTRONICS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Medical Electronics	2003	Patil A. G	ISTE Excel book
2	Biomedical Instrumentation and Measurements	Second edition 2004	Leslie Cromweel, Fred J. Weibell, Erich A.	PHI

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Handbook of Biomedical Instrumentation	New Delhi, 2003.	Khandpur, R.S	TATA McGraw Hill
2	Introduction to Biomedical equipment Technology	New York,2004	Joseph J.Carr and John M.Brown	John Wiley and Sons

VI Semester

ET 2399–OE IV: DISPLAY TECHNOLOGY & APPLICATIONS

Course Learning Objectives	Course Outcomes
The student should be able to 1) To learn fundamental concepts of different display technologies related to manufacturing techniques and materials used for FPD selection. 2) To explore electrical, optical and physical specifications required for display technologies 3) To understand different displays and addressing of displays 4) To learn backplane technology and driver integration 5) To identify and comprehend materials and applications of display	**The student will be able to** 1) Identify different display technologies and manufacturing process. 2) Analyze characteristics of display devices and Luminescence materials. 3) Analyze addressing matrix, TFT backplane and backlight unit technologies. 4) Elaborate advanced display devices and Materials .

Unit No.	Contents	Max. Hrs.
1	Overview of display technologies, emmisive-nonemmisive displays, information capacity of displays, introduction to different flat panel display technologies, Display specifications, display manufacturing process overview	6
2	Characterization and performance of displays: Concepts of aspect ratio, color gamut, contrast and gradation, directional visibility, memory and storage, resolution, addressability, Fundamentals of Photometry, Colorimetry, CIE colorimetry	6
3	Luminescence and luminescent materials: Physical processes and interactions leading to emission of light, Mechanisms of Electron and Hole Recombination in Semiconductors, Recombination Rates of Excess Carriers and Excess-Carrier Lifetimes, Basics of matrix addressing of displays: active and passive matrix.	6
4	Technical discussion of display technologies: TFT, LEDs, OLEDs, LCDs, Active matrix TFT backplanes for OLED and LCD displays. Other displays and associated technologies.	6
5	Advanced TFT Backplane Technologies (IGZO, LTPS, etc.) and Driver Integration. Back Light Unit Technologies (CCFL, LED, QD, etc.)	6
6	Future and New Applications of Displays. Materials for Display – TFT, EL and LC Materials and Modes New topic to be announced time to time	6

VI Semester

ET 2399–OE IV: DISPLAY TECHNOLOGY & APPLICATIONS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Flat Panel Displays	2008	Jiun-Haw Lee, David N. Liu, Shin-Tson Wu	Wiley publications
2	Fundamentals of Solid-State Lighting: LEDs, OLEDs, and Their Applications in Illumination and Displays	2014	Vinod Kumar Khanna	CRC press

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Liquid crystal displays: fundamental physics and technology.	2011	R. H. Chen	John Wiley and Sons
2	Liquid crystal flat panel displays: manufacturing science & technology.	2012	W. Mara	Springer, Science & Business Media,

VI Semester

ET2400–OE IV: PLCs and SCADA

Course Learning Objectives	Course Outcomes
Students should be able to 1) Understand the fundamentals of Automation and their applications, systems used in industry such as PLC, Memory devices, Input /Output system and Relays. 2) Learn PLC and SCADA programs for industrial automation. 3) Understand the concepts of HMI & SCADA 4) Understand the concepts in distributed control systems	**Students will be able to** 1) Explain the basic building blocks of Programmable logic controller 2) Develop PLC and SCADA programs for industrial automation. 3) Illustrate the concepts involved in HMI & SCADA 4) Elaborate the concepts in distributed control systems

Unit No.	Contents	Max. Hrs.
1	**Introduction to Programmable Controllers** Definition , A Historical Background , Principles of Operation , PLCs Versus Other Types of Controls , PLC Product Application Ranges, Advantages of PLCs, PLC Sizes and Scopes of Applications, Overview of PLC System	6
2	**Introduction to Programming Languages** Types of PLC Languages, Ladder Diagram Format, Ladder Relay Instructions, Ladder Relay Programming, IEC 1131-3 Programming Languages – FBD/ST/IL/SFC **Programming Instructions** NO-NC & coil based instructions (Relay based Instructions), Timers, Counters, Compare, Mathematics, Jump and Subroutines	6
3	**Introduction to SCADA** Introduction and brief history of SCADA, Fundamental principles of modern SCADA systems, the components of a SCADA system, Types of SCADA **SCADA Programming** Graphics Building & Simulation, Tag types & Management, Tools, Programming techniques, Alarms & Trends Configuration, Screen Navigation	6
4	**Introduction to HMI** FOUNDATIONS OF HMI: The Human: History of User Interface Designing, Types, Features, General architecture , Conventional & current HMI systems, Difference between HMI & SCADA, HMI Hardware interfaces, Practical uses in Industries.	6
5	**Data comparison instructions & PLC sequencers** Data comparison instructions such as EQU, LES, and GRT, Introduction to the principles of Data Transfer, Move Instruction, Introduction to Shift Registers & Its types. Purpose and application of PLC Sequencers, Masking techniques and the various types of Sequencers, SQO and SQC instructions.	6
6	**Distributed Control System**: Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.	6

VI Semester

ET2400–OE IV: PLCs and SCADA

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Programmable Logic controllers		Gary Duning	Delmar Thomson Learning
2	SCADA: Supervisory Control and Data Acquisition	Fourth Edition	Stuart A Boyer	ISA 1999
3.	Programmable Logic Controllers	Fifth Edition	Frank Petruzella	McGraw-Hill Education

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Programmable logic controller		W. Bolton	Elsevier Publisher

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2020
7th & 8th Semester
Electronics & Telecommunication Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. ET-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	ET2401	RF & Microwave	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	ET2402	Lab: RF & Microwave	**P**	0	0	2	2	1		60	40	
3	7	PC	ET2403	Digital Communication	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PC	ET2404	Lab: Digital Communication	**P**	0	0	2	2	1		60	40	
5	7	PE		Professional Elective III	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		Professional Elective IV	**T**	3	0	0	3	3	30	20	50	3 Hours
7	7	PE		Professional Elective V	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	PE		Professional Elective VI	**T**	3	0	0	3	3	30	20	50	3 Hours
9	7	STR	ET2409	Mini Project	**P**	0	0	4	4	2		60	40	
10	7	STR	ET2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
				TOTAL SEVENTH SEM		**18**	**0**	**8**	**26**	**24**				

Professional Electives -III

1	7	PE	ET2411	PE III : Power Electronics
2	7	PE	ET2412	PE III : Data Compression & Encryption
3	7	PE	ET2413	PE III : Analog VLSI
4	7	PE	ET2414	PE III : Error Correcting Codes
5	7	PE	ET2415	PE III : Wireless Mobile Communication Systems

Professional Electives -IV

6	7	PE	ET2421	PE IV : Satellite Communication & RADAR Engineering
7	7	PE	ET2422	PE IV : Embedded System
8	7	PE	ET2423	PE IV : Switching Theory
9	7	PE	ET2424	PE IV : Topics in Machine Learning
10	7	PE	ET2425	PE IV : Multimedia Communications

Professional Electives -V

11	7	PE	ET2431	PE V : Display Technology
12	7	PE	ET2432	PE V : Biomedical Instrumentation
13	7	PE	ET2433	PE V : Fuzzy Logic & Neural Network
14	7	PE	ET2434	PE V : Wireless Sensor Networks
15	7	PE	ET2435	PE V : RF Circuit Design

Professional Electives -VI

16	7	PE	ET2441	PE VI : CMOS VLSI Design
17	7	PE	ET2442	PE VI : Digital Image Analysis for Remote Sensing
18	7	PE	ET2443	PE VI : Microwave Integrated circuits
19	7	PE	ET2444	PE VI : Communication Networks
20	7	PE	ET2445	PE VI : Computer Architecture and Organization
21	7	PE	ET2446	PE VI : PLCs & SCADA

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. ET-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Electronics & Telecommunication Engineering

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	ET2451	Major Project	**P**	0	0	12	12	9		60	40	
2	8	STR	ET2452	Extra curricular Activity Evaluation	**P**	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**84**	**3**	**44**	**131**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

VII Semester
ET2401–RF & Microwave

Course Objective	Course Outcome
Students should be able to 1) Know various resonant and non resonant microwave power generators. 2) Study the concept of scattering matrix. 3) Understand working of various microwave passive devices 4) Know the various microwave measurement techniques. 5) Learn the working principle of microwave solid state devices	Students will be able to 1) Discuss the working and analyze the behavior of linear beam and cross field tubes. 2) Apply s-parameters to model and analyze output response of microwave transmission lines. 3) Analyze behavior of different passive components using s-matrix. 4) Measure performance parameters of microwave devices. 5) Explore various microwave solid state devices.

UNIT 1:
High frequency limitations of conventional vacuum tubes, Two cavity Klystron, Reflex Klystron – Mechanism and mode of Operation, Applegate diagram, Power output and efficiency, applications, Introduction to multicavity Klystron

(07 Hours)

UNIT2:
Travelling wave tube, Backward wave oscillator – working principles, characteristics.

Magnetron Oscillator – Hull cut-off voltage, Mechanism of Operation, Mode separation, Phase focusing effect, Tuning of magnetron, Applications

(07 Hours)

UNIT 3:
Introduction, scattering matrix representation of multi-port networks, Inter relationship between [S], [Z] and [Y] matrices, properties of scattering matrix. Scattering matrix of transmission lines, ABCD parameters.

(06 Hours)

UNIT 4:
Wave guide Tees - E plane Tee, H plane Tee, Magic Tee and their applications, Directional couplers, Attenuators, Isolators, Gyrators, Circulators, Scattering Matrix Derivation for all components

(06 Hours)

Unit 5:
Introduction, Power sensitive elements, Low and High power measurement, Attenuation measurement, VSWR measurement – Low and High VSWR, Impedance measurement, Frequency measurement, Measurement of cavity Q, Methods of Microwave filters design

(06 Hours)

Unit 6:

Microwave diodes – Gunn diode – Mode of operation, Crystal diode, PIN diode, IMPATT diodes, Varactor diode, Parametric amplifier, Microwave transistors, Introduction to planar transmission lines, new topic to be announced time to time

(07 Hours)

VII Semester
ET2401–RF & Microwave

Text books:				
1	Microwave Devices and Circuits	Samuel Y. Liao	3rd edition	Pearson Education
2	Foundations for Microwave Engineering	Robert E. Collin	2nd edition	McGraw Hill

Reference books:				
1	Microwave Engineering	Annapurna Das, Sisir K. Das		McGraw Hill

VII Semester
ET 2402 – Lab: RF & Microwave

Course Objective	Course Outcome
Students should be able to 1) Know various resonant and non resonant microwave power generators. 2) Study the concept of scattering matrix. 3) Understand working of various microwave passive devices 4) Know the various microwave measurement techniques. 5) Learn the working principle of microwave solid state devices	Students will be able to 1) Discuss the working and analyze the behavior of linear beam and cross field tubes. 2) Apply s-parameters to model and analyze output response of microwave transmission lines. 3) Analyze behavior of different passive components using s-matrix. 4) Measure performance parameters of microwave devices. 5) Explore various microwave solid state devices.

Expt. No.	Name of Experiment	COs
1.	To determine frequency of reflex klystron & determine its electronic tuning range	CO1
2.	To verify power Vsrepellar voltage characteristics of Reflex Klystron.	CO1
3.	To verify frequency Vsrepellar voltage characteristics of Reflex Klystron.	CO1
4.	To verify performance of waveguide tees- E-Plane tee & H-plane Tee.	CO3
5.	To verify performance of E-H plane tee (Magic Tee)	CO3
6.	To verify performance of Directional Coupler.	CO3
7.	To verify performance of Cross-hole Coupler.	CO3
8.	To verify performance of 3-port circulator	CO3
9.	To verify performance of isolator.	CO3
10.	To find relationship between Cut-off wavelength, free space wavelength & guide wavelength using slotted line section	CO 4
11.	To verify V-I characteristics of Gunn diode.	CO 5

VII Semester
ET2403 – Digital Communication

Prerequisites	**----------**
Course Objective Students should be able to 1)Understand various source coding techniques. 2) Understand signal space concepts. 3)Understand the key modules of digital communication systems with emphasis on digital modulation techniques. 4) Learn different channel coding techniques 5) Understand the concept of spread spectrum modulation, its types and applications.	**Course Outcome** Students will be able to 1) Compare different source coding techniques. 2) Describe and analyze signal space concepts. 3) Distinguish various digital modulation techniques. 4) Describe & compare different channel coding techniques 5) Apply spread spectrum modulation for various applications of communication systems.

UNIT-1 Analog source coding

Review of Random variables, PDFs & CDFs, Central limit Theorem. Model of digital communication system, PCM, DM, ADM, ADPCM, sub-band and transform coding, model based speech coding like LP coding, CELP coding.

(06 Hours)

UNIT-2: Digital source coding

Introduction to information theory, channel capacity, Huffman, L-Z encoding algorithm. Rate distortion theory for optimum quantization.

(06 Hours)

UNIT-3: signal space concept

Gram-Schmitt procedure, Signal space representation of modulated signals, Error probability and optimum receivers for AWGN channels, Matched filters.

(06 Hours)

UNIT 4: Digital modulation methods

PSK, FSK, QPSK, MSK, GMSK, MPSK, OFDM

(06 Hours)

Unit 5: channel coding techniques

Introduction to Galois field, Construction of Galois field GF (2 m) & its basic properties. Review of channel coding, Linear block codes, cyclic codes, convolution, encoding and decoding, distance properties, Viterbi algorithm Turbo code, Reed Solomon code

(06 Hours)

Unit 6: Spread Spectrum

Study of PN sequences, direct sequence methods, Frequency hop methods, digital spread spectrum, slow and fast frequency hop, synchronization methods for spread spectrum, application of spread spectrum

(06 Hours)

VII Semester
ET2403 – Digital Communication

Text books:				
1.	Digital communication	4th edition Date:2005	John G Prokis	TMG
2.	Digital communication	3rd edition August 2007	Simon Haykin	WEP

Reference books:				
1.	Modern Communication systems (Principles and application)	1st edition Publication: 1994	Leon W. Couch II	PHI
2.	Digital Communication	1st edition.	Shanmugham	CBS Publisher
3.	Modern Digital & Analog Communication Systems	4th edition Date: 2009	B.P.Lathi	Oxford Univ Pr Publication
4.	Principles of Communication Systems	2nd edition Pub Date: SEP-07	Taub Schilling	Publisher: Prentice Hall

VII Semester
ET2404 – Lab: Digital Communication

Course Objective	**Course Outcome**
Students should be able to 1) Understand various source coding techniques. 2) Understand signal space concepts. 3) Understand the key modules of digital communication systems with emphasis on digital modulation techniques. 4) Learn different channel coding techniques 5) Understand the concept of spread spectrum modulation, its types and applications.	Students will be able to 1) Compare different source coding techniques. 2) Describe and analyze signal space concepts. 3) Distinguish various digital modulation techniques. 4) Describe & compare different channel coding techniques 5) Apply spread spectrum modulation for various applications of communication systems.

Expt. No.	Name of Experiment	COs
12.	Sampling & reconstruction	
13.	Linear PCM system	
14.	Differential PCM system	
15.	Delta Modulation system	
16.	Adaptive Delta Modulation system	
17.	Companded PCM (A law & μ law)	
18.	Data formatting	
19.	Shift Keying Techniques- ASK & FSK	
20.	QPSK & BPSK	

VII Semester
ET 2411 – Power Electronics

Prerequisites	**----------**
Course Objective Students should be able to 1. Understand the characteristics of different power electronics switches and selection of components for different applications, 2. Learn different types of power devices 3. Understand the switching behaviour of power electronics circuits such as DC/DC converters. 4. Learn the role of different type of inverters.	**Course Outcome** Students will be able to 1. Analyze and design Power semiconductor devices. 2. Analyze and design DC/DC converter and Cyclo-converters. 3. Analyze and design inverter circuits. 4 .Apply the knowledge of power electronics to solve real Life problems.

UNIT I: Power semiconductor devices (part A)
Power Semiconductor Diodes, classification, reverse recovery Characteristics, series and shunt connection of power diodes, Power Transistors, Switching characteristics of power transistor, Base drive control. **06Hrs**

UNIT II : Power semiconductor devices(part B)

Power MOSFETs, IGBT, Silicon controlled rectifier(SCR), dynamic Turn ON and Turn OFF characteristics of SCR, Diac, Triac. **06Hrs**

UNIT III : AC –DC Converter
Commutation methods of SCR, Single phase half wave and full wave Controlled Rectifier with resistive and inductive load, **06Hrs**

UNIT IV: DC-DC Converters (Chopper**)** Step up, step down Choppers, design of choppers AC Voltage Controllers. Principle of ON-OFF control, Phase control, single phase cyclo-converter
06Hrs

UNIT V : DC –AC Converter
Inverters—Series resonant inverters, Modified series inverter, parallel inverter, single phase bride inverter, current source inverter, Three phase bridge Inverter: 120 degree and 180 degree mode, design of inverter. **06Hrs**

UNIT VI:
Solar converter, buck converter, boost converter, Cuk converter, Design of Gate Drive circuits for SCR, SCR protection circuits, design of snubber circuit, Introduction to AC and DC drives. **06Hrs**

VII Semester
ET 2411 – Power Electronics

Text books:				
1	Power Electronics:Circuits,Devices and Applications	Fourth Edition	Muhammad H. Rashid	Academic press
2	Power Electronics	Second Edition 2008	M. D. Singh,K. B. Khanchandani	TATA McGraw-Hill
3	Industrial and power electronics	Third Edition 2007	Deodatta Y. Shinare	Electrotech Publication
4	Power Electronics and its application	Second Edition, 2004	Alok Jain	Penram International Publishing Pvt Ltd

Reference books:				
1	Power Electronics	Third Edition 2012	Ned Mohan	John Wiley & sons
2	Fundamentals of power electronics	Third Edition 2020	Erickson, Robert W., Maksimovic , Dragan	

VII Semester
ET2412 – PE III: Data compression and encryption

Course Objective	Course Outcome
Students should be able to 1. Understand text, audio and video compression techniques. 2. Understand data security issues 3. Understand Symmetric and Asymmetric Key Cryptography schemes. 4. Understand network security.	Students will be able to 1. Implement text, audio and video compression techniques. 2. Describe data security issues 3. Implement Symmetric and Asymmetric Key Cryptography schemes. 4. Describe network security issues.

Unit 1.Introduction to Data Compression

Data Compression : Modelling and Coding, Statstical Modelling, Dictionary Schemes, LZ, Lossy Compression Shannon – Fano Algorithm, Huffman Algorithm, Adaptive Huffman Coding

Difficulties in Huffman Coding, Arithmetic Coding – Decoding, Dictionary Based Compression, Sliding Window Compression: LZ-77, LZ-78, LZW **(6 hours)**

Unit2. Image Compression

DCT, JPEG, JPEG – LS, Differential Lossless Compression, DPCM, JPEG – 2000 Standards **(6 hours)**

Unit 3.Video and Audio Compression

Analog Video, Digital Video, MPEG – 2, H – 261 Encoder and Decoder Sound, Digital Audio, μ-Law and A-Law Companding, MPEG – 1 Audio Layer (MP3 Audio Format) **(6 hours**)

Unit 4. Data Security

Security Goals, Cryptographic Attacks, Techniques Symmetric Key: Substitution Cipher, Transposition Cipher , Stream and Block Cipher DES, AES **(6 hours)**

Unit 5. Number Theory and Asymmetric Key Cryptography

Prime Numbers, Fermat's and Euler's Theorem, Chinese Remainder Theorem, Discreet Logarithms

Principles of Public Key Crypto System, RSA Key Management, Deffie-Hellman Key Exchange

Message Integrity, Message Authentication and Hash Functions, SHA, H MAC, Digital Signature Standards **(6 hours)**

Unit 6. Network Security

Email, PGP, S/MIME, Intrusion Detection System Web Security Considerations, SSL Architecture, SSL Message Formats, TLS, Secure Electronic Transactions Kerberos, X.509 Authentication Service, Public Key Infrastructure **(6 hours)**

VII Semester
ET2412 – PE III: Data compression and encryption

Text books:				
1	The Data Compression Book	Mark Nelson, Jean-Loup Gailly	2nd edition	BPB Publications
2	Cryptography and Network Security Principles and Practices	William Stallings	5th Edition	Pearson Education.
3	Introduction to Data Compression		2nd edition	Morgan Kaufmann

Reference books:				
1	Cryptography and Network Security, Tata McGraw-Hill.	BehrouzA. Forouzan	2nd edition	Tata McGraw-Hill.

VII Semester
ET 2413 –PE III :Analog VLSI Design

Prerequisites	**----------**
Course Objective Students should be able to 1. Understand the concept and basics of small signal model of MOS transistor &Perform analysis of single stage amplifiers with or without load 2. Understand small signal parameters of Differential Amplifier. 3. Understand current mirrors as bias element and single stage amplifiers in frequency domain 4. Study Performance parameters of CMOS op amp	**Course Outcome** Students will be able to 1. Analyze small signal model of MOS transistor &Perform analysis of single stage amplifiers with or without load. 2. Analyze small signal parameters of Differential Amplifier. 3. Analyze Performance parameters of CMOS op amp. 4. Analyze Performance parameters of converters.

UNIT-1 Basic MOS Device Physics

Threshold voltage, Derivation of I/V characteristics, second order effects, MOS device capacitance, MOS small signal models, MOS SPICE models

(06 Hours)

UNIT-2: Single stage amplifiers

Basic concept, common source, common source stage with resistive load, CS stage with source degeneration, source follower, common gate. **(06 Hours)**

UNIT-3: Differential amplifiers

Single ended & differential operation, Basic differential pair, qualitative and quantitative analysis, Common mode response.

(06 Hours)

UNIT 4: Operational amplifiers

Performance parameters, one stage op amp, Gain boosting, Noise in op amp

(06 Hours)

Unit 5: ADC converter and DAC converter

Converting Analog Signals to Digital Signals, Sample-and-Hold (S/H) Characteristics, Digital-to-Analog Converter (DAC) Specifications, Analog-to-Digital Converter (ADC) Specifications. **(06 Hours)**

Unit 6: Sigma Delta Converter

The Oversampling ADC, The First-Order **Sigma Delta** Modulator , The Higher Order **Sigma Delta** Modulators.

(06 Hours)

VII Semester
ET 2413 –PE III : Analog VLSI Design

Text books:				
1	Design of Analog CMOS Integrated circuits	Ninteenth reprint 2010	BehzadRazavi	Mc-graw-Hill

Reference books:				
1	CMOS circuit design, layout, and Simulation'	Second edition, reprint 2009.	Jacob Baker	WSE
2	CMOS Analog Circuit Design	second edition, 2010	P.E.Allen, D.R.Holdberg	Oxford univ. press
3	Analysis and Design of Analog Integrated Circuits	fifth edition, reprint 2010	Paul B Gray , Hurst , Lewis, Meyer	John Wiley & sons

VII Semester
ET 2414 – PE III: Error Correcting Code

Prerequisites	**----------**
Course Objective Students should be able to 1) Understand the concept and basics of information theory and the basics of source and channel coding/decoding. 2) Understand statistical theory of communication and explain the conventional digital communication system with error control codes like block code, Linear code. 3) Understand the digital electronics and describe the error control codes like Cyclic code, BCH code. 4) Study different error correcting codes in digital communication system	**Course Outcome** Students will be able to 1. Apply the concept and basics of information theory and the basics of source and channel coding/decoding. 2. Apply the knowledge of statistical theory of communication and explain the conventional digital communication system with error control codes like block code, Linear code. 3. Apply the knowledge of digital electronics and describe the error control codes like Cyclic code, BCH code. 4. Demonstrate competence in analyzing and evaluating the practice of different error correcting coded in digital communication system like Convolutional codes.

UNIT-1 : CHANNEL CAPACITY AND CODING

Introduction, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem, The Shannon Limit, Random Selection Of Codes, Hamming Distance, Few Points Of Information Theory. **(06 Hours)**

UNIT-2: BLOCK CODES

The Digital Communication Channel, Introduction To Block Codes, Single Parity Check Codes, Product Codes, Repetition Codes, Hamming Codes, Minimum Distance Of Block Codes, Soft – Decision Decoding, Automatic Repeat Request Schemes **(06 Hours)**

UNIT-3: LINEAR CODES

Definition of Linear Codes, Generator Matrices, The Standard Array, Parity - Check Matrices, Error Syndromes, Error Detection And Correction, Shortened And Extended Linear Codes..

(06 Hours)

UNIT 4: CYCLIC CODES

Definition Of Cyclic Codes, Polynomials, Generator Polynomials, Encoding Cyclic Codes, Decoding Cyclic Codes, Factors Of XN +1, Parity-Check Polynomials, Dual Cyclic Codes, Generator And Parity-Check Matrices Of Cyclic Codes **(06 Hours)**

Unit 5: BCH CODES

Linear Algebra, Galois Field, Definition and Construction of Binary BCH Codes, Error Syndromes In Finite Fields, Decoding SEC and DEC, Reed- Solomen Codes, LDPC codes

(06 Hours)

Unit 6: CONVOLUTION CODES

Convolution, Encoding Convolutional Codes, Generator Matrices For Convolutional Codes, Generator Polynomials For Convolutional Codes, Graphical Representation Of Convolutional Codes, The Viterbi Decoder. Concept Of Interleaver And Puncture Coding, Applications of error control coding

(06 Hours)

VII Semester
ET 2414 – PE III: Error Correcting Code

Text books:				
1	Introduction to Error Cor Codes	Salvatore	1st	Oxford University Press,
2	Error Correction Coding Mathematical Methods and Algorithms	Moon Tood K	, 1st Ed., 2006	Wiley- Interscience
3	Digital Communications - Fundamentals and Applications	Sklar Bernard	2nd Ed., 2009.	Pearson Education-LPE,

Reference books:				
1	Information Theory, Coding and Cryptography	Bose Ranjan	, 1st Ed., 2007.	Tata McGraw-Hill

VII Semester
ET2415– PE III: Wireless Mobile Communication Systems

Prerequisites	Analog and Digital Communications, Digital Signal Processing
Course Objective Students should be able to 1. Study cellular concepts and techniques toimprove capacity in cellular system and Study fundamentals equalization and diversity technique. 2. Understand mobile radio environment and its different parameters. 3. Learn various multiple access system.. 4. Understand the operating principles of various wireless systems & standards. 5. Learn the fundamentals of GSM & wireless networking.	**Course Outcome** Students will be able to 1. Describe various generations of mobile communications and apply the concept of frequency reuse for design of cellular system. 2. Quantify causes and effects of path loss and signal fading on received signal characteristic and used various technique to improve signal quality. 3. Describe various types of equalization and diversity technique & Multiple access techniques for wireless communication.. 4. Analyze GSM & CDMA systems and Understand the fundamentals of wireless networking.

UNIT-1: Introduction to Wireless Communication Systems & Cellular Concept
Evolution of Mobile Radio communication, Cellular telephone system, frequency reuse, channel assignment and handoff strategies, interference and system capacity, trunking and grade of service, improving capacity in cellular system. **(06 Hours)**

UNIT-2: Mobile Radio Propagation
Large & Small Scale Path Loss & Fading: Introduction to Radio Wave Propagation, Reflection, Diffraction, Scattering Practical Link Budget Design Using Path Loss Models Small Scale Multipath Propagation, Parameters of Mobile Multipath Channels, Types of Small Scale Fading, Rayleigh & Rician Distribution. **(06 Hours)**

UNIT-3: Equalization & Diversity
Fundamentals of equalization, Equalizers in communication receiver, Survey of equalizer Technique, space polarization, frequency and time diversity techniques, space diversity, polarization diversity, frequency and time diversity. RAKE Receiver **(06 Hours)**

UNIT 4: Multiple access techniques for wireless communication.
Introduction to Multiple Access, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Spread Spectrum Multiple Access, Code Division Multiple Access (COMA), Hybrid Spread Spectrum Techniques, Space Division Multiple Access (SOMA), Packet Radio, Packet Radio Protocols, Carrier Sense Multiple Access (CSMA) Protocols.

(06 Hours)

UNIT-5: GSM
GSM - global system for mobile: services and features, GSM system architecture, GSM radio subsystem, GSM channel types, GSM frame structure, signal processing in GSM, introduction to CDMA digital cellular standard (IS-95) , Case studies on latest Generation **(06 Hours)**

VII Semester
ET2415– PE III: Wireless Mobile Communication Systems

UNIT-6: Wireless Networking

Introduction to wireless networks, Differences Between Wireless & Fixed Telephone Networks, Development of wireless networks, Traffic routing in wireless networks, Wireless data services, Common channel signaling, Signaling System No7. An Example of SS7, introduction to various generation of mobile communication. Case studies on latest wireless data Networks. (**06 Hours)**.

Text books:				
1	Wireless communication Principles and practice	Second edition 5 January 2018	by T S. Rappaport	(Prentice Hall PTR, upper saddle river, New Jersey.)
2	"Modern Wireless Communications" (Indian Edition)	2011	Haykin & Moher	Pearson (Indian Edition)
Reference books:				
1	Wireless digital communication	1995	by Kamilo Feher	PHI
2	Mobile Communications Design fundamentals	1993	by William C. Y. Lee	John Willey
3	Mobile Cellular Communication	2005	by W .C .Y. Lee	Mc Graw Hill
4	Mobile Radio Propagation channel	1996	by J.D. Pearson	John Willey

VII Semester
ET2421 – PE IV: Satellite Communication & Radar Engineering

Prerequisites	**----------**
Course Objective Students should be able to 1) To understand the satellite system and Propagation on satellite. 2) To understand earth station technology. 3) To make the student understand the principles of Radar and various types of radars 4) To make them understand the RADAR antennas, clutters and Effects of weather on RADAR..	**Course Outcome** Students will be able to 1) Analyze satellite services , satellite system and Propagation on satellite. 2) Describe the Earth station technology. 3) Analyze the RADAR range equation and Doppler principle ,and types of radars 4) Analyze RADAR antennas, Duplexer, clutters and the effects of weather on radar

UNIT-1

Introduction: Origin of Satellite communication, Current state of satellite communication. Orbital aspect of satellite communication: Orbital mechanism, equation of orbit, locating satellite in orbit, orbital elements, and orbital perturbation. Space craft subsystem: Attitude and orbit control system, Telemetry tracking and command power system, and communication subsystem.

(06 Hours)

UNIT-2:

Propagation on satellite: Design aspects of satellite uplink and downlink**,** Earth's path – propagation effects, atmospheric absorption, Scintillation effects, Land and Sea multipath, Rain and ice effects, Rain drop distribution, calculation of attenuation. Rain effects on Antenna noise temperature

(06 Hours)

UNIT-3:

Earth Station technology: Earth Station design; antennas tracking, LNA, HPA, RF multiplexing, factors affecting orbit utilization, tracking, equipment for earth station. Topic on Current trends on satellite communication

(06 Hours)

UNIT 4:

RADAR Range Equation, CW and FM modulated RADAR, MTI and Pulse Doppler RADAR, Tracking RADAR.

(06 Hours)

Unit 5:

RADAR antennas, parabolic reflector, scanning field reflector, Lens antennas. Cassegrain reflector, types of feeds, RADAR Receivers, Displays and Duplexer, Detection of RADAR signals in noise, phase array antenna.

(06 Hours)

Unit 6:

RADAR clutter, Effects of weather on RADAR, Detection of targets in Precipitation, Synthetic Aperture RADAR, HF over the Horizon RADAR.

(06 Hours)

VII Semester
ET2421 – PE IV: Satellite Communication & Radar Engineering

Text books:				
1	**Introduction of RADAR system**	Third edition	**Skolnik**	**McGraw Hill**
2	**Satellite Communication**	Fourth edition	**Dennis Roddy**	

Reference books:				
1	Satellite Communications		Varsha Agrawal Anil	Wiley India Pvt Ltd
2.	Satellite Communication Systems		M. Richharia	Mcgraw-Hill Telecommunications
3.	Radar Systems Principle		Harold R.Raemer	

VII Semester
ET2422- PE IV: Embedded System

Prerequisites	**----------**
Course Objective Students should be able to 1. Study & understand the detailed architectural features of ARM processor. 2. Study instruction set of ARM processor and apply the same for programming 3. Explore the details about LPC 2148 Develop programs in interfacing of different peripherals with NODE MCU ESP8266 4. Understand memory management in ARM and operating system..	**Course Outcome** Students will be able to 1. Explore the architectural features of ARM processors 2. Apply ARM instruction set in developing assembly language programs. 3. Explore Basic embedded C programs for GPIO and interfacing with LPC 2148 and Develop programs in interfacing of different peripherals with NODE MCU ESP8266 4. Acquire knowledge about memory management in ARM and operating system.

UNIT-1 Introduction to embedded system and ARM Processor

Difference between RISC & CISC, Advantages of architectural features of ARM Processor, Processor modes, Register Organization, Exceptions and its handling. 3/5- stage pipeline ARM organization. LPC2148 ARM 7 microcontroller, Features of LPC2148, Block diagram of LPC2148, Pin diagram of LPC2148, Architectural overview, On-chip flash program memory, On-chip RAM.

(06 Hours)

UNIT-2: Memory and memory-mapped I/Os

ARM and THUMB instruction sets, ARM programmer's model, addressing modes, Instruction set in detail and programming, data processing instruction, data transfer instruction, Control flow instructions, simple assembly language programs. **(06 Hours)**

UNIT-3: ARM floating point architecture and DSP extensions

ARM floating point architecture and DSP extensions, ARM co-processors. ARM 9 TDMI ARCHITECTURAL STUDY: - H/W architecture, Timing diagrams for various accesses, Memory buses: AMBA, ASB, & APB. Architectural support for system development **(06 Hours)**

UNIT 4: Basic embedded C programs

Basic embedded C programs for GPIO and interfacing of different devices like LED, LCD, Stepper Motor, Study and programming of on-chip peripherals like timers, counters, on-chip ADC, DAC, Introduction to NODE MCU ESp8266 and ESP 32, NODE MCU ESP8266 Features & Using It with Arduino IDE, NODE MCU ESP8266 Pinout, Power requirement. **(06 Hours)**

Unit 5: memory Management

Memory Hierarchy, memory size and speed, on-chip memory, caches, cache design, memory management (**06 Hours)**

Unit 6: Architectural Support of Operating System

Architectural support for operating system. RTOS issues, The shared Data Problem, Software Architectures (Round Robin, Round Robin with Interrupts, Function Queue Scheduling,) Selecting a software Architecture, Case for Real Time Operating System, Introduction to RTOS :tasks and task states, tasks and data, semaphores and shared data, message queues, mailboxes and pipes, events, RT Linux. **(06 Hours)**

VII Semester
ET2422- PE IV: Embedded System

Text books:				
1	ARM System–on-chip Architecture	2nd edition August 25, 2000	by Steve Furber	Pearson Education Asia
2	Embedded Linux, Hardware, Software and interfacing	2nd Edition 2002	by Craig Hallabaugh	Pearson Education Asia
3	Exploring Arduino: Tools and Techniques for Engineering Wizardry 2nd Edition	2nd Edition October 24, 2019	by Jeremy Blum	Wiley; 2 edition (October 24, 2019)

Reference books:				
1	System Developer's Guide: Designing and Optimizing	Publish Date: 2004	Sloss Andrew N, Symes Dominic, Wright Chris	Morgan Kaufman Publication
2	Arduino: A Technical Reference	Publish Date: May 2016	J. M. Hughes	O'Reilly Media, Inc.

VII Semester
ET 2423 – PE IV: Switching Theory

Course Objective	Course Outcomes
Students should be able to 1) Understand various sequential logic design methods, Analysis of logic circuits and optimization techniques to minimize gate count. 2) Learn fault diagnosis, Threshold logic, analysis and design of sequential machines.	Students will be able to 1) Design and Analyze multilevel logic Network and Threshold logic for nanotechnologies. 2) Analyze testing of combinational circuits, Fault Models 3) Design and analyze the synchronous and asynchronous sequential circuits. 4) Identify and test the sequential machines with experiments.

UNIT-1

Multi-level logic synthesis, Technology-independent synthesis: Factoring, Decomposition, Extraction, Substitution, and Technology mapping: steps in technology mapping **(06 Hours)**

UNIT-2:

Threshold logic for nanotechnologies, threshold elements, synthesis of threshold networks: Unate function, Identification & Realization of threshold function. **(06 Hours)**

UNIT-3:

Testing of combinational circuits, Fault models, Structural testing, IDDQ testing, Delay fault testing, Synthesis for testability, Testing for nanotechnologies. **(06 Hours)**

UNIT 4:

Synchronous sequential circuits and iterative networks, memory elements and their excitation functions, synthesis of synchronous sequential circuits, Moore and Mealy machines, finite state machine flow charts, tables **(06 Hours)**

Unit 5:

State-identification experiments and testing of sequential circuits, Experiments, Homing experiments, Distinguishing experiments, Machine identification, Checking experiments, Built-in self-test (BIST). , New topic to be announced time to time

(06 Hours)

Unit 6

Asynchronous sequential circuits, Modes of operation, Hazards, Synthesis of SIC fundamental-mode circuits. **(06 Hours)**

VII Semester
ET 2423 – PE IV: Switching Theory

Text books:				
1	Switching & Finite Automata Theory	Zvi Kohavi, Niraja K. Jha	Third Edition 2010	Cambridge University Press
2	Fundamentals of Digital Logic With VHDL Design	Stephen Brown	Second Edition, 2007	TMH

Reference books:				
1	Modern Switching Theory and Digital Design	Lee S.C		PHI Edition
2	Digital Logic and Computer Design	M.Morris Mano		PHI Edition

VII Semester
ET 2424 – PE IV: Topics in Machine Learning

Prerequisites	Basic probability and statistics, linear algebra and calculus
Course Objective Students should be able to 1) Understand the concepts of machine learning and regression models 2) Understand the concept of classification for model evaluation. 3) Learn Supervised and unsupervised learning algorithms. 4) Learn the concept of artificial neural network and deep networks	**Course Outcome** Students will be able to 1) Apply and analyze the model using regression. 2) Apply and evaluate the performance of system for classification. 3) Apply Supervised and unsupervised learning for problem solving. 4) Apply neural network algorithms for classification. 5) Describe and evaluate deep neural network with computational complexity.

UNIT-1 Regression

Supervised and Unsupervised Learning, Regression, Model and Cost Function, Gradient Descent, Multivariate Linear Regression, Feature Scaling, Gradient Descent for multivariable **(06 Hours)**

UNIT-2: Classification

Classification, Hypothesis Representation, Decision Boundary, Cost function and Gradient Descent, Multi-classification, Regularization, Model Evaluation **(06 Hours)**

UNIT-3: Supervised Learning

KNN, SVM, Decision tree, Naive Bayes Classifiers, Random Forest **(06 Hours)**

UNIT 4: Unsupervised learning

K-means clustering, Hierarchical Clustering, DBSCAN Clustering, PCA, Anomaly Detection, Recommender System (**06 Hours)**

Unit 5: Artificial Neural Network

Introduction to neural network, Activation Functions, Perceptron rule, backpropagation **(06 Hours)**

Unit 6: Deep Learning

Introduction to deep learning, building blocks of CNN, Computational Complexity, case studies based on CNN architectures, **New topics to be announced time to time.** **(06 Hours)**

Text books:				
1	Understanding Machine Learning. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/copy.html	2017	Shai Shalev-Shwartz and Shai Ben-David.	Cambridge University Press.
2	The Elements of Statistical Learning. https://web.stanford.edu/~hastie/ElemStatLearn/	2009	Trevor Hastie, Robert Tibshirani and Jerome Friedman.	Second Edition
3	Pattern Recognition and Machine Learning. https://www.microsoft.com/en-us/research/people/cmbishop/downloads/	2006	Christopher Bishop.	Springer

VII Semester
ET 2424 – PE IV: Topics in Machine Learning

Reference books:				
1	Foundations of Data Science.	2017	Avrim Blum, John Hopcroft and Ravindran Kannan.	
2	Learning, Part II, http://www.deeplearningbook.org/	2016	Goodfellow, I., Bengio, Y., Courville, A.	MIT Press
3	Machine Learning: A Probabilistic Perspective	2012	Kevin P. Murphy	MIT Press

VII Semester
ET 2425 – PE IV: Multimedia Communications

Prerequisites	**Basics of digital data and computer networks**
Course Objective Students should be able to 1. Learn the basics of image ,audio representation and transmission 2. Understand basic concepts of image ,audio and video compression 3. Learn basic concepts of multimedia communication networks. 4. Understand basic concepts of Content-Based Retrieval in Digital Libraries	**Course Outcome** Students will be able to 1. Explain basics of analog and digital video 2. Implement image compression techniques and describe video compression techniques 3. Describe various network protocols 4. Describe basics of image retrieval from digital libraries

UNIT-1:
Fundamental concepts in Text and Image: Multimedia and hypermedia, World Wide Web, overview of multimedia software tools. Graphics and image data representation graphics/image data types, file formats, Color in image and video: color science, color models in images, color models in video **(6 hours)**

UNIT-2:
Fundamental concepts in video and digital audio: Types of video signals, analog video, digital video, digitization of sound, MIDI, quantization and transmission of audio **(6 hours)**

UNIT-3:
Multimedia data compression: Lossless compression algorithm: DCT, Wavelet- Based Coding, Embedded Zerotree of Wavelet Coefficients Set Partitioning in Hierarchical Trees (SPIHT), Basic Audio Compression Techniques **(6 hours)**

UNIT-4:
Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, MPEG2, MPEG4 **(6 hours)**

UNIT-5:
Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications :Quality of Multimedia Data Transmission, Multimedia over IP, RTCP,RTP,SIP Transport of MPEG-4,DMIF, Media-on-Demand(MOD) **,**Multimedia Broadcasting schemes **(6 hours)**

UNIT-6:
Content-Based Retrieval in Digital Libraries C-BIRD— A Case Study ,C-BIRD GUI Color Histogram Color Density Color Layout Texture Layout Search by Illumination Invariance Search by Object Model **(6 hours)**

Text books:				
1	Fundamentals of Multimedia	Ze-Nian Li , Mark S Drew	2004	PHI/Pearson Education
2	Multimedia Applications	Steinmetz, Nahrst	2004	Springer.

Reference books:				
1	Multimedia Communications: Applications, Networks, Protocols and Standars	Fred Halsall	2001	Addison-Wesley

VII Semester
ET2431-PE V: Display Technology

Prerequisites	**----------**
Course Objective Students should be able to 1. To provide the fundamental knowledge for understanding concepts of different display technologies related to manufacturing techniques and materials selection 2. To explore specifications required for display technologies and understand properties of Luminescence materials for different display types. 3. To understand the addressing methods, backplane Technology and Driver Integration part of different new displays. 4. To understand new displays properties of materials modes.	**Course Outcome** Students will be able to 1. Identify different display technologies and manufacturing process. 2. Characterized and analyzed specifications of display technology and Luminescence materials. 3. Explore design parameters for displays and analyze addressing matrix and backlight unit technologies. 4. Elaborate applications of different new displays.

UNIT I :
Overview of display technologies, information capacity of displays, introduction to different flat panel display technologies. LCD Display Internal structure and working, Fundamentals of Photometry,

(06 Hours)

UNIT II :
Characterization and performance of displays: Concepts of aspect ratio, color gamut, contrast and gradation, directional visibility, driving power, efficiency, speed, memory and storage, degradation, resolution, addressability, physiological factors, and measurement instrumentation, Colorimetry, CIE colorimetry

(06 Hours)

UNIT III :
Luminescence and luminescent materials: Physical processes and interactions leading to emission of light, processes responsible for the transfer of energy in luminescent materials, chemistry and preparation of luminescent materials, and emission properties of the prepared materials;

(06 Hours)

UNIT IV:
Basics of matrix addressing of displays: active and passive matrix. Technical discussion of display technologies: LEDs, OLEDs, LCDs, Active matrix TFT backplanes for OLED and LCD displays. Other displays and associated technologies.

(06 Hours)

UNIT V:
Advanced TFT Backplane Technologies (IGZO, LTPS, etc.) and Driver Integration. Back Light Unit Technologies (CCFL, LED, QD, etc.)

(06 Hours)

UNIT VI:
Future and New Applications of Displays. Materials for Display – TFT, EL and LC Materials and Modes

(06 Hours)

VII Semester
ET2431-PE V: Display Technology

Text books:				
1	Liquid crystal flat panel displays: manufacturing science & technology.	W. Mara	2012	Springer, Science & Business Media,
2	Introduction to Flat Panel Displays	Jiun-Haw Lee, David N. Liu, Shin-Tson Wu		Wiley publications

Reference books:				
1.	Liquid crystal displays: fundamental physics and technology.	R. H. Chen	2011	John Wiley and Sons
2.	Fundamentals of Solid-State Lighting: LEDs, OLEDs, and Their Applications in Illumination and Displays	Vinod Kumar Khanna		CRC press

VII Semester
ET2432-PE V: Biomedical Instrumentation

Prerequisites	**----------**
Course Objective Students should be able to 1) Know the physiology of heart and brain , Understand the basic principles of physical parameters 2) Comprehend the working principle of recording instruments signal analysis techniques 3) Know the concepts of modern imaging systems 4) Understand the concept of Therapeutic Equipments	**Course Outcome** Students will be able to 1) Describe various parameters of human anatomy and physiology. 2) Explain the functioning of different measuring and recording instruments 3) Describe imaging systems. 4) Learn therapeutic equipments.

UNIT-1 : Fundamentals of Biomedical Instrumentation and its Electrodes.

Anatomy and Physiology, Physiological Systems of the Body, Sources of Biomedical Signals, Basic Medical Instrumentation System, Origin of Bioelectric Signals, Recording Electrodes, Electrodes for ECG. Electrodes for EEG, Electrodes for EMG.

(06 Hours)

UNIT-2: Biomedical recorders and its Systems .

Basic Recording System, Biomedical Signal Analysis Techniques, Electrocardiograph Phonocardiograph (PCG), Electroencephalograph (EEG), Electromyograph (EMG) , Other Biomedical Recorders

(07 Hours)

UNIT-3: Measuring Instrumentation

Blood pressure measurement, Heart sound measurement oximetry, Pulse Oximeter, Electromagnetic Blood Flowmeter, Ultrasonic Blood Flowmeters, Coulters Counters.

(06 Hours)

UNIT 4: Analysers

Pulmonary Function Measurements, Spirometry, Pneumotachometers ,Measurement of Volume
Respiratory Gas Analyzers, Acid-base Balance, Blood pH Measurement, Blood pO2 Measurement.

(06 Hours)

Unit 5: Modern Imaging Systems

Basis of Diagnostic Radiology, Nature and Production of X-rays, Visualization of X-rays
Physical Parameters for X-ray Detectors, Ultrasonic Imaging Systems Medical Ultrasound, Basic Pulse-echo Apparatus, A-Scan , Echocardiograph (M-mode), B-Scanner, Real-time Ultrasonic Imaging Systems, MRI

(05 Hours)

Unit 6: Therapeutic Equipment

Cardiac Pacemakers: Need for Cardiac Pacemaker, External Pacemakers *Implantable* Pacemakers. Cardiac Defibrillators: Need for a Defibrillator, DC Defibrillator, Implantable Defibrillators Ventilators: Its types and characteristics.

(06 Hours)

VII Semester
ET2432-PE V: Biomedical Instrumentation

Text books:				
1	Handbook of Biomedical Instrumentation	1st edition	R.S.Khandpur TMH	TMH
2	**I**ntroduction to Biomedical Instrumentation	-	**B**y Mandeep Singh	**PHI**

Reference books:				
1	Biomedical Instrumentation & Measurement ,	2nd edition 1990	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer PHI	PHI

VII Semester
ET 2433 – PE V: Fuzzy Logic & Neural Network

Prerequisites	**Basic set theory,** Basic probability and statistics**,** linear algebra and calculus
Course Objective Students should be able to 1. Learn computing algorithms in Neural network and Fuzzy logic concepts 2. Understand operation of basic elements in fuzzy controller, fuzzy reasoning, relations. 3. Understand supervised and unsupervised algorithms in neural networks. 4. Learn deep learning fundamentals and develop algorithms to solve real life applications.	**Course Outcome** Students will be able to 1. Comprehend and apply fuzzy/ neural network concepts to handle uncertainty in engineering problem. 2. Apply Fuzzy relation, implications and Design Fuzzy logic controller for solving real life problems 3. Apply supervised/unsupervised algorithms for pattern recognition/classification problems. 4. Describe Deep learning models and apply deep networks to computer vision analysis

UNIT-1 Fuzzy Logic & Arithmetic Operations

Fuzzy Sets, Operations on Fuzzy Sets, Membership Functions, fuzzy compliments, t-norms and t-conorm**,** extension principle, Fuzzy arithmetic operation on intervals and on fuzzy sets, lattice of fuzzy numbers, fuzzy equations **(06 Hours)**

UNIT-2 Fuzzy Relations & Decision Making

Fuzzy relations, projections and cylindric extensions, binary fuzzy relations, fuzzy equivalence, Fuzzy Rules and Fuzzy Reasoning, Fuzzy implications, Fuzzy Inference Systems, Fuzzy Decision Making, Fuzzy controllers **(06 Hours)**

UNIT-3: Neural Network Concepts

Introduction to Biological neural network, and Artificial Neuron Models, Neural Network learning rules, NN architectures, Hebb Net, Learning in single discrete and continuous perceptron, Perceptron training algorithm**,** Feed forward vs feedback networks, ADALINE, MADALINE NN

(06 Hours)

UNIT-4: Supervised Neural Networks

Supervised Learning Neural Networks, Backpropagation algorithm, factors affecting back propagation training, Radial Basis Function Networks, Recurrent Networks, Adaptive Multilayer NN

(06 Hours)

UNIT 5: Unsupervised Neural Networks

Unsupervised Learning Neural Networks, Winner take networks, Adaptive Resonance architectures, Self-Organizing Map, Associate memory models

(06 Hours)

Unit 6: Deep learning

Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Basic structure of Convolutional Network, Case studies: Alex net, VGGNet, GoogLeNet, Applications of CNN: Train deep neural networks for computer vision tasks, **New topic to be announced time to time** **(06 Hours)**

VII Semester
ET 2433 – PE V: Fuzzy Logic & Neural Network

Text books:				
1	Fuzzy Sets and Fuzzy Logic:Theory and Applications	1996	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications	2017, 2nd edition	S. Rajasekaran and G. A. Vijayalakshmi Pai	Prentice Hall of India
3	Elements of Artificial Neural Network	2009	K. Mehrotra	Penram International Publishing Pvt Ltd; Second edition MIT, Cognet
4	Neural Networks and Deep learning	2018	Charu C. Aggarwal	Springer International Publishing

Reference books:				
1.	Fuzzy Logic with Engineering Applications	3rd Edition, 2011	Timothy J.Ross,	McGrawHill, New York
2.	Principles of Soft Computing	2011, 2nd edition	S. N. Sivanandam, S. N. Deepa	Wiley India Pvt Ltd
3.	"Neural Networks and Deep Learning", http://neuralnetworksanddeeplearning.com	2015	Michael Nielsen	Determination Press
4.	Deep learning.	2015	Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville.	An MIT Press book in preparation

VII Semester
ET 2434 -PE V: Wireless Sensor Networks

Prerequisites	**----------**
Course Objective Students should be able to: 1. To Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology 2. Understand the medium access control protocols and address physical layer issues 3. Learn key routing protocols,transport layer protocols for sensor networks, and design requirements 4. Understand the Sensor management ,sensor network middleware, operating systems.	**Course Outcome** Students will be able to: 1. Understand and explain common wireless sensor node architectures. 2. Carry out simple analysis and planning of WSNs. 3. Demonstrate knowledge of MAC protocols, routing protocols developed for WSN. 4. Demonstrate knowledge of mobile data-centric networking principles.

UNIT-1:
Characteristics Of WSN: Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs,

(06 Hours)

UNIT-2:
Network architecture-optimization goal and figure of merit-design principles for WSN, service interface of WSN, Gateway concept challenges of WSN, comparison with other network.

(06 Hours)

UNIT-3
Medium Access Control Protocols: Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention- based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol

(06 Hours)

UNIT-4:
Routing And Data Gathering Protocols Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

(06 Hours)

UNIT-5
Naming and addressing, Time synchronization, Properties of Localization and positioning procedures, single hop localization, positioning in multihop environments, and impact of anchor placement.

(06 Hours)

UNIT-6:
Applications Of WSN: WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking .

(06 Hours)

VII Semester
ET 2434 -PE V: Wireless Sensor Networks

Text books:				
1	Protocols and architecture for Wireless sensor Networks Wiley	2007	Holger Karl, Andreas Willig,	Wiley Publications
2	Wireless Sensor Network Designs,	2003	Anna Hac	Wiley Publications
3	Handbook of Algorithms for Wireless Networking and Mobile Computing	2006	Azzedine Boukerche	Chapman & Hall/CRC Publications

Reference books:				
1	Wireless Sensor Networks : A systems perspective	August 2005	NirupamaBulusu and Sanjay Jha,	Artech House Publications
2	Wireless Sensor Networks : Architecture and Protocols	2003, 2003.	Jr., Edgar H. Callaway,	Auerbach Publications
3	Wireless Sensor Networks	2005 C.S.	Raghavendra, Krishna M. Sivalingam and TaiebZnati	Springer Publications

VII Semester
ET2435 – PE V : RF Circuit Design

Prerequisites	----------
Course Objective Students should be able to **1.** Learn fundamentals of series and parallel RF circuits. **2.** Understand the use of HF component in design the RF circuit and bandwidth estimation techniques. **3.** Learn the design of high frequency amplifier an phase detectors **4.** Understand the concept of CMOS technology in RF circuits.	**Course Outcome Students will be able to** **1.** Compare the behavior of series and parallel RLC circuit at HF. **2.** Analyze the HF circuit design and Distinguish the different bandwidth estimation techniques. **3.** Compare the power amplifier parameters with HF amplifier with phase detector. **4.** Apply the knowledge of CMOS technology for design of supply independent bias circuit

UNIT-1 Fundamentals of RF Circuits

Introduction, History of wireless Communication, Noncellular wireless Applications, Propagation, Parallel RLC Tank Circuit, Series RLC Circuit , RLC Network as Impedance Transformer, Skin Effect, Resistor, Capacitor, Inductor **(06 Hours)**

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UNIT-2: MOSFET and Transmission Lines

MOSFET Physics, MOS Device Physics in Short Channel Regime , Other Effects, Link Between Lumped and Distributed Regime ,Driving Point impedance at iterated structures , Transmission line , Behavior of finite length Transmission line. **(06 Hours)**

UNIT-3: Bandwidth Estimation

Review of Smith Chart and S-Parameter, Application of smith chart, Rise time, Delay, Bandwidth Estimation Techniques - Open Circuit Time Constant , Short Circuit Time constant
. **(06 Hours)**

UNIT 4: HF RF Amplifier and Bandwidth Detection

Introduction to High Frequency Amplifier Design, Zeros as Bandwidth Enhancer , The shunt series Amplifier, Tuned Amplifiers, Neutralization and Unilateralization Cascaded Amplifiers, . **(06 Hours)**

Unit 5: Biasing of RF Circuit

Introduction to Voltage references and Biasing, Review of Diode Behavior, Diodes and Bipolar transistors in CMOS Technology Supply independent bias circuits, Band gap Voltage References, Amplifier linearity. **(06 Hours)**

Unit 6: RF Power Amplifier and Phase Detectors

Introductions to RF Power Amplifiers, Classification of Power Amplifiers, Modulation of Power Amplifiers, Introduction to Phase lock loops , Linear zed PLL Model, Phase Detector, Sequential Phase Detector, Loop Filters and Charge Pumps **(06 Hours)**

VII Semester
ET2435 – PE V : RF Circuit Design

Text books:				
3.	The Design of CMOS Radio Frequency Integrated Circuits	2nd Edition	Thomas H. Lee	Cambridge University Press
4.	RF Circuit Design Theory and Applications	2nd Edition	R. Ludwig & P. Bretchko	Pearson Publication

Reference books:				
5.	Analysis and Design of Analog Integrated Circuits	4th Edition	Paul R. Gray	Whiley India Publication

VII Semester
ET2441-PE VI : CMOS VLSI Design

Prerequisites	Logic Circuit Design, MOSFET Operation, Sequential Circuits .
Course Objective Students should be able to 1. To understand and study analysis of the MOS transistor with first order and second order effects. 2. To study the static and dynamic operating principles of inverter circuit. 3. To understand the different CMOS implementation process. 4. To learn switching characteristics and interconnection effects of MOS device, advanced techniques in CMOS logic.	**Course Outcome** Students will be able to 1. An ability to analyze the characteristics of MOSFET. 2. An ability to analyze the voltage transfer characteristics of MOS inverters. 3. An ability to apply the LAMBDA design rules for design of optimized CMOS circuits and describe the process of fabrication for CMOS circuits 4. An ability to design and analyze switching characteristics and interconnection effects of MOS device, advance CMOS logic circuits.

UNIT –I : Basic MOS Device Physics
General Consideration: MOS as a switch, MOS Structure & Symbols, MOS I/V Characteristics, MOS Enhancement Transistor, Second order effect of MOS: Body Effect, Junction Effect, Gate Leakage Effect, Channel Length Effect, Tunneling Effect, Velocity Modulation, Mobility Variation **06 Hrs**.

UNIT-2:
MOSFET Inverter Characteristics
Resistive Load Inverter , Inverter with n type MOSFET load,CMOS Inverter, Principle of operation & DC Characteristics, Tri-stated Inverter, Noise Margin Calculation. **07 Hrs**

UNIT-3:
Fabrication & Layout of CMOS IC
CMOS Fabrication Technology: N-well, P-well, Twin Tub Process, Silicon on Insulator (SOI) Process, Physical Design of Logic Gates, Euler's Path, Stick Diagram, Layout, Latch-up Effect. **06 Hrs.**

UNIT-4:
Switching Characteristics & Interconnection Effect
MOS Device Capacitance Estimation, Switching Characteristics: Rise Time, Fall Time, Propagation Delay, Delay Estimation: Propagation Delay, Contamination Delay, Power Dissipation in CMOS: Static & Dynamic Power Calculation, Charge Sharing, Fan-in, Fan-out. **05 Hrs**

UNIT-5: Combinational Circuit Design
Circuit Families, Static CMOS , Ratioed Circuits , Cascode Voltage Switch Logic, Dynamic Circuits, Pass-Transistor Circuits, Circuit Pitfalls, More Circuit Families. **06 Hrs**
UNIT-6: Sequential **Circuit Design**
Introduction, Sequencing Static Circuits . . Sequencing Methods , Max-Delay Constraints, Min-Delay Constraints,Time Borrowing, Clock Skew, Circuit Design of Latches and Flip-Flops, Conventional CMOS Latches, Conventional CMOS Flip-Flops, Design Using Various Logic Families such as Pseudo NMOS Logic, Dynamic CMOS Logic, CMOS Domino Logic, Zipper Logic, Clocked CMOS Logic, CVSL, Bi-CMOS Logic Family **06 Hrs**

VII Semester
ET2441-PE VI : CMOS VLSI Design

Text books:				
1	"Introduction to VLSI Circuits and Systems"	First Edition	John P. Uyemura	Wiley Publication.
2	"Principle of CMOS VLSI Design"	2nd Edition, 1994.	Neil H. E. Weste, K. Eshraghian	Addison Wesley VLSI Series.

Reference books:				
1	"CMOS VLSI Design"	3rd Edition, 2005.	Pucknell, K. Eshraghian	Prentice Hall
2	"CMOS Digital Integrated circuits Analysis and Design"	Third edition, 2008	Sung-Mo Kang, Yusuf leblebici,	Tata Mc- Graw Hill,

VII Semester
ET2442– PE VI: Digital Image Analysis for Remote Sensing

Prerequisites	**Principles of Image Analysis**
Course Objective Students should be able to 1) Understand Remote Sensing & sensor Concepts 2) Understand the fundamentals and image characteristics of remote sensing. 3) Learn image enhancement techniques 4) Study image classification technique and hyperspectral image analysis	**Course Outcome** Students will be able to 1) Comprehend the basic and applied principles of remote sensing, RS image characteristics 2) Understand and evaluate image spatial and spectral transforms and their effect on image quality and data integrity 3) Apply the image correction techniques and classification algorithms on remote sensing images 4) Analyze high-dimensional remote sensing imagery with appropriate remote sensing data and processing methods.

UNIT-1: Remote Sensing Concepts

Review of Remote Sensing Concepts: spatial and radiometric characteristics – spectral and temporal characteristics, Optical Radiation Model: The wave/ particle models - energy/matter interaction – Radiometric Correction–Atmospheric Correction, Image sensors

(06 Hours)

UNIT-2: Digital Image Formation and Characteristics

Digital Image Formation: point spread functions – sampling and quantization

Digital Image Characteristics: Univariate and multivariate image statistics – noise models- power spectral density- co-occurrence matrix

(06 Hours)

UNIT-3: Image Enhancement and Spectral Transforms

Contrast enhancement – band rationing – principal component analysis – vegetation transforms – texture transforms, Spatial Transforms: convolution concept - low and high pass filtering – spatial transformations – Fourier transform – wavelet transforms.

(06 Hours)

UNIT 4: Geometric Correction

Sensor geometry and empirical models for geometric corrections techniques.

(06 Hours)

Unit 5: RS Image Classification

Thematic Information Extraction: review of supervised and unsupervised Image classification – Maximum Likelihood and Bayesian classification, Non-parametric & parametric classification.

(06 Hours)

Unit 6: High Dimension Image Analysis

Subpixel classification: Linear mixing model, fuzzy set classification, Hyperspectral Image Analysis: Feature extraction, classification algorithms for hyperspectral data, Applications of Remote Sensing, **New topic to be announced time to time** **(06 Hours)**

VII Semester
ET2442– PE VI: Digital Image Analysis for Remote Sensing

Text books:				
1	Remote Sensing: Models and Methods for Image Processing	Third Edition, 2007	Robert A. Schowengerdt	Elsevier
2	Remote Sensing Digital Image Analysis	4th Edition, 2006	John A. Richards, Xiuping Jia	Springer

Reference books:				
1	Introductory Digital Image Processing: A Remote Sensing Perspective	Fourth Edition, 2016	Jhon R. Jensen	Pearson Series
2	Physical Principles of Remote Sensing	Third Edition, 2012	W.G. Rees	Cambridge University Press

VII Semester
ET 2443- PE VI : Microwave Integrated circuits

Prerequisites	RF & Microwave ,UHF.
Course Objective Students should be able to 1. To understand the various microwave Integrated circuits components 2. Develop the hands-on Trainer Kits of MIC. 3. To analyze the various passive & active MIC components. 4. To get hands on spectrum analyzer. and analyze different microstrip component on it.	**Course Outcome** Students will be able to 1. Identify the different MIC components. 2. Analyze the different passive and active Microstrip line devices in MIC. 3. Analyze the Microstrip Patch antenna. 4. Describe the fabrication process of MIC Devices and Components.

UNIT-1: Introduction to planar Transmission Lines:
Microwave Communication System, Microwave Component System, Microstrip lines, Striplines Characteristic impedance, Guide wavelength and loss, Slot line – Wave-guide analysis, coupling coaxial and micro strip lines Coplanar line: Analysis using conformal transformation and Hybrid mode method .

06 Hrs

UNIT-2: Micro strip line devices:
Micro strip coupler and branch-line couplers, even and odd mode analysis, coupling coefficient and bandwidth. Impedance transformers and filters, Lumped elements for MIC design and fabrication of inductors, resistors and capacitors

06 Hrs

UNIT-3: Microwave Resonators & Power dividers
Serial and Parallel Resonators circuits, Wilkinson Power divider, Non-reciprocal components, micro strip circulators, isolators, phase shifters

06 Hrs

UNIT-4: Planar Antennas
Types of Antennas, Radiation mechanism, radiation fields, patch antennas, traveling wave antennas, slot antennas, Excitation techniques, surface waves ,Advantages and Disadvantages of Micro strip antennas , Methods of Analysis. **06 Hrs**

UNIT-5: Design of micro strip circuits:
High power circuits – Transistor Oscillator, step recovery diode frequency multiplier, avalanche diode oscillator, PIN diode switch, Low power circuits: Schottky diode, Balanced mixer, parametric amplifier, PIN diode limiter, Diode phase shifter. **06 Hrs**.

UNIT-6: Fabrication Technologies in MICs
MIC substrate Materials, Dielectric Substrates properties, Fabrication Technology in HMICs: Thick film technology, Thin film technology, Methods of testing, Encapsulation of devices, Mounting, Introduction to MMICs, Fabrications Technologies in MMICs: Epitaxial growth, Diffusion, Ion implantation, Electron Beam technology for pattern delineation

06 Hrs

VII Semester
ET 2443- PE VI: Microwave Integrated circuits

Text books:				
1	"Microwave Engineering"	3rd Edition	David Pozar	Wiley Ind. Publishers
2	"Microwave Devices and Circuits"	. 3rd Edition	Samuel Liao	Prentice-Hall of India Ltd
3	"Antennas and Radio Wave Propagation,"	3rd Edition	R.E.Collin	McGraw Hill Publishers 1985
Reference books:				
1	"Strip like Transmission Line for MIC"	--	Bharti Bhat and S. K. Koul	New Age International.
2	"Microwave Integrated Circuits"	--	K. C. Gupta and Amarjit Singh	Wiley East. Ltd, 1974
3	"Micro strip Antennas"	--	I.J. Bahl and P. Bhartia	Artech House1980.

VII Semester
ET2444 – PE VI: Communication Networks

Prerequisites: Digital Communication	**----------**
Course Objective **Students should be able to** Understand Networks, Network topologies and service primitives. 1. Learn the structure and applications of Connecting devices. 2. Learn basics of LAN, MAN, WAN. 3. Understand Multimedia Networking. 4. Comprehend Network applications and Network Securities	**Course Outcome** **Students will be able to** 1. Compare data transmission protocols and understand the applications of communication network 2. Apply the knowledge of LAN structure to design data communication system. 3. Detect Data transmission errors in communication networks. 4. Compare different data security protocols.

Unit-1Computer Network and Internet **6 Hours**

Internet, the network edge, ISPs and Internet backbone, Protocol layers and their service models, History of Computer network and Internet

Unit-2 Application Layer **6 Hours**

Principles of Network Applications, the web and HTTP, FTP, Email, DNS,

Unit-3: Transport Layer **6 Hours**

Transport layer design issues, transport service primitives, internet transport protocol TCP/IP architecture, TCP/IP protocol, TCP/IP utilities, wireless TCP

Unit-4: Network layer **6 Hours**

Network layer design issues, IP packets, IP addressing, virtual circuit and datagram networks, router and routing algorithms, congestion, internetworking, UDP, routers and gateways

Unit-5: The link layer and Local area Network **6 Hours**

Services,error detection and correction techniques, multiple access protocols, and link layer addressing, Ethernet, Hubs and Switches, PPP

Unit-6: Security in Communication Networks **6 Hours**

Network Security, cryptography, authentication, Integrity, firewalls, attacks and countermeasures,

VII Semester
ET2444 – PE VI: Communication Networks

Text books:				
1	**Data Communication and Networking**	Behrouz Forouzan	**Fifth Edition**	McGraw Hill
2	**Computer Networking A top down Approach Featuring and Internet**	James F. Kurose	**Third Edition**	**Pearson**
Reference books:				
1	**Computer Networks**	Andrew Tanenbaum	**Fourth Edition**	Prentice Hall PTR

VII Semester
ET2445- PE VI: Computer Architecture and Organization

Prerequisites	
Course Objective Students should be able to 1) Study the fundamentals and advance concepts of computer architecture and different arithmetic operation including the algorithms & implementation for fixed-point and floating-point numbers. 2) Understand control unit operations and performances issues 3) Study and apply the Study the hierarchical memory system including cache memories and virtual memory.. 4) Study the concepts of pipelining and Parallel Processors.	**Course Outcome** Students will be able to 1) Describe the fundamentals and advance concept in computer organization and understand the different methods used by processor for arithmetic calculations, perform arithmetic operations and understand the storage format for floating point numbers. 2) Write control sequence for Instructions also understand performances issue in processor and memory. 3) Understand the hierarchical memory system including cache memories and virtual memory. 4) Understand the concepts of pipelining and Parallel Processors.

UNIT-1

Basic functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic - integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication - shift-and-add, Booth multiplier, carry save multiplier, etc. Division - restoring and non-restoring techniques, floating point arithmetic. **(6Hrs)**

UNIT-2:

Instruction set architecture of a CPU - registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. CISC, RISC architecture Case study - instruction sets of a generic CPU. **(6Hrs)**

UNIT-3:

Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit. Microprogrammed Control - Basic concepts, minimizing microinstruction size, multiplier control unit. Microprogrammed computers - CPU control unit

(6Hrs)

UNIT-4:

Memory hierarchy – main memory – types and interfacing; Cache memory – its organizations and operations, levels of caches; Memory management module – paging and segmentation, virtual memory; Disk memory, RAIDs. Back-up memory **(6Hrs)**

UNIT-5:

Pipelining:Basic concepts of pipelining, throughput and speedup, pipeline hazards.Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

(6Hrs)

UNIT -6

Peripheral devices and their characteristics: Input-output subsystems, I/O transfers - program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes - role of interrupts in process state transitions.

(6Hrs)

VII Semester
ET2445- PE VI: Computer Architecture and Organization

Text Books			
1	Computer Organization and Design: The Hardware/Software Interface	David A. Patterson and John L. Hennessy	5th Edition Elsevier
2	Computer Organization and Embedded Systems	Carl Hamacher	McGraw Hill Higher Education 6th Edition
3	Computer architecture and organization	Carl Hamacher	McGraw Hill Higher Education 4th Edition

Reference Books			
1	Computer Architecture and Organization	John P. Hayes	WCB/McGraw-Hill 3rd Edition
2	Computer Organization and Architecture: Designing for Performance	William Stallings	10th EditionPearson Education.
3	Computer System Design and Architecture	Vincent P. Heuring and Harry F. Jordan,	2nd Edition Pearson Education

VII Semester
ET2446 – PE VI: PLCs & SCADA

Prerequisites	**----------**
Course Objective **Students should be able to:** 1) Understand the fundamentals of Automation and their applications, systems used in industry such as PLC, Memory devices, Input /Output system and Relays. 2) Understand the working of Timing Circuits, Programming techniques with Input/Output Instructions and Addressing, overview of PLC timers and their application in industrial control. 3) Understand the PLC Counters, Data Comparators Instructions and application of sequencers based on these systems 4) Understand the networking using PLC systems and peripherals advanced PLC programming languages which are widely used in industrial automation.	**Course Outcome** **Students will be able to:** 1) Describe automation, its importance, expectations from automation and applications in industry. 2) Describe and analyze Timing Circuits and Program PLC using ladder diagram for various applications. 3) Analyze and apply various instructions of PLC, PLC counters. 4) Explain the basic concepts of networking using PLC systems and peripherals

UNIT-1 :-

Introduction to Programmable Controllers

Definition , A Historical Background , Principles of Operation , PLCs Versus Other Types of Controls , PLC Product Application Ranges, Ladder Diagrams and the PLC , Advantages of PLCs, PLC Sizes and Scopes of Applications

Processors, the Power Supply, and Memory

Introduction , Processors, Processor Scan , The System Power Supply , Programming Devices, Memory Overview , Memory Types, Memory Structure and Capacity. Configuring the PLC Memory—I/O Addressing.

The Input/Output System

Introduction to Discrete I/O Systems , I/O Rack Enclosures and Table Mapping , Remote I/O Systems
PLC Instructions for Discrete Inputs, Types of Discrete Modules, PLC Instructions for Discrete Outputs
Overview of Analog Input Signals , Analog Input Connections, Special Analog, Temperature, and PID Interfaces.

(06Hours)

UNIT-2:

Introduction to Programming Languages

Types of PLC Languages, Ladder Diagram Format , Ladder Relay Instructions , Ladder Relay Programming, IEC 1131-3 Programming Languages – FBD/ST/IL/SFC, Control Task Definition, Control Strategy , Implementation Guidelines.

Programming Instructions

NO-NC & coil based instructions(Relay based Instructions), Timers, Counters, Compare, Mathematics, Jump and Subroutines, Scaling (Analog Instructions).

Installation & Wiring

I/O Installation, Wiring, and Precautions ,PLC Start-Up and Checking Procedures.

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(06 Hours)

VII Semester
ET2446 – PE VI: PLCs & SCADA

UNIT-3:

Introduction to SCADA

Introduction and brief history of SCADA, Fundamental principles of modern SCADA systems, the components of a SCADA system, Types of SCADA,

SCADA Programming

Graphics Building & Simulation, Tag types & Management, Tools, Programming techniques, Alarms & Trends Configuration, Screen Navigation, Properties, Scripts, Security.

Database & Controller Connectivity

Using Spreadsheets to Create Points Lists, ODBC Server, Excel communication, Creating Records for data, PLC connectivity through interface and protocols. **(06 Hours)**

UNIT 4:

Introduction to HMI

FOUNDATIONS OF HMI: The Human: History of User Interface Designing, Types, Features, General architecture , Conventional & current HMI systems, Difference between HMI & SCADA, HMI Hardware interfaces, Practical uses in Industries.

Programming HMI

Software Description, Tools Handling, Screen Developments, HMI objects & Object Libraries, Alarms generation, Trends Plotting & its usages, Security & Recipe Management. HMI interfacing with PLC's.

(06 Hours)

Unit 5:

Data comparison instructions & PLC sequencers

Data comparison instructions such as EQU, LES, and GRT,. Introduction to the principles of Data Transfer, Move Instruction, Introduction to Shift Registers & Its types.Purpose and application of PLC Sequencers, Masking techniques and the various types of Sequencers, SQO and SQC instructions.

(06 Hours)

Unit 6:

Distributed Control System:

Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

(06 Hours)

Text books:				
1	Introduction to Programmable Logic controllers		Gary Duning	Delmar Thomson Learning
2	SCADA: Supervisory Control and Data Acquisition	Fourth Edition	Stuart A Boyer	ISA 1999

Reference books:				
1	Programmable Logic Controllers	W.Bolton	Elsevier Publisher	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B.Tech SoE and Syllabus 2020

ELECTRONICS & COMMUNICATION ENGINEERING

VIII Semester
ET2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	On successful completion of the course students will be able to: 1. Demonstrate a sound technical knowledge of their selected project topic. 2. Undertake problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Communicate effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 **PSO** : i,ii,iii	

The group of students will continue to work for the project allotted previously and will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

VIII Semester
ET2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
1. To expose to culture and tradition. 2. To provide opportunity for student to perform and present their hidden talent, still and art. 3. To nurture hobbies. 4. To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits. 5. To develop creative talent, self-confidence, sense of achievement. 6. To be able to design process on environmental, social, political, ethical, health and safety. 7. To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	1. An ability to work initially as well as part of team to achieve set goals. 2. An ability to work to serve society and for betterment of society. 3. An ability to communicate with people at large.
Mapped Program Outcomes : 5,6,7,9,10,11	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.

Nagar Yuwak Shikshan Sanstha's

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology
SoE & Syllabus 2020
3rd to 8th Semester
Computer Technology

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CT-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
				Third Semester										
1	3	BS	GE2201	Engineering Mathematics III	**T**	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CT2201	Computer Architecture & Organisation	**T**	4	0	0	4	4	30	20	50	3 Hours
3	3	PC	CT2202	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	CT2203	Lab: Object Oriented Programming	**P**	0	0	2	2	1		60	40	
5	3	PC	CT2204	Data Structures	**T**	4	0	0	4	4	30	20	50	3 Hours
6	3	PC	CT2205	Lab: Data Structures	**P**	0	0	2	2	1		60	40	
7	3	PC	CT2206	Lab: Python Programming	**P**	0	0	2	2	1		60	40	
8	3	PC	CT2207	Lab: Web Technology	**P**	0	0	2	2	1		60	40	
				TOTAL		**14**	**0**	**8**	**22**	**18**				
				Fourth Semster										
1	4	BS	GE2206	Discrete Mathematics and Probability Theory	**T**	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CT2251	Operating Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CT2252	Lab:Operating Systems	**P**	0	0	2	2	1		60	40	
4	4	PC	CT2253	Advanced Data Structures	**T**	4	0	0	4	4	30	20	50	3 Hours
5	4	PC	CT2254	Lab: Advanced Data Structures	**P**	0	0	2	2	1		60	40	
6	4	PC	CT2255	Mathematical Foundations for Data Analysis	**T**	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	CT2256	Lab: Mathematical Foundations for Data Analysis	**P**	0	0	2	2	1		60	40	
8	4	PC	CT2257	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
9	4	PC	CT2258	Lab: Database Management Systems	**P**	0	0	2	2	1		60	40	
				TOTAL		**16**	**0**	**8**	**24**	**20**				
				Audit Courses										
1	3	HS	GE2121	Env Studies for 3 Sem. EL,ET,CT	**A**	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
3	4	HS	AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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SoE No. CT-202.1

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(Revised Scheme of Examination w.e.f. 2022-23 onward)

Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamentals of Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	CT2301	Computer Networks	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	CT2302	Lab: Computer Networks	**P**	0	0	2	2	1		60	40	
4	5	PC	CT2303	Theoretical Foundations of Computer Science	**T**	4	0	0	4	4	30	20	50	3 Hours
5	5	PE		Professional Elective-I	**T**	3	0	0	3	3	30	20	50	3 Hours
6	5	PE		Lab: Professional Elective-I	**P**	0	0	2	2	1		60	40	
7	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3 Hours
8	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3 Hours
9	**5/6**	**STR**	**CT2310**	**IND VISIT and its report**	**P**	**0**	**0**	**0**	**0**	**1**		100		
					TOTAL	**19**	**0**	**4**	**23**	**22**				

Professional Electives -I

1	5	PE-I	CT2311	PE I: Randomized Algorithm
	5	PE-I	CT2312	PE I: Lab Randomized Algorithm
2	5	PE-I	CT2313	PE I: Mobile Operating System
	5	PE-I	CT2314	PE I: Lab: Mobile Operating System
3	~~5~~	PE-I	CT2315	PE I: Advanced Web Technologies
	5	PE-I	CT2316	PE I: Lab: Advanced Web Technologies
4	5	PE-I	CT2317	PE I: Introduction to Geographical Information System
	5	PE-I	CT2318	PE I: Lab: Introduction to Geographical Information System
5	5	PE-I	CT2319	PE I: Computer Graphics
	5	PE-I	CT2320	PE I: Lab: Computer Graphics
6	5	PE-I	CT2321	PE I: Realtime Systems
	5	PE-I	CT2322	PE I: Lab:Realtime Systems
7	5	PE-I	CT2323	PEI : Privacy and Security in Online Social Networks
	5	PE-I	CT2324	PEI : Lab: Privacy and Security in Online Social Networks

Open Electives -I

1	5	OE-I	CT2325	OE I: Introduction to DBMS
2	5	OE-I	CT2326	OE I: Essentials of IT
3	5	OE-I	CT2327	OE I: Image Processing
4	5	OE-I	CT2328	OE I: Operating System Concepts
5	5	OE-I	CT2329	OE-I Introduction to Salesforce

Open Electives -II

1	5	OE-II	CT2331	OE II: Soft Computing
2	5	OE-II	CT2332	OE II: Software Testing
3	5	OE-II	CT2333	OE II: Internet Technology
4	5	OE-II	CT2334	OE II: Multimedia and Animation
5	5	OE-II	CT2335	OE II: Current Trends and Technologies

Audit Courses

1	5	HS	AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0	

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TA = for Practical : MSPA will be 15 marks each**

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Computer Technology

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						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamentals of Management	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	CT2351	Design & Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	CT2352	Lab: Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
4	6	PC	CT2353	Language Processor	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PC	CT2354	Lab: Language Processor	**P**	0	0	2	2	1		60	40	
6	6	PC	CT2355	Software Engineering	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PC	CT2356	Lab: Software Engineering	**P**	0	0	2	2	1		60	40	
8	6	PE		Professional Elective-II	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	PE		Lab: Professional Elective-II	**P**	0	0	2	2	1		60	40	
10	6	OE		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3 Hours
11	6	OE		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3 Hours
					TOTAL	**21**	**0**	**8**	**29**	**25**				

Professional Electives -II

1	6	PE-II	CT2361	PE II: Digital Image Processing
	6	PE-II	CT2362	PE II: Lab: Digital Image Processing
2	6	PE-II	CT2363	PE II: Internet of Things
	6	PE-II	CT2364	PE II: Lab: Internet of Things
3	6	PE-II	CT2365	PE II: Business Intelligence
	6	PE-II	CT2366	PE II: Lab: Business Intelligence
4	6	PE-II	CT2367	PE II: Introduction to Natural Language Processing
	6	PE-II	CT2368	PE II: Lab:Introduction to Natural Language Processing
5	6	PE-II	CT2369	PE II: Customer Relationship Management
	6	PE-II	CT2370	PE II: Lab: Customer Relationship Management

Open Electives -III

1	6	OE-III	CT2371	OE III: Introduction to DBMS
2	6	OE-III	CT2372	OE III: Essestials of IT
3	6	OE-III	CT2373	OE III: Image Processing
4	6	OE-III	CT2374	OE III: Operating System Concepts
5	6	OE-III	CT2375	OE III: Introduction to Salesforce

Open Electives -IV

1	6	OE-IV	CT2381	OE IV: Soft Computing
2	6	OE-IV	CT2382	OE IV: Software Testing
3	6	OE-IV	CT2383	OE IV: Internet Technology
4	6	OE-IV	CT2384	OE IV: Multimedia and Animation
5	6	OE-IV	CT2385	OE IV: Current Trends and Technologies

Audit Courses

1	6	HS	AU2130	YCCE Communication Aptitude Preparation (YCAP6.3) for CT, IT, CSE	**A**	3	0	0	3	0	

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TA = for Practical : MSPA will be 15 marks each**

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B.TECH SCHEME OF EXAMINATION 2020-21

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Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	CT2401	Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	CT2402	Lab: Artificial Intelligence	**P**	0	0	2	2	1		60	40	
3	7	PC	CT2403	Network Security	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE		Professional Elective-III	**T**	3	0	0	3	3	30	20	50	3 Hours
5	7	PE		Professional Elective-IV	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		Lab:Professional Elective-IV	**P**	0	0	2	2	1		60	40	
7	7	PE		Professional Elective-V	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	CT2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	CT2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -III

1	7	PE-III	CT2411	PE III: Neural Network & Fuzzy Logic
2	7	PE-III	CT2412	PE III: Adhoc Wireless Network
3	7	PE-III	CT2413	PE III: Information Retrival System
4	7	PE-III	CT2414	PE III: Human Computer Interaction
5	7	PE-III	CT2415	PE III: Business Intelligence and Applications

Professional Electives -IV

1	7	PE-IV	CT2421	PE IV: Pattern Recognization
	7	PE-IV	CT2422	PE IV: Lab: Pattern Recognization
2	7	PE-IV	CT2423	PE IV: Cyber Forensic
	7	PE-IV	CT2424	PE IV: Lab: Cyber Forensic
3	7	PE-IV	CT2425	PE IV: Machine Learning
	7	PE-IV	CT2426	PE IV: Lab: Machine Learning
4	7	PE-IV	CT2427	PE IV: Design Patterns
	7	PE-IV	CT2428	PE IV: Lab: Design Patterns
5	7	PE-IV	CT2429	PE IV: Mobile Communication
	7	PE-IV	CT2430	PE IV: Lab: Mobile Communication
6	7	PE-IV	CT2431	PE IV: Software Project Management
	7	PE-IV	CT2432	PE IV: Lab: Software Project Management
7	7	PE-IV	CT2433	PE IV: Numerical Computing
	7	PE-IV	CT2434	PE IV: Lab: Numerical Computing

Professional Electives -V

1	7	PE-V	CT2435	PE V: Cloud Computing
2	7	PE-V	CT2436	PE V: Parallel Programming
3	7	PE-V	CT2437	PE V: Data Mining
4	7	PE-V	CT2438	PE V: Embedded Systems
5	7	PE-V	CT2439	PE V: Operations Research
5	7	PE-V	CT2440	PE V: Bioinformatics

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TA = for Practical : MSPA will be 15 marks each**

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Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	CT2451	Major Project	P	0	0	12	12	9		60	40	
2	8	STR	CT2452	Extra curricular Activity Evaluation	P	0	0	0	0	1		100		
					TOTAL	**0**	**0**	**12**	**12**	**10**				
					GRAND TOTAL	**85**	**0**	**48**	**133**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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III Semester

GE2201 - Engineering Mathematics III

Objectives	Outcomes
1. Able to find numerical solution of various mathematical equations 2. Give knowledge of Laplace transform, Z transform, Fourier transform 3. Define the periodic functions in the form of Fourier series 4. Solve partial differential equations	The student will be able to: 1. Estimate the Calculus of Numerical Function. 2. Determine transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations. 3. Discuss the nature of periodic function and express it in terms of series. 4. Use appropriate method/s to solve partial differential equations.

Unit I: Finite Differences

Difference table; Operators E and Δ, Central differences, Factorials notation, Numerical differentiation and integration, Difference equations with constant coefficients. **(6 hours)**

Unit II: Laplace Transform

Laplace Transforms: Laplace transforms and their simple properties, Unit step function, inverse of Laplace transform, convolution theorem, Applications of Laplace transform to solve ordinary differential equations .**(7 hours)**

Unit III: Z-transform

Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant co-efficient. **(6 hours)**

Unit IV: Fourier Series

Periodic Functions and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions **(7 hours)**

Unit V: Partial Differential Equation

Partial Differential Equations of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve first and second order partial differential equations. **(7 hours)**

Unit VI : Fourier Transform : Definition: Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem**.** **(6 hours)**

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John Wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John Wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan
5	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	Laxmi Prakashan

III Semester
CT2201 - Computer Architecture and Organization

Course Objective	Course Outcomes
Student will be able: 1. To Understand Internal working of Computer System, its basic principles & execution of machine instructions 2. To Understand basic processor design using Hardwired and microprogrammed control unit. 3. To Know Organization of main memory, cache memory. 4. To Know Various ways in which I/O operations are performed.	Upon successful completion of the course, the student will be able to: 1. Relate & Identify the function and design of the various units of computers that process data and store the information. 2. Analyze and write control signal for executing machine instructions for different processors. 3. Explain & Design the organization of memory, memory hierarchy, other peripheral devices, and estimate the cost of computation. 4. Compare among different types of I/O operation

UNIT-1: **[6 hrs]**
Basic Structure of Computer Hardware and Software: Functional Units, Basic Operational Concepts, Bus Structures, Software, addressing methods and machine program sequencing: Memory Locations, addressing and encoding of information, Instructions and Instruction sequencing,

UNIT- 2: **[7 hrs]**
Addressing modes, Assembly language, Stacks, Subroutine. Instruction set : SimpleRISC
Processing Unit: Some fundamental concepts, Execution of a complete instruction, Single, two, three bus organization, Sequencing of control Signals.

UNIT-3: **[7 hrs]**
Processor Design, hard wired control, Microprogrammed Control: Microinstructions, Grouping of control signals, Microprogram sequencing, Micro Instructions with next Address field, perfecting microinstruction.

UNIT-4: **[7 hrs]**
Arithmetic (Fixed and Floating point): Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction, Arithmetic and Branching conditions, Multiplications of positive numbers, Signed- Operand multiplication, fast Multiplication, Booth's Algorithm.

UNIT-5: **[7 hrs]**
Integer Division, Floating point numbers and operations. The Main Memory: Basic concepts, Memory Hierarchy, semiconductor RAM memories, Memory system consideration, semiconductor ROM memories, Speed Size and Cost, Cache Memory, Performance Considerations.

UNIT-6 : **[6 hrs]**
Mapping techniques, Pipelining: Basic Concepts, Data Hazards, Instruction Hazards Computer Peripherals: I/O Devices, I/O transfers – program controlled, interrupt driven and DMA, Interrupt handling.

Text Books:

SN	Title	Edition	Authors	Publisher
1	Computer Organization	5thedition	V.Carl Hamacher, Zvonko Vranesic,	McGraw Hill Publications.

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Computer Organization and Architecture	6th edition	WillaiamStaliing	Pearson Education
2	Computer Architecture & Organization	3rd edition	J.P. Hayes	McGraw Hill Publications.

		June 2020	1.00	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

III Semester
CT2202 - Object Oriented Programming

Course Objective	Course Outcomes
1. Understand the concept of object-oriented programming and modelling	1. Understand the concept of object-oriented programming and modelling
2. Have an appreciation of the object-oriented programming concepts like reusability of code, inheritance, abstraction, and polymorphism	2. Apply the knowledge of object-oriented programming to solve the given problem
3. Gain an understanding of generic components and how to handle the I/O stream classes	3. Analyze the problem to provide the object-oriented solution using advanced programming concepts
4. Develop an understanding of MVC architecture and how to build the event driven solution of the problem	4. Design the event driven web based solution for the problem

UNIT I: **[05 Hrs]**
Introduction to object oriented programming paradigm, procedure oriented programming vs OOP, features of OOP, benefits of OOP, defining class, instantiating a class. UML diagrams to represent class, objects and various relationships

UNIT II **[07 Hrs]**
Functions in OOP, function overloading, Passing & returning Objects, pointers to members, constructors and its types, Access specifiers and packages. Inheritance, types of inheritance, run time polymorphism, abstract classes, Interface, collection interface.

UNIT III **[06 Hrs]**
Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.

UNIT IV **[07 Hrs]**
Multithreading, Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations

UNIT V **[06 Hrs]**
MVC architecture, Java web components and its architecture Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images.

UNIT VI **[06 Hrs]**
Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – Introduction to Swing – layout management – Swing Components – Text Fields, Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes

Text Books:

SN	Title	Edition	Authors	Publisher
1	Object Oriented Programming with C++	6th	E. Balguruswamy	TMH
2	Thinking in Java	4th	Bruce Eckel	Prentice Hall

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Java Complete Reference	7th	Herbert Schildt	McGraw-Hill
2	Mastering C++	4th	Ravishankar, Venugopal	TMH

		June 2020	1.00	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

III Semester
CT2203 - Lab. Object Oriented Programming

Course Objective	Course Outcomes
1. To introduce object oriented programming features and its diagrammatic representation of its model components. 2. To understand concept of class, handling its features and the reusability concept in object oriented language. 3. To understand the mechanism to make use of files and standard libraries. 4. To introduce the exception handling mechanism and the MVC architecture along with web components to design the software solution. 5. To introduce how to perform t riven programming.	1. Able to analyze the problem and can proposed the solution in OO approach. 2. Able to implement the solution using suitable reusability technique provided in OOP language. 3. Able to implement the solution using files and standard template library. 4. Able to design the error free software solution using the standard architecture patterns. 5. Able to design and implement the event driven solution for the problem.

Expt. No.	Experiments based on
01	Implement the concept of Class and its data members and member functions in Java/C++
02	Implement the concept of function and operator overloading in Java/C++
03	Implement the concept of friend function
04	Implement the concept of class constructor and its type in Java/C++
05	Implement the concept of Abstraction in Java/C++
06	Implement the concept of all types of inheritance in Java/C++
07	Implement he collection listener to solve the problem in Java
08	Implement the concept of run time polymorphism in Java/C++
09	Implement the concept of Files using command line arguments in Java/C++
10	Implement the concept of function templates and class template in C++
11	Implement the concept of exception in Java/C++
12	Implement the concept of applet to prepare a web application in Java
13	Implement the event driven approach to prepare the web application in Java

III Semester
CT2204 - Data Structures

Course Objective	Course Outcomes
• To make students familiar with syntaxes and usages of various programming constructs of C language • To make student understand concept of abstract data types like stacks and queues • To make student understand file handling operations • To create thinking ability needed for implementation of programming logic with proper use of memory	• To Identify programming constructs needed to solve real world problems • To Implement various abstract data types • To Write program for file handling by using various access modes and operations needed as per the requirement of given problem • To Implement programming logic needed for solving given problem

UNIT 1: **[7 Hrs]**
Types and operations, Iterative constructs and loop invariants, Quantifiers and loops, Structured programming and modular design, Illustrative examples, Scope rules, parameter passing mechanisms, recursion, program stack and function invocations including recursion

UNIT 2: **[7 Hrs]**
Overview of arrays and array based algorithms - searching and sorting:merge sort,quick sort, Sparse matrices.

UNIT 3: **[5 Hrs]**
Structures (Records) and array of structures (records). Database implementation using array of records. Dynamic memory allocation and deallocation. Dynamically allocated single and multi-dimensional arrays, polynomial representation.

UNIT 4: **[6 Hrs]**
Concept of an Abstract Data Type (ADT), Lists as dynamic structures, operations on lists, implementation of linked list using arrays and its operations. Introduction to linked list implementation using self-referential-structures/pointers.

UNIT 5: **[7 Hrs]**
Stack, Queues and its operations. Implementation of stacks and queues using both array-based and pointer-based structures. Applications of stacks and queues.

UNIT 6: **[4 Hrs]**
1. Files, operations on them, examples of using file.

Text Books:

SN	Title	Edition	Authors	Publisher
1	Fundamentals of Data Structures in C++	2nd 2009	Ellis Horowitz, Sartaj Sahani, Dinesh Mehta	University Press
2	Data Structures and Program Design in C	2nd 2009	Robert Kruse, Cl Tondo	Pearson Education
3	The C programming Language	2nd Edition	Brian Kernighan , Dennis Ritchie	Prentice Hall

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Data Structures with C	Latest	Seymour Lipschutz	TMH
2	Data structures using C	Latest	Reema Thareja	Oxford
3	Algorithms and Data Structures	First	M.M.Raghuwanshi	Narosa

III Semester
CT2205 - Lab. Data Structures

Course Objective	Course Outcomes
• To make students familiar with syntaxes and usages of various programming constructs of C language • To make student understand concept of abstract data types like stacks and queues • To make student understand file handling operations • To create thinking ability needed for implementation of programming logic with proper use of memory	• To Identify programming constructs needed to solve real world problems • To Implement various abstract data types • To Write program for file handling by using various access modes and operations needed as per the requirement of given problem • To Implement programming logic needed for solving given problem

List of Programs

1. Program for counting number of digits in a random number
2. Program for generating list of random numerals and print them in words
3. Program to print Pascal's triangle

```
          1
        1   1
      1   2   1
    1   3   3   1
1  4   6   4   1
1  5   10  10  5   1
```

4. Program for finding GCD of two numbers using factorial method
5. Program for finding GCD of two numbers using recursion. Also, print number of recursive calls.
6. Program for allocating memory dynamically for single dimensional array and sort it using quick sort and merge sort
7. Program for allocating memory dynamically for two-dimensional array printing it in spiral manner.
8. Program to create linked list of cell phone with any 3 attributes as data fields and print it
9. Program to create file for storing details of all the items needed for playing any game of your choice also perform display, insertion of new record at any location, deletion of any record
10. Program to implement stack and print MAX data item from it

III Semester
CT2206 - Lab. Python Programming

Course Objective	Course Outcomes
1. To make student aware about various programming frameworks of Python 2. To make student familiar with syntax of various data structures and their operation along with control statements in Python 3. To make students comprehend concepts of file handling,classes and objects 4. To make student aware about various packages inbuilt in Python along with their usages	1. To select any framework for python programming as per their understanding 2. To write any python program using various data structures and control statements 3. To write program where file handling and concepts of classes and objects are needed 4. To develop advanced applications using functionalities provided under various packages of python

Unit I: **[04Hrs]**
Python frameworks : Basic syntax, variables and expressions, basic operators, decision making

Unit II : **[06 Hrs]**
Control flow statements: continue, break, Loops: while, for and Functions

Unit III: **[06 Hrs]**
Data structures: list, dictionary, arrays, tuples, sets, strings

Unit IV: **[06Hrs]**
File handling, Classes and objects

Unit V: **[06 Hrs]**
Introduction to Various Libraries:
NumPy: Fundamental package for scientific computing
NLTK- Natural language toolkit

Unit VI: **[06 Hrs]**
Python patterns- Implementing Graphs NetworkX- A package for the creation, manipulation, and study of the structure, dynamics, and functions of complex networks.

Expt.No.	Experiments based on
01	Informal introduction to programming IDEs Downloading and installing Python
02	Python: variables, operations, control flow - assignments, condition-als, loops, functions
03	Python: types, expressions, strings, lists, tuples, dictionaries
04	Python memory model: names, mutable and immutable values Operations pertaining to various data structures
05	More on Python functions: optional arguments, default values Passing functions as arguments Higher order functions on lists: map, list comprehension
06	Exception handling, Basic input/output, Handling files
07	Classes and Objects
08	Various packages in Python

Text Books:

SN	Title	Edition	Authors	Publisher
1	Introduction to Programming Using Python	1st	Y. Daniel Liang	Pearson
2	Python: The Complete Reference	1st	Martin C Brown	McGraw Hill

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Data Structures and Algorithms Using Python	1st	Rance D. Necaise	Willey

III Semester
CT2207 - Lab. Web Technology

Course Objective	Course Outcomes
The student should be able to 1. Introduction to internet technology. 2. Study of basic of web page designing and validations 3. Introduction to the concepts of data storage using XML 4. Learn the advance technique for designing the interactive web page.	On completion of this course, the student will be able to 1. Understand various internet technologies 2. Design the web pages using HTML and CSS 3. Implement the XML technology to store the data 4. Develop the interactive web pages using JavaScript

S.N	List of Practical	Mapped	Deadline
1.	[A] Introduction to internet (overview of internet, email, www, broadband, FTP) B] Study and implement basic HTML Tags	CO1, CO2	
2.	Create a web form by using form tags in HTML(use any example)	CO2	
3.	Develop and demonstrate the usage of inline, internal and external style sheet using CSS	CO2	
4.	Introduction to XML. Program to demonstrate the use of External and Internal DTD. (Write n XML file which will display the Book information which includes the following: 1) Title of the book 2) Author Name 3) ISBN number 4) Publisher name 5) Edition 6) Price)	CO3	Before MSE-I
5.	Write a program in JavaScript to perform arithmetic operations.	CO1,CO2,CO4	
6.	Write a Program in JavaScript To create Dialogue Boxes.	CO1,CO2,CO4	
7.	Write a program in JavaScript to demonstrate the use of While and For Loop	CO1, CO2, CO4	
8.	Write a program in JavaScript to demonstrate the use of Conditional Statements and Functions.	CO1, CO2 CO4	Before MSE-II
9.	Write JavaScript to validate the following fields of the Registration page. 1. First Name (Name should contains alphabets and the length should not be less than 6 characters). 2. Password (Password should not be less than 6 characters length). 3. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com) 4. Mobile Number (Phone number should contain 10 digits only). 5. Last Name and Address (should not be Empty).	CO1, CO2, CO4	
10.	Mini project: Submission of Website with Report.	CO1, CO2, CO3, CO4	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

4th Semester

Computer Technology

28 June 2019

IV Semester
GE2206 – Discrete Mathematics and Probability Theory

Objectives	Outcomes Students will be able to
To introduce the concept of Set theory and functions	explain the basic concept of classical sets, fuzzy sets, Relations, functions and logical methods.
To make aware of various algebraic structures	identify the nature of different algebraic structures such as Group, Ring, field
To understand the concept of Probability distribution	Determine the probability functions of one and two random variables
To introduce the concept of Mathematical Expectation	Calculate the Statistical parameters for random variables

Unit I:
Mathematical Logic and Set Theory: Statement and Notation: Negation, Conjunction, Disjunction, Tautologies, Truth Tables, Basic Concepts of Set Theory, Inclusion & equality of set, Power Set, Ordered Pairs and n-tuples, Operations on Sets , , mathematical induction. Propositions, Predicate logic, formal mathematical systems.
(7 hours)

Unit II:
Relations and Functions: Relation and Ordering, Properties of Binary in a set, Relation Matrix and Graphs, Partition and Covering of a set, Equivalence relation, Partial order relations, Partially Ordered sets, Function (Definition and Introduction), Composition of functions, Inverse Functions, Characteristics function of a set.
(6 hours)

Unit III:
Group Theory: Groups (Definitions and Examples) Subgroups and Homomorphism, Cosets and Lagrange's theorem, Normal subgroups, Codes and Group Codes. Semi groups and Monoids (definitions and examples).Homomorphism of semi groups and monoids, Subsemi groups and monoids.
(7 hours)

Unit IV:
Rings (Definitions and Examples): Integral domain, field , ring homomorphism **Fuzzy Sets and Fuzzy Logic:** Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.
(6 hours)

Unit V:
Random variables and probability distribution: Random variables: discrete and continuous; probability density function of one and two variables; Probability distribution function for discrete and continuous random variables(one and two variables), Joint distributions, conditional distributions.

(6 hours)

IV Semester
GE2206 – Discrete Mathematics and Probability Theory

Unit VI:

Mathematical Expectation: Definition of mathematical expectation, functions of one and two random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

(6 hours)

Text Books:

1. Discrete Mathematics Structure with application to Computer Science by J. P. Tremblay &
R. Manohar ,23rd re-print,2005,Tata McGraw-Hills Publication Company Limited, New Delhi.
2. Probability and Statistics – M R Spiegel, John Schiller, R. AluShrinivasan, 2nd edition, Tata McGraw-Hills Publication Company Limited, New Delhi.
3 Advanced Engineering Mathematics - by H.K. Dass, 8th revised edition, 2007, S.Chand and Company Limited ,Delhi.

Reference Books:

1. Discrete Mathematics by LipschutzSchaums's Outline series,2ndedition,Tata McGraw-Hills Publication Company Limited, New Delhi.

2 Discrete Mathematical structures :-By Bernard Kolman ,Robert C.Busby,Sharon Ross,3rd edition,2001,Prentice Hall of India, New Delhi.

IV Semester
CT2251 – Operating Systems

Course Objective	Course Outcomes
1. To learn different types of OS & services provided by OS. 2. To understand process management and inter-process communication. 3. To know the deadlock concepts & deadlock avoidance algorithms. 4. To understand the need of memory management. 5. To learn different file system organization.	Upon successful completion of the course, the student will be able to: 1. Analyze & compare different OS & its services. 2. Apply & analyze CPU scheduling algorithm & also find different ways to synchronize the process. 3. Use different methods to handle deadlock. 4. Apply various memory management techniques. 5. Compare various disk scheduling algorithms based on their performances.

UNIT I **[06 Hrs]**

Introduction, services provided by OS, functions of OS, system calls.
Process management-introduction, process control block, process states, process context switch, threads: user level and kernel level.

UNIT II **[08 Hrs]**

CPU scheduling, goals of scheduling, CPU scheduling algorithms: FCFS, SJF, SRTF, RR, Priority based.
Inter-process communication: process cooperation and synchronization, race condition, critical section, mutual exclusion and implementation, semaphores, classical inter-process communication problems.

UNIT III **[07 Hrs]**

Deadlocks: System Model, deadlock characterization-necessary conditions, resource allocation graph (RAG), methods for handling deadlock-deadlock avoidance, deadlock detection, deadlock prevention, recovery from deadlock.

UNIT IV **[06 Hrs]**

Memory management techniques-contiguous and non-contiguous, paging and segmentation, translation look aside buffer (TLB) and overheads.

UNIT V **[06 Hrs]**

Virtual memory and demand paging, page faults, page replacement algorithms, thrashing and working set model.

UNIT VI **[06 Hrs]**

File systems-introduction, disk space management and space allocation strategies, directory structures, disk caching, disk arm scheduling strategies: FCFS, SSTF, SCAN, CSACN, LOOK, CLOOK, FileOrganization: Sequential, Index, IndexSequential

Text Books:

SN	Title	Authors	Edition	Publisher
1	Operating system concepts	A. Silberchatz and P.Galvin	5th Edition	Addison Wesley Longman Inc.
2	Operating system Principles	A. Silberchatz and P.Galvin	7th Edition	John Wiley & Sons Inc.

Reference Books:

SN	Title	Authors	Edition	Publisher
1	Modern operating systems	A.S. Tanenbaum	2nd edition	Prentice Hall of India publication.
2	Operating System	Crowley	2nd Edition	Tata McGraw Hill publication
3	Operating System	William Stalling	5th Edition	Pearson Education publication.
4	Shell Programming	Rebecca Thomas		Prentice Hall
5	The UNIX operating system	Maurice Bach		Prentice Hall publication.
6	Operating Systems	Achyut Godbole	3rd Edition	McGraw Hill Education

IV Semester
CT2252 – Lab. Operating Systems

Course Objective	Course Outcomes
1. To learn different types of OS & services provided by OS. 2. To understand process management and inter-process communication. 3. To know the deadlock concepts & deadlock avoidance algorithms. 4. To understand the need of memory management. 5. To learn different file system organization.	Upon successful completion of the course, the student will be able to: 1. Analyze & compare different OS & its services. 2. Apply & analyze CPU scheduling algorithm & also find different ways to synchronize the process. 3. Use different methods to handle deadlock. 4. Apply various memory management techniques. 5. Compare various disk scheduling algorithms based on their performances.

Expt. No.	Experiments based on
01	Basics of Linux commands and its use.
02	(i) Write a shell script to find maximum of 3 numbers. (ii)Write a shell script to check whether entered number even or odd
03	(i) Write a shell script to find factorial of a number (ii)Write a shell script to find the sum of all the digits of a number
04	Write a program to create a process using fork( ) system call.
05	Write a program to implement Non-Preemptive Priority scheduling algorithm.
06	Write a program to implement FIFO page replacement algorithm.
07	Write a program to implement First-Fit/Worst-Fit strategies
08	Installation of Linux Operating System.
09	Case study on Advanced Operating System (Ameoba).

IV Semester
CT2253– Advanced Data Structures

Course Objective	Course Outcomes
• To understand various types of linked lists, their structures and operations performed on them. • To understand structures and working of advanced data structures like skip list, disjoint set, hash table etc. • To understand various types of tree like multidimensional trees, tries etc • To understand graph data structures along with its representation methods and various terminologies	• Implement different types of linked list with various operations on them • Implement various operations on skip list, disjoint set and hash table • Identify and Implement various operations on different types of trees • Write program for finding shortest path between pair of entities

UNIT 1: **[8Hrs]**
Lists - Singly-linked lists, doubly linked lists and circular linked lists. Operations on linked list etc. Applications of lists in polynomial representation, multi-precision arithmetic. Multi linked structures.

UNIT 2: **[5Hrs]**
Introduction to Skip lists, data structures for disjoint set representation, hash table

UNIT 3: **[8 Hrs]**
Trees, binary trees, binary trees- basic algorithms and various traversals. Binary Search Trees (BSTs) and insertion, deletion in BSTs. Heaps and heap sort

UNIT 4: **[9Hrs]**
Height-balanced (AVL) trees, Splay tree, Red-black trees, Multi-way trees-B and B+ and applications

UNIT 5: **[5Hrs]**
Multidimensional trees, Tries and Pattern matching algorithms

UNIT 6: **[7Hrs]**
Graphs – their representation & traversals. Spanning trees, topological sort, shortest path algorithm, all-pairs shortest paths

Text Books:

SN	Title	Authors	Edition	Publisher
1	Data Structures with C	Seymour Lipschutz	Latest	TMH
2	Data structures using C	Reema Thareja	Latest	Oxford

Reference Books:

SN	Title	Authors	Edition	Publisher
1	Introduction to Algorithms	Thomas Cormen, Charles Leiserson, Ronal Rivest, Clifford Stein	3rd 2015	PHI
2	Fundamentals of Data Structures in C++	Ellis Horowitz, Sartaj Sahani, Dinesh Mehta	2nd, 2009	University Press
3	Data Structures and Program Design in C	Robert Kruse, Cl Tondo	2nd, 2009	Pearson Education

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

IV Semester
CT2254– Lab. Advanced Data Structures

Course Objective	Course Outcomes
• To understand various types of linked lists, their structures and operations performed on them. • To understand structures and working of advanced data structures like skip list, disjoint set, hash table etc. • To understand various types of tree like multidimensional trees, tries etc • To understand graph data structures along with its representation methods and various terminologies	• Implement different types of linked list with various operations on them • Implement various operations on skip list, disjoint set and hash table • Identify and Implement various operations on different types of trees • Write program for finding shortest path between pair of entities

Expt. No.	List of Programs
01	Program based on Linked list
02	Program based on implementing one data structure using another data structure
03	Program to Print the Alternate Nodes in a Linked List using Recursion
04	Program based on Binary tree
05	Program based on Binary search tree
06	Program for Heap sort
07	Program based on Tries
08	Program based on graph
09	Program for detecting presence of cycle in given graph G
10	Program for printing topological sort of given graph

IV Semester
CT2255 Mathematical Foundations for Data Analysis

Course Objectives	Course Outcomes
Students will learn: 1. Basis of statistics and linear algebra. 2. Concepts of probability, probability distribution 3. Concepts of sampling, sampling distribution, estimation and regression analysis 4. Concept of hypothesis testing and various other testing methods	Upon completion of the course students will be able to: **1.** **Apply** different visualization and summarizing technique to given data for its interpretation. **2.** **Solve** given problem using the probability theory and linear algebra **3.** **Perform** sampling distribution to estimate the given data and predict the solution using regression **4.** **Analyze** the data using hypotheses and other testing methods **5.** **Implement** various statistics methods on a given dataset using modern tool and write a report

Syllabus:

Unit	Content	Hours
1	**Introduction to Statistics and Linear Algebra:** The role of statistics, numerical and graphical methods for describing and summarizing data. Linear Algebra: Introduction to Vectors, Solving Linear Equations, Vector Spaces and Subspaces, Orthogonality and determinants, linear transformations.	8
2	**Probability and Probability distribution:** Basic terminology in probability and rules, Probabilities under conditions of statistical independence and dependence, Bayes Theorem. Random variables, expected values, variance, probability distributions, model given data	6
3	**Sampling Distributions and Estimation**: Sampling Distributions: Introduction to sampling, random sampling, non-random sampling, Introduction to sampling distributions, design of experiments. Estimation: Introduction, point estimates, interval estimates and confidence interval, determining the sample size in estimations.	6
4	Simple Regression and Correlation: Introduction, Estimation Using the Regression Line, Correlation Analysis Making Inferences about Population Parameters Using Regression and Correlation Analyses.	6
5	**Testing Hypotheses:** Introduction, Basic to the Hypotheses-testing Procedure, Testing Hypotheses, One sample test: Hypotheses Testing of Means when the population standard deviation is Known, Hypotheses Testing of Means when the population standard deviation is not known, Hypotheses Testing of proportions, Limitations of the tests of hypotheses	7

Unit	Content	Hours
6	**Parametric and Non-Parametric Testing:** Introduction to parametric and non-parametric tests, ANNOVA, Chi-square test, sign test, rank sum test.	6

Text Books:

SN	Title	Authors	Edition	Publisher
1	Statistics for Management	Richard I. Levin & David S. Rubin	7th Edition	Pearson Education
2	Introduction to Linear Algebra	Gilbert Strang	5th Edition	Wellesley - Cambridge Press
	Introduction to probability and statistics for engineers and scientist	Sheldon M. Ross	3rd Edition	Elsevier

Reference Books:

SN	Title	Authors	Edition	Publisher
1	Practical Statistics for Data Scientists, 50 Essential Concepts.	Peter Bruce & Andrew Bruce		
2	An Introduction to Statistical Learning with Applications in R	Gareth James, Daniela Witten, Trevor Hastie & RobertTibshirani		
3	MATHEMATICAL FOUNDATIONS FOR DATA ANALYSIS	JEFF M. PHILLIPS		

IV Semester
CT2256 : Lab. Mathematical Foundations for Data Analysis

Expt. No.	List of Experiments
01	Installation of any open-source interactive programming language used for data analytics and implement its basic functionality
02	Implement visualization techniques and analyze the data
03	Implement the functionalities of linear algebra
04	Implement different probability distributions
05	Implement sampling technique and analyze the data
06	Implement estimation and analyze the data
07	Implement regression technique for estimation
08	Implement hypothesis testing
09	Implement parametric and non-parametric tests

IV Semester
CT2257– Database Management Systems

OBJECTIVES	OUTCOMES
Students will learn: **1.** The database management system, database modelling and its designing concepts **2.** The mathematical representation of the database operations. **3.** The query language to maintain and extract the data from database. **4.** The database design, maintenance and operational issues.	Upon successful completion of the course, the student will be able to: 1. Understand database management system, through modelling and designing concepts 2. Apply the knowledge of query language to perform the operations on database. 3. Apply the knowledge of database concepts to perform the transaction and concurrency control 4. Design database using the entity relation diagrams and relational database aspects.

UNIT I **[07 Hrs]**

Introduction to Database Management System: General File System and Database system Concepts and Architecture, Data Models, Schemas and Instances, Abstraction & Different Levels of Data Abstraction, Data Independence: Logical & Physical Independence. Code of ethics for database designers. Entity-Relationship Model: Entities and Entity Sets, Relationships and Relationship Sets, Attributes, Mapping Constraints, Keys, Entity Relationship Diagram, Reducing E-R Diagrams to Tables, Generalization, Aggregation, Design of an E-R Database Scheme.

UNITII **[06Hrs]**

Relational Data Model: Structure of Relational Databases
Relational Algebra: Structure of relational databases, Fundamental Relational-Algebra Operations, Additional relational algebra operations, extended relational algebra operations, modification of the databases

UNITIII **[05Hrs]**

SQL: Data definition language (DDL), Data Manipulation Language (DML), Basic structure of SQL Queries, Set operations, Null Values, Nested subqueries, views, modification of database, transaction, Joins.

UNITIV **[07Hrs]**

Advanced SQL: SQL data types & schemas, Integrity Constraints, Domain Constraints, PL SQL, Stored procedures and functions Assertions, triggers, Advanced SQL Features.

IV Semester
CT2257– Database Management Systems

UNITV **[08Hrs]**

Relational Database Design: Pitfalls in Relational Database Design, Functional Dependencies, Normalization using Functional Dependencies.

Transaction Management: ACID Properties, Implementation of ACID Properties, Database processes to support ACID Properties, Schedules, and Testing of Serializability

UNITVI **[06Hrs]**

Concurrency Control: Lock-based Protocols, Timestamp Based Protocols, Validation Techniques.

Crash Recovery: Failure Classification, Log Based Recovery, Buffer Management, Checkpoints

TEXT BOOKS:

1. "Database System Concepts" Korth, Silberschatz: McGraw-Hill publication.
2. "Fundamentals of Database Systems ", Elmasri, Navathe& Gupta, Pearson Education.

REFERENCE BOOKS

1. Database System Concepts by Henry Korth and Others
2. Database Systems by Connolly, 3rd edition, Pearson Education.
3. Database Systems by S. K. Singh, Pearson Education.
4. Principles of Database Systems – Ullman, Golgotia Publications 1998.

IV Semester
CT2258– Lab. Database Management Systems

Course Objective	Course Outcomes
Student will be able: 1. To Understand fundamental database concepts and the different database systems, methodologies to conceptualize systems. 2. To model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model. 3. To understand, advanced develop applications involving advanced database systems. 4. To Know Various database concepts, Identify the key issues in developing database systems and applications.	Upon successful completion of the course, the student will be able to: 1. Design relational database for any given problem, write appropriate queries for accessing database. 2. design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs. 3. Examine the different operation of Transaction to design efficient system. 4. Compare among different types of database and its different concept.

Expt. No.	List of Programs
01	Design an ER Diagram.
02	Study and implement DDL Command.
03	Study and Implement Entity Constraints, Referential Constraints, Domain Constraints
04	Study and Implement DML Commands (select, Insert).
05	Study and Implement Update and Delete Command.
06	Study and Implement Aggregate function.
07	Study and Implement Inner join.
08	Study and Implement Outer Join.
09	To Design a full database system and queries for given topic

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology
SoE & Syllabus 2020
5th Semester Computer Technology

28 June 2020

V Semester

GE 2312 - Fundamental of Economics

Objectives	Outcome
1. Recognizes consumer's behavior and pricing. 2. Extrapolates an operation in market with productions constrain. 3. Describes the national income accounting and public finance. 4. Interprets international trade and institutions.	On completion of this course, the student will be able to: 1. Relate their buyer behavior to particular product and the pricing in the market. 2. Examine and classify various market structure and factors of production and its role in production process. 3. Analyze the national income accounting and the various issues related to banking, taxation, and inflation. 4. Elaborate about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institutions.

Unit No.	Contents	Max. Hrs.
1	Introduction to Economics and Consumers' Behaviors: Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, exceptions to law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, exception to law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand.	8
2	Production and Costs: Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation.	6
3	Market structures - equilibrium output and price: Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination.	7
4	National income accounting: Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation.	5
5	Money, Banking and Public Finance: Money: definition, functions and role, Evolution of money, Banking- reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes- Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (GST, Import duties), Revenue and capital expenditure	5
6	International Trade and Institutions: Definitions of closed vs. open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions.	5

V Semester
GE 2312 - Fundamental of Economics

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Modern Economics	13th Edition	H. L. Ahuja	S. Chand Publisher, 2009.
2	Modern Economic Theory	3rd edition	K. K. Devett	S. Chand Publisher, 2007

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Advance Economic Theory	17th Edition	H. L. Ahuja	S. Chand Publisher, 2009
2	International Trade	12th edition	M. L. Zingan	Vindra Publication, 2007
3	Macro Economics	11th Edition	M. L. Zingan	Vindra Publication, 2007
4	Economics: Samuelson,			
5	Monitory Economics	11th Edition	M. L. Sheth	Vindra Publication, 2007
6	Economics of Development and Planning	12th Edition	S. K. Misra and V. K. Puri	Himalaya Publishing House, 2006.

V Semester
CT2301 – Computer Networks

Objective	Outcome
1. The architecture and principles of today's computer networks 2. The protocols and their functionalities 3. The requirements for the future Internet and its impact on the computer network architecture.	On completion of this course, the student will be able to: 1. Identify appropriate design issues and explain network reference model. 2. Select appropriate protocol at various layers for the given application. 3. Solve problems in the networking domain. 4. Analyze the performance of network using different tools

Unit No.	Contents	Max. Hrs.
1	Introduction: The uses of computer networks, LAN's, MAN's, WAN's., protocol hierarchies, design issues for layers, interfaces and services, connection oriented and connectionless services, service primitives relationship of services to protocols. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference models, Critique of OSI model & protocols, critique of TCP/IP reference model.	6
2	Transmission Impairments, Transmission Media: Guided, unguided, Architecture of the Internet, Wireless LANs: IEEE 802.11, IEEE 802.16 , The Public Switched Telephone Network, Switching: circuit, packet and message switching, Modems	5
3	The Data Link Layer: Data link layer design issues- Framing, Error Control, Flow Control, Link Management, Error detection and Correction-Error-Correcting Codes, error-detecting codes, Elementary data link protocols-An Unrestricted simplex Protocol, A simplex stop and wait protocol, A simplex protocol for a noisy channel, Sliding window protocols- A one bit sliding window protocol, Go Back N protocol, Selective Repeat Protocol.	6
4	The Medium Access Sublayer: Static and Dynamic Channel allocation in LAN's and MAN's, Access Protocols-ALOHA, Persistent and Non Persistent CSMA, CSMA/CD, Collision free protocols, Binary countdown, Limited-connection protocol: The adaptive tree walk protocol.	6
5	The Network Layer: Network Layer design issues-services provided to the transport layer, Logical Addressing: Classbase and classless, Subnetting and Supernetting, Routing and Routing Algorithms-Flooding, Flow-Based, Distance Vector, Link State, Hierarchical. Congestion Control algorithms- Preallocation of buffers, Packet discarding, Choke packets, Load shedding, Jitter control. Leaky bucket algorithm, token bucket algorithm, IP header format (IPv4, IPv6).	6
6	The Transport Layer: Transport layer design issues-services provided to the session layer, Quality of service, transport service primitives, Elements of transport protocols-Addressing, Establishing and Releasing a connection, Flow control and Buffering, Multiplexing, Crash Recovery. Transmission Control Protocol (TCP). The Application Layer: DNS, SMTP, FTP, TFTP.	5

Text Books

SN	Title	Edition	Authors	Publisher
1.	Computer Networks		A.S. Tanenbaum	Pearson Publication
2.	Computer Networking		Behrouz A. Forouzan	McGraw-Hill Publication

V Semester
CT2302 – Lab: Computer Network

Sr. No.	Practical List
1	How to bring two computers in the network. Configure TCP/IP to configure Internet on your computer.
2	Use Network Utility Command like ping, ipconfig, netstat, tracert to observe the network details.
3	To implement Hamming Code using C and C++.
4	To implement Dijkstra's Routing algorithm using backtracking approach.
5	Use traffic monitoring tool Wireshark to observe network traffic with packet details.
6	Configure router. Configure network using Cisco Packet Tracer software and show packet transmission from source to destination.
7	Configure Virtual LAN using cisco packet tracer.
8	Use Openssl command to perform Asymmetric key encryption (RSA) and also implement RSA algorithm.
9	To study Wireless network of YCCE campus
10	Advance Practical: Introduction to NS2

V Semester

CT 2303- Theoretical Foundation of Computer Science

Objective	Course Outcome
1. To introduce students to the mathematical foundations of computation including automata theory, regular languages. 2. To understand of different types of grammars and the properties of Context Free Grammar 3. To study the concepts of Push Down Automata and Turing machine. 4. To understand decidable and undecidable problems.	On completion of this course, the student will be able to: 1. Construct automata, regular expression for any pattern. 2. Write context free grammar for various languages. 3. Design push down automata and Turing Machine for a language. 4. Derive whether a problem is decidable or not.

Unit No.	Contents	Max. Hrs.
1	Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Design of Finite State Machines, Acceptance of strings and languages, Non-Deterministic Finite Automation, Deterministic Finite Automation, Equivalence between NFA and DFA, NFA with ε-transition, Minimization of FA.	8
2	Regular Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets (Proofs not required), Regular grammars, Right linear and left linear regular grammars, inter-conversion between LLG & RLG, Equivalence between regular grammar and F.A., Inter-conversion between RE and RG.	7
3	Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal form, Greibach normal form.	7
4	Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Inter-conversion, Closure of properties of CFL, DPDA & NDPDA.	6
5	Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Church‟s hypothesis, Chomsky hierarchy of language, Linear bounded automata and context sensitive language, Universal Turing Machin	6
6	Un-decidability Problems related to Recursive enumerable language and Turing Machine, post correspondence problem. Recursive function Theory –Basis functions and operations on them. Bounded minimization preemptive μ recursive function unbounded minimization and recursive function	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Automata Theory, Languages, and computation	3rd Edition	Hopcroft J.E., Rajeev Motwani, Jeffrey D. Ullman	Pearson Education
2	Introduction to languages and the Theory of Computation	3rd Edition	John C.Martin	Mc Graw Hill

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester

CT 2303- Theoretical Foundation of Computer Science

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to the Theory of Computation	2nd Edition	Michael Sipser	GALE CENGAGE Learning
2	Theory of Computation	1st Edition	Dr. O. G. Kakde	Laxmi Publication

V Semester

CT 2311- PE I: Randomized algorithms

Objective	Course Outcome
1. Understand basic concepts of probability calculus in algorithmic context. 2. Analyze the expected running time of simple randomized algorithms. 3. Understand simple randomized algorithms that run fast or that return the correct output with high probability. 4. Study the probabilistic method to show the existence of certain combinatorial objects.	On completion of this course, the student will be able to: 1. Apply basic concepts of probability calculus in algorithmic context. 2. Derive good upper bounds for the expected running time of simple randomized algorithms. 3. Design simple randomized algorithms that run fast or that return the correct output with high probability. 4. Apply the probabilistic method to show the existence of certain combinatorial objects.

Unit No.	Contents	Max. Hrs.
1	Introduction to Randomized Algorithms Probability Review	5
2	Regular Moments and Deviation The Probabilistic Method	5
3	Markov Chains – I Markov Chain – II	5
4	Number Theoretic Algorithms Graph Algorithms	5
5	Approximate Counting Data Structures	5
6	Computational Complexity Summary	5

Text Books

SN	Title	Edition	Authors	Publisher
1	Probability and Computing: Randomized Algorithms and Probabilistic Analysis.	2005	Michael Mitzenmacher and Eli Upfal.	Cambridge University Press

Reference Books

SN	Title	Edition	Authors	Publisher
1	Randomized algorithms	1995	Rajeev Motwani and Prabhakar Raghavan.	Cambridge University Press

V Semester
CT 2312- PE I: Lab: Randomized algorithms

Sr. No.	Practical list
1	WAP to implement randomized quicksort algorithm.
2	WAP to implement randomized algorithm of your choice.
3	WAP to implement first probabilistic method
4	WAP to implement second probabilistic method.
5	WAP to implement first number theoretic algorithms
6	WAP to implement second number theoretic Algorithms
7	WAP to implement first randomized graph algorithms
8	WAP to implement second randomized graph algorithms
9	WAP to implement first approximate counting
10	WAP to implement second approximate counting

V Semester

CT2313 – PE1: Mobile Operating System

Objective	Course Outcome
1. Understand different Mobile Operating Systems and to learn the Android platform architecture. 2. To have basic requirement & different controls for design & development of mobile app. 3. Gain an understanding data management & inter application communication. 4. To learn application configuration & publishing.	On completion of this course, the student will be able to: 1. Compare different flavors of mobile operating system and their specific features. 2. Create an application using different controls. 3. Prepare a project which can manage data and can communicate with native application 4. Publish the designed application which can handle multiple devices with different configurations

Unit No.	Contents	Max. Hrs.
1	Mobility Technology Trends, Mobile Ecosystem Overview, Mobile Devices Overview, Mobile Development, Methodology, Wireless Networks Overview, Proximity Technologies	5
2	Introduction to Android: Android Overview, Introduction to activities/Fragments, Introduction to services, broadcast receivers and content providers, Android Application Structure, Source Files, Resources, Assets and Manifest. IDE Usage: Basic IDE Operation (Eclipse), Project Creation and Handling (App Creation through Wizard), Running App on AVD and Device, DDMS and Debugging. User Interface Designing-1: Layout Overview, Linear Layout, Relative Layout, Frame Layout, Widgets (UI Controls) Overview and Text View, Image View, Button.	6
3	User Interface Designing-2: Notification Bar, Toast and DSialog, Listview, and Adapter, View Reusability, Spinner and Comples View. Broadcast Receivers: Broadcast receivers overview, Manifest Registration vs Component Registration, Unregistration, SMS Event Receiver, Boot Event Receiver and NetworkEvent Receiver. Service: Service Overview, Service Lifecycle, Service Usage Applicability and Message Binder, Action Bar and Context Menu.	5
4	Data Management: Data Storage Overview, Persistent v/s Local, Shared Preferences, Internal Storage and SQLite Database, Threads and Processes: Thread, Process overview, Async Task, Loaders, Handlers, Intent: Intent, Intent Filters and Intent Resolution, Component Activations: Activity Stack, Launch Modes and Activity Flags	6
5	Inter Application Communication: Inter app Communication requirement overview and Intents Based. Communication with Native application: Gallery, Camera, SMS App and Contacts, Content Providers: Content Provider Overview, Need and Usage, Content Provider Structure. Network Communication: Network Communication basics and Connecting to server/request creation, Response Formats XML/JSON and Rest/Web Services. URI Permissions, Views, Triggers	5
6	User Interface Designing-3: Style and Themes, View and Layout animation Application Configuration: Localization, Orientation and Config Change Handling, Handling multiple resolution devices, Device and Tablet consideration, Support Library. Application Publishing: Application Signing, Application Distribution, Application Publishing, Google Play	5

Text Books

SN	Title	Edition	Authors	Publisher
1	Professional Android Application Development	–	Reto Meier	Wiley Publishing Inc

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
CT2314 – PE1: Lab: Mobile Operating System

Sr. No.	Practical List
1	Create a dialog box having login functionality.
2	Create an application which has following features: • Show list of numbers on screen along with the type. • Bottom of the screen there should be a row that contains three elements: i. Spinner (Show the predefined phone number type like home, office, mobile, etc) ii. Text box to enter actual number iii. Button saying "Add" - Clicking on this should take the input from the first two items and add a new row item to the list. • On pressing back key (exiting from the application), it should show a confirmation dialog with appropriate title, message and two action buttons "OK" and "Cancel"
3	Create an application which has following features: • Clicking on "Cancel" should show a toast message "We are happy to be with you." and close the dialog. • Clicking on "OK" should close the dialog, exit from the application and generate a notification that says "Press me to go back to application". Then clicking on the notification should restart the application.
4	Create an application which has following features: • Launch phone contacts, display the selected contact in your application. • Try to launch Camera, Gallery & SMS application.
5	Create an application using Listview, Services, Navigation drawer & tab view
6	Create an application for changing background color based on selection from list view
7	Create an application for applying different themes on text views.
8	Create an application using Launch Modes.
9	Create an application displaying any animation.

V Semester

CT2315- PE I: Advanced Web Technologies

Objective	Course Outcome
1. To learn basic aspects of Web services, Server side scripting, Advanced CSS 2. To introduce with AJAX 3. To learn Basics of Advanced Client side programming 4. To learn JavaScript	On completion of this course, the student will be able to: 1. Design Web pages using HTML5, CSS3 2. Perform various operations using AJAX 3. Use features of Client side programming 4. Develop Web pages using JavaScript

Unit No.	Contents	Max. Hrs.
1	Web Services: Overview of HTTP, FTP, SMTP Protocols, Web Servers, Server-side scripting, REST	6
2	Basics of Client side programming: Document Object Model (DOM), Overview of DOM Element Selector 6 (Examples in jQuery), Document ready function, HTML5, Audio and Video, Forms, CSS3 -Introduction to CSS3, What is CSS3? Differences between CSS3 and earlier CSS specifications, How browsers are handling CSS3? CSS3 Selectors- Selectors Overview, Explore specific selectors, Designing and Developing with CSS3-Background and color Typography, CSS3 Box Model, Page layout, Media Queries, Implementing CSS3, Best Practices, Advantages and limitations of working with CSS3.	8
3	Rich Internet Applications (RIA): Overview of Traditional Web Communication Processes and Technologies, Web 2.0, Introduction to AJAX-Create an XML Http Request Object, interacting with a Web Server, Processing Client Requests, Securing AJAX Applications, Progressive Web Apps, Form Factor detection, Browser detection, Feature detection	7
4	Advanced Client side programming: Semantic Elements, WebSockets, SSE, WebRTC, Web Graphics & Canvas, WebGL, WebWorkers, SVG. Libraries: Modernizer, Polyfills, Polymer	8
5	JavaScript: Functional programming, Asynchronous programming, Event driven systems, Debugging, Testing, Workflow optimization, and deployment pipelines, Web Components, Introduction to Web Frameworks-React, Node.js, Angular' JS	8
6	Server-Side Programming: Introduction to the server-side programming, Server-side web frameworks like Django, Express. etc.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX	2013	Kogent Learning Solutions Inc.	Dreamtech Press India Pvt. Ltd
2	Javascript Bible	7th	Danny Goodman Michael Morrison Paul Novitski Tia Gustaff Rayl	Wiley India Pvt Ltd

Reference Books

SN	Title	Edition	Authors	Publisher
1	Web Enabled Commercial Application Development Using HTML, JavaScript, DHTML (With CD) and PHP	4th Revised Edition	Ivan Bayross	BPB Publication

V Semester
CT2316- PE I: Lab: Advanced Web Technologies

Sr. No.	Practical List
1	Write a JavaScript function that creates a table, accept row, column numbers from the user, and input row-column number as content (e.g. Row-0 Column-0) of a cell.
2	Create employee registration webpage using HTML5 form objects
3	Implement CSS3 for Online shopping system
4	Create a dynamic web page which displays arithmetic operations [addition, subtraction, division, multiplication and modulus] using HTML Frame
5	Write a suitable script which show methods of Server object [HTML Encode, URL Encode, Mappath, Execute and Transfer]
6	Write a script which creates and retrieves Cookies information
7	Create a dynamic web page which displays capabilities of a web browser using Browser Capabilities Component using JavaScript
8	Create a simple XMLHttpRequest and retrieve data from a TXT file.
9	Create a simple XMLHttpRequest and retrieve data from a TXT file.
10	Create a simple script to download Images Using AJAX,
11	Create a simple script to Auto-Populate Select Boxes using AJAX

V Semester

CT2317– PE I: Introduction to Geographical Information System

Objective	Course Outcome
1. Get an overview of fundamental concepts of GIS, applications and study. 2. Explore the Coordinate Systems, Map Projections metadata, spatial data, spatial analysis and new trends in GIS. 3. Comprehend the Making and sharing of maps.	On completion of this course, the student will be able to : 1. Demonstrate the fundamental concepts of GIS 2. Develop the apprehension of various concepts in GIS 3. Design and share maps.

Unit No.	Contents	Max. Hrs.
1	Introduction to GIS: Concepts of GIS, Applications currently used by Industry &Govt and their common usages. Fundamental concepts of GIS: GIS terminologies, various components of GIS software and types of GIS applications. The GIS Software Market, Role of GIS in smart cities.	6
2	Fundamentals of Coordinate Systems and Map Projections: History of Coordinate Systems, Geographic Coordinate Systems, Map Projections and Geo referencing.	7
3	Fundamentals of Spatial Data: Introduction to Spatial Data Formats, Creation of Vector data, Organization of Spatial Data and Displaying Spatial Data, metadata and spatial data standards.	7
4	Making Sharing Maps: Map Creation and Design, Sharing Maps as Services, Sharing Spatial Data and using shared Spatial Data.	6
5	Fundamentals of Spatial Analysis: Spatial Analysis, analyzing Vector and Raster data, overview of analysis tools, analyzing Spatial Relationships and sharing Analysis Results	7
6	New trends in GIS: GIS Trends Changing the World, Machine learning in GIS, Geospatial big data, Integration of GIS with different technologies, GIS with LiDar data.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	An Introduction to Geographical Information Systems	3rd t Edition (2006)	D. Ian Heywood, Sarah Cornelius & Steve Carver	Pearson Prentice Hall

Reference Books

SN	Title	Edition	Authors	Publisher
1	Getting to Know ArcGIS	4th Edition (2015)	Michael Law & Amy Collins	Esri Press
2	Mathematical Modeling in Geographical Information System global Positioning System and Digital Cartography	4th Edition (2006)	H. S. Shrama, D. R. Ram, Rama Prasad & P. R. Binda	Concept Publishing Company

V Semester
CT2318 – Lab - PE I: Introduction to Geographical Information System

Sr. No.	Practical List
1	To explore different proprietary GIS and Open GIS software.
2	To study the installation of GIS Desktop Software and explore various components of the GIS Desktop Software.
3	To explore various coordinate systems. Download any shape file and explore its coordinate system and change the existing coordinate system.
4	To create Geodatabase, layer files and shape files from the scratch.
5	To explore data formats using GIS Desktop Software and vector data points such as points, lines and polygon and create the map using simple vector data structure.
6	To create map in data view and layout view.
7	To install GIS Server, creating web services out of GIS maps or data, sharing maps, using GIS web services.
8	Geoprocessing tools
9	Model builder
10	Project

V Semester

CT2319- PE I: Computer Graphics

Objective	Course Outcome
1. To learn basic aspects of computer graphics. 2. To learn aspects of visual communication and understand presentation issues in computer graphics. 3. To learn interactive handling of images and text. 4. To understand computer animation and design animation program.	On completion of this course, the student will be able to : 1. Draw lines and polygons and fill polygons using basic graphics functions 2. Select proper imaging technology to be used for image creation 3. Handle interactive software with images & text 4. Develop animated programs for various applications.

Unit No.	Contents	Max. Hrs.
1	Introduction: Point Pixel Plotting. Line Generation Algorithms, polygon filling algorithms	8
2	2D Graphics: 2D Transformations, Clipping, Window, View Port Mapping, Graphical User Interfaces and Interactive input methods, picture construction techniques	6
3	3D Graphics: 3D Transformation, 3D Viewing, Visible Surface Detection, Back Face Detection, Depth Buffer Method, Scan Line Method, Virtual Reality Environment	7
4	Visual Communication: Creative Process, Digital Imaging Technology, Still Image, Digital Imaging, Using Images in Multimedia, Images on Web, Color Models.	8
5	Interactive Illustrated 3D with Images and Text: Generating Illustrated Documents, Consistency of Rendered Images and their Textual Labels, Architecture, Zoom Techniques for Illustration Purpose, Interactive handling of Images and Text, Figure Captions for Anatomical Illustrations.	8
6	Computer animation: Design of animation sequence, general computer animation functions raster animation, computer animation languages, key frame systems, motion specifications.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	"Computer Graphics in C Version	2nd	Donald Hearn and M. Pauline Baker	Pearson Education

Reference Books

SN	Title	Edition	Authors	Publisher
1	Multimedia: Computing, Communication and applications	2nd	Raf Steinmetz and Klara Nahrstedt	Pearson Education.
2	Multimedia Graphics	-	John Villamil Casanova and Leony Fernandez-Elias	Prentice Hall India
3	Computer Visualization-Graphics Abstraction and Interactivity	1st	Thomas Strothotte	Springer Verlag, Berlin

V Semester
CT2320 – Lab - PE I: Computer Graphics

Sr. No.	Practical List
1	WAP to implement line generation using DDA algorithm.
2	WAP to implement Bresenham's line generation algorithm.
3	WAP to fill a polygon using any one of the polygon filling algorithms.
4	WAP to perform to perform simple 2D transformations like Translation, Rotation and Scaling.
5	WAP to perform to perform composite 2D transformations
6	WAP to create simple three-dimensional object like cube apply transformations like Translation, Scaling and Rotation.
7	Image enhancement, Image transformation from color to gray scale.
8	WAP to create simple GIF animated images.
9	Creation of moving ball or any object.

V Semester
CT2321 - PE-I: REAL TIME SYSTEMS

Objective	Course Outcome
1. Explore the basics of RTOS its characterization and classification. 2. Understand standard scheduling algorithms, its taxonomy and optimization. 3. Learn resource sharing techniques for real time systems. 4. Understand synchronization of multiprocessor and distributed system. 5. Get an overview of Commercial RTS, its use and operations	On completion of this course, the student will be able to : 1. Understand RTS, its characteristics and application in Hard and soft domain 2. Use and Compare various standard RTS scheduling algorithms. 3. Understand resource sharing techniques of Real Time System. 4. Choose appropriate synchronization techniques in multiprocessor and distributed system based on Aporadic and Sporadic job. 5. Apply comparison of Commercial RTS, from designing perspective

Unit No.	Contents	Max. Hrs.
1	Introduction to real time systems: Digital control, high-level controls, signals processing, real time applications. Hard and soft real time system: Jobs & processors, release times, deadlines, timing, constraint, Hard & Soft timing constraint, Hard real time systems, soft real time systems. Modeling of real time systems.	6
2	Approach to real time scheduling: Clock-driven approach, weighted round-robin approach, priority-driven approach, dynamic versus static systems, effective release times and deadlines, optimality of EDF & LST algorithms, non optimality of the EDF & LST, challenges in validating timing constraints in priority-driven systems, off line versus on-line scheduling. Clock driven scheduling: notation & assumptions, static timer- driven scheduler, general structure of cyclic schedules, cyclic executives, improving the average response time of a periodic jobs, scheduling sporadic jobs, practical consideration and generalizations, algorithms for constructing static schedules, pros-cons of clock-driven scheduling.	10
3	Priority-driven scheduling: Static assumptions, fixed-priority versus dynamics priority algorithms, maximum schedulable utilization, optimality of the RM & DM algorithms, a schedulability test for fixed priority tasks with short response times & with arbitrary response times, sufficient schedulability conditions for the RM and DM algorithms.	8
4	Scheduling aperiodic & sporadic jobs in priority-driven systems: assumptions & approaches, deferrable servers, sporadic servers, constant utilization, total bandwidth and weighted fair-queuing servers, slack stealing in dead-line driven systems, slack stealing in fixed-priority systems, scheduling of sporadic jobs.	8
5	Resources and resource access control : assumption on resources and their usage, effects of resource contention & resource access control, non preemptive critical sections, basic priority-inheritance protocol, basic priority-ceiling protocol, stack-based priority ceiling protocol, use of priority-ceiling protocol in dynamic- priority systems, preemption-ceiling protocol, controlling accesses to multiple-resources, controlling concurrent accesses to data object.	6
6	Real-time Communication: model of real time communication, priority-based service discipline for switched networks, weighted round-robin service discipline, medium-access control protocols of broadcast network and resource reservation protocols, real-time protocol, and communication in multicomputer systems.	6

V Semester
CT2321 - PE-I: REAL TIME SYSTEMS

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Real-Time Systems	5th (2013)	Jane W. S Liu	Pearson Education
2	Real Time Systems	3rd(2010)	C. M. Krishna & Kang G. Shin,	McGraw Hill Publication.

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Real-Time Systems: Theory and Practice	2007	Rajib Mall	Pearson Education.
2	Real-Time Computer Control an Introduction	2nd	Stuart Bennett	Pearson Education
3	Real time systems	1st	Albert M. K. Cheng, J. Willey and sons	Editors Dan Ionescu, Aurel Cornell world scientific
4	Real time systems	2nd	Kopetz, Hermann,	Springer

V Semester
CT2322 - PE-I: REAL TIME SYSTEMS

Sr. No.	Practical List
1	To study different types of Real Time Operating System
2	To study Commands of LINUX Operating System for real time application.
3	Write a program to create processes in LINUX environment.
4	Write a program to implement round robin scheduling in LINUX environment.
5	Write a program to implement Priority-driven scheduling
6	Write a program to create massages Queue for Inter Process communication.
7	Write a program to implement multithreading in LINUX environment.
8	To Study basic priority-inheritance protocol, basic priority-ceiling protocol.
9	To Study System calls for process creation, suspension and Termination.
10	To study shared memory in Inter-process Communications.

V Semester

CT2323 – PE - I: Privacy and Security in Online Social Networks

Objective	Course Outcome
1. To learn the use of different API's and tools for collecting online social networking data. 2. To understand privacy and policies for online social media. 3. To understand eCrimes and Attacks in online social media. 4. To learn profile linking on online social media	On completion of this course, the student will be able to : 1. Collect online social networking data using different tools and API's. 2. Review privacy and policies in social media. 3. Categorize eCrimes and Attacks in OSM. 4. Link profiles of user on OSM.

Unit No.	Contents	Max. Hrs.
1	Incidents, OSM APIs and tools for data collection, Trust and Credibility on OSM	7
2	Misinformation on Social Media, Privacy and Social Media, Privacy and Pictures on Online Social Media	7
3	Policing and Online Social Media	6
4	eCrime on Online Social Media, Link Farming in Online Social Media, Nudges, Semantic attacks: Spear phishing	8
5	Profile Linking on Online Social Media, Anonymous Networks	7
6	Privacy in Location Based Social Networks, Beware of What You Share Inferring Home Location in Social Networks, On the dynamics of username change behavior on Twitter, Boston Marathon Analyzing Fake Content on Twitter.	8

Reference Books

SN	Title	Edition	Authors	Publisher
1	Programming Collective Intelligence: Building Smart Web 2.0 Applications	First Edition	Toby Segaran	
2	Practical Web 2.0 Applications with PHP	2007	Quentin Zervaas	
3	Building Social Web Applications	2009	Gavin Bell	
4	The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws	Second Edition	Dafydd Stuttard, Marcus Pinto	

V Semester
CT2324 – Lab - PE I: Privacy and Security in Online Social Networks

Sr. No.	Practical List
1	Collect data from Facebook using the graph API in Unix environment.
2	Collect data using twitter API in Unix environment.
3	Store the data collected from various OSNs in MySQL database.
4	Store the data collected from various OSNs in MongoDB.
5	Represent social media data in a graph format consisting of nodes and edges
6	Analyzing textual data obtained from Facebook using Python NLTK.
7	Generate graphs and clusters of data of social networks like Facebook and Twitter using Gephi.

V Semester
CT2325 – OE I: Introduction to DBMS

Objective	Outcome
To understand basic database concepts by students whose basic degree is not in Computer or IT.	Upon successful completion of this course, the student will be able to: Students should be able to design database forgiven situation, write appropriate queries for accessing database.

Unit No.	Contents	Max. Hrs.
1	An Overview of the Database Management System: What is database? Why database? database system, database management system (DBMS), advantages of DBMS	6
2	An Architecture of the Database system: Three levels of architecture, mappings, role of database administrator (DBA), E-R model, three approaches of DBMS relational, hierarchical and network.	6
3	Relational Database Management System (RDBMS): Introduction, RDBMS terminology, relational model, base tables, key	5
4	The SQL Language: Introduction, Characteristics of SQL, data definition command	5
5	Data manipulation commands	5
6	Introduction to XML	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Data base System Concepts	Fifth Edition	Silberschatz A, Korth H.F and Sudarshan S	Tata McGraw-Hill.
2	Fundamentals of Database System		R. Elmasri, S. B Navathe	Pearson Education.

Reference Books

SN	Title	Edition	Authors	Publisher
1	Fundamentals of DBMS		Leon A and Leon M	Tata McGraw-Hill
2	DBMS		Gill P. S	I.K. International
3	Database Management Systems		Leon A and Leon M	Vikas Publishing House
4	Database Systems: Concepts, Design & Applications		Singh S. K	Pearson Education

V Semester

CT2326 – OE I: Essentials of IT

Objectives	Outcome
1. To understand basics of algorithm design, object-oriented concepts and Java programming fundamentals. 2. To understand the database system concepts, relational database design basics and learn SQL for various data operations. 3. To understand basics of web page design and Javascript programming fundamentals 4. To understand software engineering basics and various SDLC phases.	Upon successful completion of the course, the student will be able to: 1. Develop algorithm and write pseudo code for a given problem statement. 2. Construct Entity-Relationship Model and design RDBMS for a given problem statement. 3. Design static and dynamic web pages using HTML and Javascript and write simple programs in Javascript. 4. Apply software engineering concepts in any software project implementation.

Unit No.	Contents	Max. Hrs.
1	Programming fundamentals of Java: problem solving skills, Algorithm – representation using pseudo code, algorithm properties. Programming in java- programming constructs in JAVA, control structures type casting, SDLC overview and need for Object oriented approach, object-oriented concepts, introduction to UML.	8
2	OO fundamentals – Java Implementation: OO fundamentals, coding standards, reference variables and objects in memory, methods, „this" reference. Data structures: data structures, linear data structures, non- linear data structures.	8
3	Data base basics- data storage, need for DBMS, functions of DBMS, data perspectives in DBMS, types of data models, relational model and keys, Database Design – Database life cycle, Data requirements, logical design – ER modeling, converting ER model to relational schema, functional dependency, normalization.	8
4	SQL – need for SQL, types of SQL statements, data types in SQL, SELECT statement with various operators, single row and multi row functions, group by and having clauses.	8
5	Introduction to web technologies: Computer Networks, HTML tags and CSS, Implementation of Java Scripts, Operators and control structures, function and dialog boxes, DOM element.	8
6	Software Engineering – Basics, SE models and approaches, Requirement developing activities, software design and construction, software testing, introduction to user experience, Project categories and project management phases, software quality.	8

Text Books:

SN	Title	Edition	Authors	Publisher
1	Java: The complete reference	7th Edition	Herbert Schildt.	McGraw-Hill
2	Database System Concepts	5th Edition	Silberschatcz, Korth, Sudarshan	McGraw-Hill Education
3	Software Engineering: A Practitioner's Approach	6hEdition	Roger Pressman	McGraw Hill Higher Education

V Semester
CT2327 – OE I: Image Processing

Objectives	Outcomes
1. Overview the Fundamental concepts of Digital Image Processing 2. Explore image enhancement techniques in spatial domain and frequency domain 3. Understand the fundamental concept of image compression 4. To Study various similarity based, and dissimilarity-based image segmentation approaches. 5. Understand the basic concepts of image representation and description.	Upon successful completion of the course, the student will be able to: 1. Describe and understand Basic relationships between pixels. 2. Compare and Implement various image enhancement techniques in spatial domain and frequency domain. 3. Compare and illustrate different image compression techniques to understand the advantage of image compression 4. Identify and demonstrate the applications of similarity based and dissimilarity-based approaches for image segmentation. 5. Interpret and illustrate various representation techniques.

Unit No.	Contents	Max. Hrs.
1	Introduction: Fundamental Steps in Image Processing, Elements of DIP systems, A Simple Image Model, Sampling and Quantization, Some Basic Relationships between Pixels.	5
2	Image Enhancement in the Spatial Domain: Introduction to Spatial domain, Basic Gray Level Transformations, Histogram Processing, Histogram Equalization, Spatial Domain Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	6
3	Transforms: Introduction to the Fourier Transform, Discrete Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, Typical Applications. Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters.	6
4	Image Compression: Fundamentals of Image compression, coding redundancy, spatial and temporal redundancy, Irrelevant Information, Measuring Image Information, Image compression models, Various compression methods.	6
5	Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.	6
6	Image Representation: Chain Codes, Polygonal Approximations, Signatures, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to various color image processing models.	6

Text Books:

SN	Title	Edition	Authors	Publisher
1	Digital Image Processing	3rd edition	Rafael C. Gonzalez and Richard, E. Woods	Prentice Hall
2	Digital Image Processing		Jayaraman, S. Esakkirajan, T. Veerakumar	Tata McGrawHill

V Semester

CT2327 – OE I: Image Processing

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Digital Image Processing		A. K. Jain	Prentice Hall
2	Image Processing Principles & Applications		Tinku Acharya and Ajoy K. Ray	Willey Inter-Science

V Semester
CT2328 - Operating System Concepts

Objectives	Outcomes
1. To understand the concepts of Linux and its potential. 2. To get a knowledge of shells	Upon successful completion of the course, the student will be able to: 1. Use LINUX operating system. 2. Write Shell scripts

Unit No.	Contents	Max. Hrs.
1	Introduction: History of Linux and Unix, Linux Overview, Linux releases, open linux	6
2	Linux Commands and Filters : Mkdir, CD, rmdir, pwd, ls, who, whoami, cat, more, fail, head, concept of, mv, chmod, grep,wc, comm., split, sort, diff, kill, write, wall, merge, mail, news	5
3	Shell: The command line special characters and file arguments, standard input/output and redirection, pipes, redirecting and piping with standard errors, shell scripts, jobs.	5
4	Linux file Structure: Linux files, file structure, listing displaying and printing files, managing directories, file and directory operations.	5
5	Vi Editor: Vi editing commands advanced Vi editing commands, line editing commands, options in Vi.	6
6	System Administration: System management, managing users, installing and managing devices, floppy disk management, file system administration, backups.	6

Text Books:

SN	Title	Edition	Authors	Publisher
1	Linux – The Complete Reference		Richard Peterson	Tata McGraw Hill, New D e l h i
2	Linux – Install and Configuration Black Book		Die Annleblanc and Issac Yates	IDG Books India Private Ltd., Delhi
3	Unleashed Linux			Tech Media Publishers

V Semester
CT2329 – OE I: Introduction to Salesforce

Objectives	Outcomes
1. To realize the concepts and principles of Salesforce CRM. 2. To appreciate the role and changing face of Salesforce CRM as an IT enabled function. 3. To have knowledge of a CRM implementation in aura framework by understanding the business case and importance of implementing such a system in an organization.	Upon successful completion of this course, the student will be able to: 1. Employ the knowledge of customer-centered organization and implement the integral processes within an organization that are automated and how does the automation create predictability and efficiencies. 2. Represent a customize a CRM application for organization to suit their business needs. 3. Determine CRM strategies by understanding customers' preferences for the long-term sustainability of the Organizations.

Unit No.	Contents	Max. Hrs.
1	Introduction to Cloud: Definition of Cloud Computing, Cloud Architecture, Cloud Types, Service models, Deployment models, Examining the Characteristics of Cloud Computing, Benefits of cloud computing, Disadvantages of cloud computing.	8
2	CRM Concepts and its tools: Definition, History, Key Benefits, Service Level Agreements (SLAs), creating and managing effective SLAs. Architecture, Service Nature of Salesforce, Features, Products and its overviews, Traditional CRM vs. Salesforce CRM.	7
3	CRM Administration and Data Model Design: Lightning and classic UI and differences, Creation of org, Object Manager, App Manager, Setup, App creation, tabs, Types of Objects, Data Types, Sandboxes, Understanding Relationships and its limitations, Types of Relationship and their differences, Junction Object, formulas, Dependency picklist fields, Validation Rules.	7
4	Data Management with CRM Tool: Record details, List Views, Filters, Actions Page layouts, Compact Layouts, Introduction to Workflows, email templates, Limitation of workflows, approval processes, Process Builder, Lightning Flow, Community Creation, Reports and Dashboards.	8
5	Security Model: Introduction to Profiles and Permission Set, Overview of Data Security, Control access to org, object, field, record, OWD, Role and Roles Hierarchy, Sharing Rule, Sharings Objects, Apex Sharing.	7
6	CRM Tool Development: Introduction to Apex, Collections, SOQL and SOSL, DML Operations. Lightning Aura Component: Introduction to Aura component, Advantages, attributes handling in aura component.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Salesforce CRM: The Definitive Admin Handbook Paperback	2nd	Paul Goodey	Packt Publishing Limited
2	Customer Relationship Management Concept and Cases	1st (2013)	Alok Kumar Rai	Prentice Hall of India Private Limted
3	Customer Relationship Management	1st (2012)	V. Kumar & Werner J.	Wiley

V Semester
CT2329 – OE I: Introduction to Salesforce

Reference Books		
SN	**Title**	**Link**
1	CRM Tool Links (Online)	http://help.salesforce.com

V Semester
CT2331 – OE II: Soft Computing

Objectives	Outcomes
1. Understand the applications of soft computing in various domains. 2. Have an appreciation of Fuzzy logic and its applications. 3. Gain an understanding of Rough Set theory and its usage as soft computing. 4. Develop an understanding of single-objective optimization problems using gas. 5. Introduce artificial neural networks and its applications	Upon successful completion of the course, the students will be able to: 1. Reveal different applications of soft computing to solve problems from different domains 2. Demonstrate Fuzzy logic and its applications 3. Explain Rough Set theory and its usage as soft computing 4. Relate single-objective optimization problems using GAs. 5. Describe Artificial neural networks and its applications

Unit No.	Contents	Max. Hrs.
1	Introduction to Soft Computing: Concept of computing systems, Soft computing versus Hard computing, characteristics of Soft computing, some applications of Soft computing techniques, Learning Process, Overview of Supervised and un-supervised learning, Single and Multi-Layer Network, Associative Memory	6
2	Introduction to Fuzzy Logic: Introduction to Classical Sets, Fuzzy sets, Fuzzy membership functions, properties and operations on Fuzzy sets	6
3	Fuzzy Relations: Fuzzy relations, propositions, rules, and inferences, Fuzzy logic controller design, Defuzzification, some applications of Fuzzy logic	7
4	Rough Set Theory: Fundamental concepts: Information system or information table, In-discernibility relation, Approximations, Decision tables and decision algorithms, Dependency of attributes, Reduction attributes in information system, Applications of rough set theory	7
5	Genetic Algorithms: Concept of Genetic algorithm, basic terminologies in Genetic algorithm, GA operators, stopping criteria for genetic algorithm, solving single-objective optimization problems using Gas, advantages and limitations of GA, applications of GA	8
6	Artificial Neural Network: Introduction to Biological neurons and it's working, simulation of biological neurons to problem solving, different ANN architectures, training techniques for ANNs, Applications of ANNs to solve some real life problems	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Principles of soft computing		S, N, Sivanandam, S. N. Deepa	Wiley

Reference Books

SN	Title	Edition	Authors	Publisher
1	An Introduction to Genetic Algorithm		Melanic Mitchell	MIT Press
2	Fuzzy set theory: Foundations and Applications		George J. Klir	

V Semester

CT2332 – OE II: Software Testing

Objective	Outcome
1. Understand Software testing fundamentals / principles. 2. Learn systematic approach to software testing using strategies. 3. Explore Methods and tools of testing software.	Upon successful completion of this course, the student will be able to: 1. Formulate problem by following Software testing life cycle. 2. Design Manual Test cases for Software Project. 3. Demonstrate utilization of testing automation though testing tool.

Unit No.	Contents	Max. Hrs.
1	Basic concepts of Testing: Need of Testing, Basic concepts-errors, faults, defects, failures, objective of testing, central issue in testing, Testing activities, V-Model, Sources of information for test cases, Monitoring and Measuring Test Execution, Test tools and Automation, Limitation of Testing.	6
2	Unit Testing: Concepts of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Tools for Unit Testing.	5
3	Control Flow Testing: Outline of Control Flow Testing, Control Flow Graphs, Path in Control Flow Graph, Path selection criteria, All path coverage criteria, Statement coverage, Path coverage.	6
4	Data Flow and System Integration Testing: Introduction Data flow testing, Data flow graph, Data flow testing criteria, Fundamentals of System Integration: Types of interfaces and interface errors, System integration testing, Software and Hardware integration.	5
5	System Testing: Taxonomy of system test, Basic Test, Functionality test, Robustness test, Performance test, Scalability test, Stress test, Load and Stability test, Reliability test, Regression test, Documentation Test.	6
6	Test Design: Test cases, Necessity of test case documentation, Test case design methods, Functional specification-based test case design, Use case bases, application based test case design, level of test execution.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Software Testing and Quality Assurance		Kshirsagar Naik and Priyadarshini Tripathi	Wiley
2	Software Testing Concepts and Tools		Nageswara Rao Pusuluri	Dream Tech Press
3	Software Testing Principles, Techniques and tools	1st Edition	M.G. Limaye	McGraw Hills

Reference Books

SN	Title	Edition	Authors	Publisher
1	Foundations of Software Testing	2nd Edition	Aditya P. Mathur	Pearson Education
2	Software Testing Tools		Dr. K. V. K. K. Prasad	Dream Tech

V Semester

CT2333 – OE II: Internet Technology

Objective	Outcome
1. To understand the current topics in Web & Internet technologies. 2. To learn fundamental tools and technologies for web design 3. To understand various threats and security hazards on internet	Upon successful completion of this course, the student will be able to: 1. Describe the basic concepts for network implementation. 2. Comprehend the technologies and effectively deal with programming issues relating to web page creation 3. Figure out the various security hazards on the Internet and need of security measures.

Unit No.	Contents	Max. Hrs.
1	Introduction: Overview, Network of Networks, Intranet, Extranet and Internet. World Wide Web: Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Review of TCP/IP: Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. Internet Routing Protocol: Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail: POP3, SMTP.	6
2	HTML: Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value. Extensible Markup Language (XML): Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts: Introduction, Environment Variable, GET and POST Methods.	6
3	JavaScript: Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object - string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies: Definition of cookies, Create and Store a cookie with example. Java Applets: Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications	6
4	Internet Telephony: Introduction, VoIP. Multimedia Applications: Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV. Search Engine and Web Crawler: Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.	6
5	Threats: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Network security techniques: Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH).	6
6	Firewall: Introduction, Packet filtering, Stateful, Application layer, Proxy.E-Commerce and security: issues including symmetric and asymmetric key, encryption and digital signature, authentication, Emerging trends, virtual reality over the web, etc.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Web Technology: A Developer's Perspective	2013	N.P. Gopalan and J. Akilandeswari	PHI Learning, Delhi
2	Internetworking Technologies, An Engineering Perspective	2011	Rahul Banerjee	PHI Learning, Delhi

V Semester
CT2334 – OE II: Multimedia and Animation

Objectives	Outcomes
1. Gain fundamental knowledge of multimedia. 2. Understand the technologies in multimedia and animation. 3. Learn the basics of animation	Upon successful completion of the course, the student will be able to: 1.To understand multimedia basics - hardware and software. 2.To develop skills in design, illustration, image manipulation, graphic designing, video editing, visual effects and game designing. 3. To develop the skills in animation software.

Unit No.	Contents	Max Hrs.
1	Multimedia definitions, CD-ROM and the multimedia highway. Applications of multimedia, introduction to making multimedia, the stages of project, requirements to make good multimedia, multimedia skills and training, the multimedia tech.	7
2	Multimedia hardware, Macintosh and windows production platforms, hardware peripherals, connections, memory and storage devices, input devices output hardware, communication devices, media software, basic tools, making instant multimedia authoring tools.	6
3	Multimedia building blocks –text-using text in multimedia, computers and text, font editing and design tools, Sound-the power of sound , multimedia system sound, Digital audio, preparing digital audio files, Audio file format, images-Making still Images, Color, Image file format, video-Broadcast video standard, Analog video, Digital video, optimizing video files for CDROM	7
4	What is meant by Animation, why we need Animation, History of Animation, Uses of Animation. Types of Animation, Principles of Animation, Some Techniques of Animation, and Animation on the WEB, Special Effects, and Creating Animation.	6
5	Creating Animation in Adobe Animate: Introduction to Animate –Working with the Timeline and Frame-based Animation-Working with the Timeline and Tween-based Animation –Understanding Layers–Action script.	6
6	3D Animation & its Concepts, Types of 3D Animation, Skeleton & Kinetic, 3D Animation Texturing and Lighting of 3D Animation, 3D Camera Tracking, Applications & Software of 3D Animation.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Multimedia Making Work	3rd Ed.	Tay Vaughan	TMH
2	Principles of Multimedia	2007	Ranjan Parekh	TMH
3	Multimedia Technologies		Ashok Banerji, Ananda Mohan Ghosh	McGraw Hill Publication

V Semester

CT2334 – OE II: Multimedia and Animation

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Multimedia systems design		K. Andleigh, and K. Thakkrar	PHI
2	Multimedia: Computing, Communications and Applications		Raif Stein Metz and Kiara Nahrstedt	
3	Advanced Multimedia Programming		Steve Rimmer	McGraw Hill

V Semester

CT2335 – OE I: Current Trends and Technologies

Objective	Outcome
1. Gain fundamental knowledge of electronic communication. 2. Understand the technologies in Internet, e-Technologies & e-Learning. 3. Learn the basics of Green Computing and its implementation in industries 4. Develop the understanding of concepts in Social Media.	Upon successful completion of this course, the student will be able to: 1. Use the basics of internet for deployment of various servers and recourses. 2. Design and implement technologies for e-Commerce and e-Learning. 3. Choose appropriate implementation of Green Computing. 4. Make use of Social Networking properly and securely.

Unit No.	Contents	Max Hrs.
1	Fundamentals of Communications: Types of communication-Wired, wireless, mobile, Modes of transmission: Simplex, Half Duplex, Full Duplex, Multiplexing techniques, History and evolution of wireless and mobile systems, Transition and characteristics of 1G, 2G, 3G, 4G, Spectrum, regulations, and frequency allocation	7
2	Fundamental of INTERNET: History, Internet working, Connections, Internet services, The World Wide Web, Tools for the WWW, Web servers, Web browsers, Web page makers and editors, Plug-ins and delivery vehicles.	6
3	e-Technologies: Electronic Commerce: Framework, Media Convergence of Applications, Consumer, Applications, Organization Applications, Electronic Payment Systems: Digital Token, Smart Cards, Credit Cards, Risks in Electronic, Payment System, Designing Electronic Payment Systems, Electronic Data Interchange (EDI): Concepts, Applications, (Legal, Security and Privacy) issues, EDI and Electronic Commerce, Standardization and EDI, EDI Software, Implementation, EDI Envelope for Message Transport, Internet-Based EDI.	7
4	e-Learning: Definition, Introduction, Types of e-Learning: Learner-led e-Learning, Facilitated e-Learning, Instructor-led e-Learning, Embedded e-Learning, Telemonitoring And e-Coaching E-Learning Models: WBT, CBT, LMS, LCMS, Virtual School Systems, E-Learning Tools And Technologies: e-mail, Online Discussion, Chat and Instant Messaging, Voting, Whiteboard, Application Sharing, Conferencing, Online Meeting Tools, Case study.	6
5	Green Computing: Introduction, Why....Green Computing? Approaches to Green Computing-Virtualization, Power Management, Power supply, Storage, Video Card, Display, IT Equipment, Recycling, Remote Conferencing & Telecommuting Strategies, Product longevity, Resource allocation, Terminal servers, Operating system support, How to Implement? Industrial implementations of Green Computing- Blackle, Fit-PC, Zonbu computer, Sunray thin client.	6
6	Social Networking: Definition, Overview of Social Networking Sites, Types of Social Networking Sites: General purpose, Niche. Advantages of Social Networking Sites, Drawbacks of Social Networking Sites, Features and Need of Social Networking, Security Issues with Social Networking Sites, Case Studies	7

V Semester

CT2335 – OE I: Current Trends and Technologies

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Impact of E-Business Technologies on Public and Private Organizations		OzlemBak, Nola Stair	
2	Mobile Computing		Tomasz Imielinski Henry F. Korth	
3	Broadband telecommunications technology		Byeong Gi Lee, Minho Kang, Jonghee Lee	

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to broadband communication systems		Cajetan M. Akujuobi, Matthew, N. O. Sadiku	
2	E-Learning Tools and Technologies		William Hortan, Katherine Hortan	Wiley

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2020

6th Semester

Computer Technology

28 June 2019

VI Semester
GE2311 - Fundamentals of Management

Objective	Outcome
1. To introduce the fundamentals and legal provision of Management 2. To introduce the Human Resource and Financial practice of organization 3. To Introduce the Project Management 4. To provide knowledge of Marketing Activities of Management	Upon successful completion of the course, the student will be able to: 1. Explain the Legal provision and Functions of Management. 2. Analyze the role of Human Resource and Financial Management in the organization. 3. Analyze the project life cycles. 4. Identify tools and techniques for the marketing of goods and services.

Unit No.	Contents	Max Hrs.
1	Evolution of Management Thought: Scientific and Administrative Theory of Management Definition and Concept of Management, Functions of Management: Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership	6
2	The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company	6
3	Human Resource Management-Meaning and Scope, Principles of HRD, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Grievance Redressal Procedure.	7
4	Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Tools and Techniques of Project Management, Network techniques - Introduction and Use of CPM & PERT for planning, SWOT Analysis, Project Risk Analysis, Project Control.	7
5	Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting	6
6	Definition & Functions of Finance department, Sources of finance, Types of capital, Profit maximization vs. Wealth Maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet	6

Text and Reference Books:

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)

9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

VI Semester

CT2351 - Design & Analysis of Algorithms

Objective	Outcome
1. Understand different asymptotic notations. 2. Have an appreciation of different mathematical principles of algorithm analysis 3. Gain an understanding and apply various algorithm design strategies like divide and conquer strategy, greedy strategy, dynamic programming strategy and backtracking strategy. 4. To understand various complexity classes like P, NP, NP-complete and NP-Hard.	Upon successful completion of the course, the student will be able to: 1. Compare different types of asymptotic notations and find the time complexity in terms of asymptotic notations 2. Solve recurrences using various techniques. 3. Implement divide and conquer strategy, greedy strategy, dynamic programming algorithms and backtracking strategy 4. Identify and differentiate between various types of complexity classes.

Unit No.	Contents	Max Hrs.
1	Mathematical foundations, summation of arithmetic and geometric series, $\sum n$, $\sum n^2$, bound summations using integration, analyzing control structures, worst case and average case analysis, Asymptotic notations, sorting algorithms such as selection sort, insertion sort, bubble sort, heap sort, External Sorting, lower bound proof	5
2	Recursive functions and recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions, elementary and advanced data structures with operations on them and their time complexity, Amortized analysis.	5
3	Divide and conquer basic strategy, binary search, quick sort, merge sort, Fast Fourier Transform etc. Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.	5
4	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem.	5
5	Basic Traversal and Search Techniques, breadth first search, connected components, Backtracking basic strategy, 8 – Queen's problem, graph coloring, Hamiltonian cycles etc.	5
6	NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP-complete, Cook's Theorem, decision and optimization problems, polynomial reduction.	5

Text Books:

1. "Computer Algorithms", Horowitz, Sahni, Rajasekaran, Universities press
2. "Introduction to Algorithms", Cormen ,Leiserson, Rivest, Stein, Prentice Hall of India
3. "Fundamentals of Algorithms", Brassard, Bratley, Prentice Hall of India

VI Semester

CT2352 – Lab Design & Analysis of Algorithms

Sr. No.	Practical list
1	WAP to implement basic sorting algorithms.
2	WAP to implement basic sorting algorithms.
3	WAP to implement divide and conquer algorithms.
4	WAP to implement divide and conquer algorithms.
5	WAP to implement greedy algorithms.
6	WAP to implement greedy algorithms.
7	WAP to implement dynamic programming algorithms.
8	WAP to implement dynamic programming algorithms.
9	WAP to implement backtracking algorithms.
10	WAP to implement backtracking algorithms.

VI Semester
CT2353 - Language Processor

Objectives	Outcomes
1. To study the structure of Compiler and FLEX tool for generating lexical analyzer 2. To explore top down, Bottom up parsing approaches and YACC tool for generating syntax analyzer 3. To understand Syntax Directed Translation Scheme. 4. To introduce Symbol Table Management and Error Detection and Recovery with respect to all phases of compilation. **5.** To understand Code optimization and Code generation techniques.	Upon successful completion of the course, the student will be able to: 1. Design lexical analyzer using FLEX tool. 2. Implement syntax analyzer using YACC tool. 3. Create a syntax-directed definition and an annotated parse tree. 4. Demonstrate the use of a symbol table throughout compilation. 5. Apply various code optimizing transformations and code generation techniques.

Unit No.	Contents	Max Hrs.
1	Introduction to Compilation Process, Compilers & Translators, Phase structure of Compiler, Design of Lexical Analysis.	6
2	Specifying Syntactic Structure of Programming Language using Context Free Grammars, The role of Parser, Top-down Parsing, Bottom Up Parsing, Predictive Parsers, Recursive Decent Parser.	7
3	Construction of efficient LR Parsers (SLR, CLR & LALR), Canonical Collection of set of items and construction of Parsing table, Implementation of LR Parsing table.	7
4	Syntax Directed Translation: Intermediate Code, Postfix notation, Parse tree and Syntax Trees, Three address codes, quadruples, triples, Translation of Arithmetic Expression, Boolean expressions, Control Statements. Array references, Procedure Calls, Declarations, Case Statements, Use of Compiler writing tools (Lex/ Flex, Yacc / Biason).	7
5	Symbol Tables: Contents, Representing scope information. Error detection and Recovery: Error handling, Lexical-phase, Syntactic phase and semantic phase.	6
6	Introduction to Code Optimization, the principle sources of optimization, Loop optimization, The DAG representation, Introductory Data Flow analysis, Introduction to Code Generation: Object programs, Problems in Code Generation, Register allocation and assignment, Code generation from DAG, Peephole optimization.	7

Text Books:

1. Compilers Principles, Techniques & Tools by Alfred V. Aho, Jeffrey D. Ullman & Ravi Sethi, 2nd Edition, Pearson Education
2. Principles of Compiler Design by Alfred V. Aho, Jeffrey D. Ullman, Addison Wesley Publication

VI Semester
CT2353 - Language Processor

Reference Book:

1. "Compiler Design", Dr. O.G. Kakde, Laxmi Publication.
2. "Introduction to Compiling Techniques: First Course Using ANSI C, Lex and Yacc", J. P. Bennett, McGraw-Hill Publication
3. "Building Your Own Compiler with C++", Jim Holmes, Prentice Hall

VI Semester
CT2354 – Lab: Language Processor

Sr. No.	Practical List
1	To Study Fast Lexical Analyzer Generator i.e. FLEX.
2	Write a Flex program to check whether the entered word is VOWEL or NOT with and without Function. Note: The word is called vowel if its first alphabet is a vowel.
3	Write a Flex program to recognize identifiers, constants, keywords, etc.
4	Write a Flex program to count the number of a. characters, words, spaces, and lines in each input text file. b. printf and scanf present in each input program fragment.
5	Write a Flex program to check whether the entered string of parenthesis is balanced or not in each input text file.
6	Write a Flex program to recognize a valid arithmetic expression and to recognize the identifier and operators present and print them separately.
7	Write a Flex program to Count the number of IF conditions in a program using the Lexical Analyzer.
8	Study of YACC and Write a YACC Program to display message "Have a good Day".
9	Write a YACC Program to recognize strings 'aaab', 'abbb', 'ab' and 'a' using the grammar for L= ($a^n b^n$, n>= 0)
10	Write a YACC program to recognize a valid arithmetic expression that uses operators +, -, *, / .

VI Semester
CT2355 – Software Engineering

Objective	Outcome
1. Study software engineering best practices and different strategies applicable for software development, software requirement and its design activity. 2. Explore the various testing types and its strategies. 3. Understand configuration management, version control and change control process of Software development. 4. Understand project management, planning, scheduling, risk management, project and process metrics. 5. Get an overview of open source Software Engineering tool viz. Subversion and understand some concepts such as Re-engineering and Reverse engineering.	Upon successful completion of the course, the student will be able to: 1. Choose appropriate software engineering process model, requirement engineering principles and software designing fundamentals for a given project. 2. Select appropriate testing strategy and apply testing principles for testing a given application. 3. Apply basics of software configuration management, version control and change control in software development. 4. Evaluate cost estimation, effort and severity of software risk for given application. 5. Perform basic operations on Sub-version for software version control.

Unit No.	Contents	Max. Hrs.
1	Introduction to Software Engineering, A Generic View of process, Process models: Water fall Model, RAD Model, Prototyping Model, Component Development Model, Agile Model, Requirement Engineering: Requirement Engineering Task Initialization Eliciting Requirement, Developing Use Case, Analysis Model, Negotiation, Validation	6
2	Building the Analysis mode: Requirement Analysis, Analysis Modeling Approaches, Data Modeling Concept, Object Oriented Analysis, Types of Modeling, Design Engineering: Design Concept, Design Model.	7
3	Testing Strategies: Strategic Approach, Strategic issues, Strategies for conventional Software, Strategies for Object Oriented Software, Validation Testing, Testing Tactics: White-Box Testing, Basis Path testing: Flow Graph Notation, Independent Program Paths, Control Structure Testing, Black Box Testing, Introduction to object oriented testing.	7
4	Configuration Management: Base lines, Software Configuration items, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting, SCM Standards.	5
5	Project Management, Metrics for Process and Projects, Project Estimation, Risk Management: Reactive vs. Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection.	7
6	Advanced Topics in Software Engineering: Re engineering Computer aided software engineering, Open source SE tools introduction, Example-Subversion: Overview, Typical subversion usage and work flow.	5

VI Semester
CT2355 – Software Engineering

Text Books:

1. Software Engineering–A Practitioner's Approach (Sixth Edition) by Roger S. Pressman– McGraw Hill.
2. Object Oriented Software Engineering by Leth Bridge, Pearson Edu.

Reference Books:

1. Software Engineering, 9th Edition, Ian Sommerville, University of St Andrews, Scotland, ©2011 , Pearson

VI Semester

CT2356 – Lab : Software Engineering

S. No	Practical List
1	Introduction to Software Engineering fundamentals, UML and RATIONAL ROSE Interface.
2	To study and create Software Requirement Specification document for given case study
3	To study and draw UML Use Case diagram for the given case study.
4	To study and draw UML Class diagram for given Case Study.
5	To study and draw UML Activity diagram for given Case Study.
6	To study and draw UML Sequence Diagram for given Case Study.
7	To study and draw State Diagram for given Case Study.
8	Write a Program to find out the Estimation (cost and effort) by using COCOMO model.
9	To Perform Manual and Automated testing using CASE tool for given Case Study
10	To Study and execute Version Control using Subversion

VI Semester

CT2361– PE II: Digital Image Processing

Objectives	Outcomes
1. Overview the Fundamental concepts of Digital Image Processing 2. Explore image enhancement techniques in spatial domain and frequency domain 3. Understand the fundamental concept of image compression 4. To Study various similarity based, and dissimilarity-based image segmentation approaches. 5. Understand the basic concepts of image representation and description	Upon successful completion of the course, students will be able to: 1. Describe and understand Basic relationships between pixels. 2. Compare and Implement various image enhancement techniques in spatial domain and frequency domain. 3. Compare and illustrate different image compression techniques to understand the advantage of image compression 4. Identify and demonstrate the applications of similarity based and dissimilarity-based approaches for image segmentation. 5. Interpret and illustrate various representation techniques.

Unit No.	Contents	Max. Hrs.
1	Introduction: Fundamental Steps in Image Processing, Elements of DIP systems, Elements of Visual Perception, Fundamentals of Image processing, A Simple Image Model, Sampling and Quantization, Some Basic Relationships. between Pixels, Image Geometry in 2D.	6
2	Image Enhancement in the Spatial Domain: Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	6
3	Transforms: Introduction to the Fourier Transform, Discrete Fourier Transformation, Fast Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, Discrete Cosine Transform, Typical Applications. Image Enhancement in the frequency Domain: Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering, Implementation	7
4	Image Compression: Fundamentals of Image compression, coding redundancy, spatial and temporal redundancy, Irrelevant Information, Measuring Image Information, Fidelity criteria, Image compression models, compression standards, Basic compression methods, Huffman coding, colomb coding, arithmetic coding, LZW coding, runlength coding	7
5	Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.	8
6	Image Representation: Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to color image processing: RGB and HSI color models, introduction to image file formats: TIFF, JPEG, BMP, etc.	7

VI Semester

CT2361– PE II: Digital Image Processing

Text Books:

1. Digital Image Processing by Rafael C. Gonzalez and Richard, E. Woods, 3rd edition, Prentice Hall.
2. Digital Image Processing by Jayaraman, S. Esakkirajan, T. Veerakumar, publication Tata McGrawHill.

Reference Books:

1. Fundamentals of Digital Image Processing by A.K.Jain, Prentice Hall.
2. Image Processing Principles & Applications by Tinku Acharya &Ajoy K. Ray, Willey Inter-Science.

VI Semester

CT2362 – PE II: Lab: Digital Image Processing

Sr. No.	Practical List
1	Write a program in MATLAB for following Point processing techniques in spatial domain a. Negation of an image b. Thresholding of an image c. Contrast Stretching of an image
2	Write a Program in MATLAB to Create a Histogram of a given Image.
3	Write a program in MATLAB to perform following smoothing operations on an image a. Average filter b. Ordered Statistics filter
4	Write a program to sharp an image using Laplacian mask.
5	Write a program to compress an image using Huffman Coding
6	Write a program to segment an image using multilevel thresholding.
7	Write a program to apply split and merge algorithm on a given image.
8	Write a program to find the code chain of a given image.
9	Write a program to find the shape number of a given image.
10	Write a program to find Euler number of image a given image.

VI Semester
CT2363 – PE II: Internet of Things

Objectives	Outcomes
1. Get acquainted with various IOT environments. 2. Study IOT architecture and its enabling technologies. 3. Acquire hands on laboratory experience, utilizing IOT kit.	Upon successful completion of the course, students will be able to: 1. Develop various IOT environments 2. Demonstrate IOT architecture and its enabling technologies 3. Analyze IOT environments using various communication technologies 4. Apply various IOT enabling technologies for creation of IOT environments

Unit No.	Contents	Max. Hrs.
1	Introduction: Concepts behind the Internet of Things, Characteristics of IoT, IoT enabling technologies, IoT Communication Model, IoT architecture, Applications of IoT, Transducers, Sensors, Sensor classes, Sensor types, Actuators and its types	6
2	IOT Protocols: Application layer: MQTT, COAP, XMPP, AMQP, Network Layer: IPv4, IPv6, 6LoWPAN, IoT Communication protocols: IEEE802.15.4, ZigBee, Wireless HART, Zwave, Bluetooth, NFC, RFID	7
3	Wireless Sensor networks: Components of sensor nodes, Node Behavior in WSNs, Applications, WSN Coverage, OGDC algorithm, Stationary and Mobile Wireless Sensor Networks.	6
4	Cloud Computing: Recent Trends in Computing, Characteristics, Components of Cloud Computing, Service Models, Deployment Models, Service Management, Cloud Security, IoT Data analytics, Case studies, Middleware for IoT	6
5	Machine to Machine Communication: Node types, IP and Non-IP based M2M network Interoperability in Internet of Things: Current Challenges in IoT, Interoperability, Types of Interoperability	6
6	Software-Defined Networking: Current Network to SDN, SDN Architecture, Challenges, OpenFlow Protocol, APIs in SDN, Controller Placement, Recent Advances of SDN in IoT, Industrial internet of things, Case studies	6

Reference Book:

1. Internet of Things: A hands on approach by Arshdeep Bahga and Vijay K. Madisetti
2. NPTEL course material on Introduction to Internet of Things

VI Semester

CT2364 – PE II: Lab: Internet of Things

Sr. No.	Practical List
1	To study Arduino Uno IoT Kit with ATMega 328 Microcontroller
2	Design a sketch for running of LEDs
3	Design a sketch to monitor state of switch by establishing serial communication between Arduino and computer
4	Design a sketch to read analog value of potentiometer by establishing serial communication between arduino and computer.
5	Design a sketch for blinking LEDs without using delay.
6	Design a sketch to develop switch based binary LED counter. Also observe output on serial monitor.
7	Design a sketch to create a simple digital clock using LCD display.
8	Design a sketch to make use of EEPROM to control devices (LED).
9	To log data of temperature sensor over internet and analysis it.
10	Advance Practical: Study and setup of ESP -32 board

VI Semester
CT2365 – PE II: Business Intelligence

Objective	Outcome
1. Understand the concept of business intelligence, digital data and the multidimensional data modeling 2. Have an appreciation of the process of building of multidimensional data model and various operations that can be performed on it 3. Gain an understanding of how to measure and present the business information 4. Develop an understanding of application of the business intelligence in the real-world scenario	Upon successful completion of the course, students will be able to 1. Reveal the knowledge of basic concepts of Business Intelligence and multidimensional modelling and able to compare digital data types. 2. Build and operate the multidimensional data model for the specific scenario to extract the information. 3. Analyze the business information to construct the reports from it. 4. Decide the mode / channel to implement the business intelligence solution for the specific problem.

Unit No.	Contents	Max Hrs.
1	Introduction to Business Intelligence: Introduction to digital data and its types – structured, semi-structured and unstructured, BI Definitions & Concepts, BI Framework, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices	6
2	Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP) Introduction to Multi-Dimensional Data Modeling: Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, Data Warehousing concepts and its role in BI	6
3	Basics of Data Integration (Extraction Transformation Loading): Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data – types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL using Pentaho data Integration (formerly Kettle).	7
4	Identifying Dimension tables and fact table, designing of dimension and fact tables‟ schema, design of snowflake schema, query redirection. Aggregations: Why aggregate? designing Summary tables, which summaries to create	7
5	Introduction to business metrics and KPIs, creating cubes using Microsoft Excel, Basics of Enterprise Reporting: A typical enterprise, Malcolm Baldrige - quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard, enterprise reporting using MS Access / MS Excel, best practices in the design of enterprise dashboards	6
6	Case study: Overview and use of products from Pentaho and other open software. BI road Ahead: BI and mobility, BI and cloud computing, BI for ERP systems, Social CRM and BI	7

VI Semester

CT2365 – PE II: Business Intelligence

Text Books:

1. Fundamentals of Business Analytics by R. N. Prasad, Seema Acharya Wiley India
2. Data Warehousing in the real world A practical guide for building Decision Support System by Sam Anahory, Dennis Murray, PEARSON

Reference Books:

1. Business Intelligence by David Loshin.
2. Business intelligence for the enterprise by Mike Biere.
3. Business intelligence roadmap by Larissa Terpeluk Moss, Shaku Atre.
4. An introduction to Building the Data Warehouse, IBM.
5. Business Intelligence For Dummies, Swain Scheps.
6. Successful Business Intelligence: Secrets to making Killer BI Applications by Cindi Howson Information dashboard design by Stephen Few

VI Semester
CT2366 – PE II: Lab: Business Intelligence

Sr. No.	Practical List
1	Design a conceptual multidimensional model for the given data.
2	Create a table for Time dimension using existing data source
3	Extract the data from various sources and move it to backup area. Load the data from backup area to staging area and then Load data in data warehouse from staging area.
4	Create a chart report, by considering module names on the X-axis, Percentage Scored in the Various Modules on Y-axis.
5	Create a table report to display Year, Quarter, Month, Module name of the assessment conducted in the current month, Assessment type of the module conducted in the current month. Enable drill down for "Year," "Quarter, and "Month."
6	Graph the percentage sales over time to see the trends using given dataset. Also Pivot the data to see total sales by quarter and category and analyze the data
7	Report the sales by category and the corresponding freight charges. Filtering should be enabled in the Year and Quarter columns, and the selected Year and Quarter need to be visible. Also Sort the Sales data in terms of Year, Quarter and Month.
8	Extract the data from various sources using PENTAHO and apply the transformation on the data.
9	Describe the characteristics of data imported in R by using R functions.
10	Consider a data set and visualize it using appropriate visualization technique in 'R'
11	Apply data transformation and represent the data model in Orange tool
12	Perform data visualization using Tableau

VI Semester
CT2367 – PE II: Introduction to Natural Language Processing

Objectives	Outcomes
1. To understand basic aspects of Natural languages used in processing of text. 2. To get acquainted with the basic concepts and algorithmic description of the main levels of language levels: morphology, syntax, semantics, and pragmatics. 3. To Learn the mathematical and linguistic foundations 4. To appreciate underlying approaches for the various areas in NLP.	Upon successful completion of this course, the student will be able to: 1. Describe linguistic phenomena with formal grammars. 2. Illustrate and test algorithms for NLP problems 3. Examine NLP applications 4. Devise real world NLP applications using NLP techniques

Unit No.	Contents	Max. Hrs.
1	Introduction: History of NLP, Generic NLP system, levels of NLP, Knowledge in language processing, Ambiguity in Natural language, stages in NLP, challenges of NLP, Applications of NLP	5
2	Morphology fundamentals: Morphological Diversity of Indian Languages, Morphology Paradigms, Shallow Parsing, Named Entities, Maximum Entropy Models, Random Fields. Word Level Analysis, Morphology analysis –survey of English and Indian language Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST), Morphological parsing with FST, Lexicon free FST Porter stemmer. N –Grams- N-gram language model, N-gram for spelling correction.	8
3	Structures: Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents, Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.	7
4	Meaning: Lexical Knowledge Networks, Wordnet Theory, Indian Language Wordnets and Multilingual Dictionaries, Semantic Roles, Word Sense Disambiguation, WSD and Multi-linguality. Semantic Analysis: Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses – Homonymy, Polysemy, Synonymy, Hyponymy, Robust Word Sense Disambiguation (WSD), Dictionary based approach.	8
5	Pragmatics Discourse: Coreferences, reference resolution, reference phenomenon, syntactic and semantic constraints on co reference.	7
6	Natural language Processing applications (preferably for Indian regional languages): Sentiment Analysis, Text Entailment, Robust and Scalable Machine Translation, Question Answering in Multilingual Setting, Cross Lingual Information Retrieval (CLIR).	7

Text Books:

1. Jurafsky, Daniel, and James H. Martin, Speech and Language Processing:An Introduction to Natural Language Processing, Speech Recognition,and Computational Linguistics, PrenticeHall, 2000.
2. Christopher D. Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing. Cambridge, MIT Press, 1999.

VI Semester

CT2367 – PE II: Introduction to Natural Language Processing

Reference Books:

1. James Allen, Natural Language Understanding, Benjamin/Cummings, 2ed, 1995.
2. Eugene Charniak, Statistical Language Learning, MIT Press, 1996.
3. Martin Atkinson, David Britain, Harald Clahsen, Andrew Redford, Linguistics, Cambridge University Press, 1999.

VI Semester

CT2368 – PE II: Lab: Introduction to Natural Language Processing

Sr. No.	Practical List
1	Implement Linguistic features of Language: Write a Program to tokenize words and sentences of given paragraph
2	Morphological features: 2.1 Write a program to perform lemmatization of language words using wordnet. 2.2 Write a program to return morphological features of input text in any Indian language Morphological Analyzer.
3	Write a program to demonstrate usage of Regular expression.
4	Identify ambiguity present in the given text. (Use a tool to check ambiguity)
5	Write a program to create parse tree for given text in given paragraph.
6	Illustrate utility of NLTK: 6.1 Write a program to remove stop words using NLTK 6.2 Implement NLTK features
7	Write a program to get Antonyms for given word from Wordnet for Indian languages.
8	Write a program to design a spam mail recognition system.
9	Create a spellchecking application for Indian Language.
10	Create Mini application based on NLP domains.

VI Semester
CT2369 – PE II: Customer Relationship Management

Objectives	Outcomes
1. To understand the concepts and principles of Salesforce CRM. 2. To appreciate the role and changing face of Salesforce CRM as an IT enabled function. 3. To implement a CRM using apex in aura framework by understanding the business case and importance of implementing such a systemin an organization.	Upon successful completion of this course, the student will be able to: 1. Apply the knowledge of customer-centered organization and implement the integral processes within an organization that are automated and how does the automation create predictability and efficiencies. 2. Design a customize a CRM application for organization to suit their business needs. 3. Analyze the result of developed CRM application from various perspectives for implementing it.

Unit No.	Contents	Max. Hrs.
1	Introduction to Cloud: Definition of Cloud Computing, Cloud Architecture, Cloud Types, Service models, Deployment models, Examining the Characteristics of Cloud Computing, Benefits of cloud computing, Disadvantages of cloud computing. CRM Concepts and its tools: Definition, History, Key Benefits, Service Level Agreements (SLAs), creating and managing effective SLAs. Architecture, Service Nature of Salesforce, Features, Products and its overviews, Traditional CRM vs. Salesforce CRM.	8
2	CRM Administration and Data Model Design: Lightning and classic UI and differences, Creation of org, Object Manager, App Manager, Setup, App creation, tabs, Types of Objects, Data Types, Sandboxes, Understanding Relationships and its limitations, Types of Relationship and their differences, Junction Object, formulas, Dependency picklist fields, Validation Rules.	7
3	Data Management with CRM Tool: Record details, List Views, Filters, Actions Page layouts, Compact Layouts, Introduction to Workflows, email templates, Limitation of workflows, approval processes, Process Builder, Lightning Flow, Community Creation, Reports and Dashboards.	7
4	Security Model: Introduction to Profiles and Permission Set, Overview of Data Security, Control access to org, object, field, record, OWD, Role and Roles Hierarchy, Sharing Rule, sharings Objects, Apex Sharing.	8
5	CRM Tool Development: Introduction to Apex, Collections, SOQL and SOSL, DML Operations, Controllers In APEX, Email Service Using Apex Class and Triggers, Asynchronous APEX, Batch APEX, Apex Test Classes.	7
6	Lightning Aura Component: Introduction to Aura component, attributes handling in aura component, handle action in controller, Parent and child component, Events handling in aura component, Server-side controller.	8

Reference Books:

1. Salesforce Handbook Paperback – 20 Mar 2011 by Wes Nolte (Author), Jeff Douglas (Author) , Publisher: Lulu.com, ISBN-10: 1446108538 , ISBN-13: 978-1446108536
2. Salesforce CRM: The Definitive Admin Handbook Paperback – Import, 24 Jul 2013 by Paul Goodey, Publisher: Packt Publishing Limited; 2nd edition edition

3. Alok Kumar Rai, CUSTOMER RELATIONSHIP MANAGEMENT CONCEPT & CASES, Prentice Hall of India Private Limted,New Delhi. 20112
4. S. Shanmugasundaram, CUSTOMER RELA TIONSHIP MANAGEMENT, Prentice Hall of India Private Limted,New Delhi, 20083.
5. Kaushik Mukherjee, CUSTOMER RELATIONSHIP MANAGEMENT, Prentice Hall of India Private Limted,New Delhi, 20084.
6. Jagdish Seth, et al, CUSTOMER RELA TIONSHIP MANAGEMENT5.
7. V. Kumar & Werner J., CUSTOMER RELA TIONSHIP MANAGEMENT, Willey India, 2008

CRM Tool Links:- http://help.salesforce.com

VI Semester

CT2370 – PE II: Lab: Customer Relationship Management

Sr. No.	Practical List
1	Introduction to Salesforce CRM.
2	Creation of Custom Objects.
3	To create Look-up and Master Details Relationship with objects.
4	To implement formula field.
5	To form dependencies among fields.
6	To study different layouts.
7	To implement a workflow.
8	To Customize process flow using process builder.
9	To create clone user and assigned permissions.
10	To create an Email templates
11	A. Write an Apex code to perform the DML Operations on Standard or the custom objects created by the user. B. Write an Apex Code to display the list of books with its issuing Members with starting letters of Books
12	A. To Create a Hello world Aura Component B. To Create and Edit Aura Component
13	Write an aura component to display the addition of two integer numbers, define a button called submit. When a submit button is clicked the result will be displayed on the screen.
14	Case Study- Introduction about community cloud
15	Case Study- Creation of salesforce custom Domain.

VI Semester
CT2371 – OE III: Introduction to DBMS

Objective	Outcome
To understand basic database concepts by students whose basic degree is not in Computer or IT.	Upon successful completion of this course, the student will be able to: Students should be able to design database forgiven situation, write appropriate queries for accessing database.

Unit No.	Contents	Max. Hrs.
1	An Overview of the Database Management System: What is database? Why database?, database system, database management system (DBMS), advantages of DBMS	6
2	An Architecture of the Database system: Three levels of architecture, mappings, role of database administrator (DBA), E-R model, three approaches of DBMS relational, hierarchical and network.	6
3	Relational Database Management System (RDBMS): Introduction, RDBMS terminology, relational model, base tables, key	5
4	The SQL Language: Introduction, Characteristics of SQL, data definition command	5
5	Data manipulation commands	5
6	Introduction to XML	6

Text Books:

1. Silberschatz A, Korth H.F and Sudarshan S, "Data base System Concepts", Fifth Edition, Tata McGraw-Hill.
2. R. Elmasri, S. B Navathe, "Fundamentals of Database System", Pearson Education.

Reference Books:

1. Leon A and Leon M, "Fundamentals of DBMS", Vijay Nicole & Tata McGraw-Hill.
2. Gill P.S, "DBMS", I.K. International.
3. Singh S.K, "Database Systems: Concepts, Design & Applications", Pearson Education.
4. Leon A and Leon M, "Database Management Systems", Vikas Publishing House.

VI Semester

CT2372 – OE III: Essentials of IT

Objectives	Outcome
1. To understand basics of algorithm design, object-oriented concepts and Java programming fundamentals. 2. To understand the database system concepts, relational database design basics and learn SQL for various data operations. 3. To understand basics of web page design and Javascript programming fundamentals 4. To understand software engineering basics and various SDLC phases.	Upon successful completion of the course, the student will be able to: 1. Develop algorithm and write pseudo code for a given problem statement. 2. Construct Entity-Relationship Model and design RDBMS for a given problem statement. 3. Design static and dynamic web pages using HTML and Javascript and write simple programs in Javascript. 4. Apply software engineering concepts in any software project implementation.

Unit No.	Contents	Max. Hrs.
1	Programming fundamentals of Java: problem solving skills, Algorithm – representation using pseudo code, algorithm properties. Programming in java- programming constructs in JAVA, control structures type casting, SDLC overview and need for Object oriented approach, object-oriented concepts, introduction to UML.	8
2	OO fundamentals – Java Implementation: OO fundamentals, coding standards, reference variables and objects in memory, methods, „this" reference. Data structures: data structures, linear data structures, non- linear data structures.	8
3	Data base basics- data storage, need for DBMS, functions of DBMS, data perspectives in DBMS, types of data models, relational model and keys, Database Design – Database life cycle, Data requirements, logical design – ER modeling, converting ER model to relational schema, functional dependency, normalization.	8
4	SQL – need for SQL, types of SQL statements, data types in SQL, SELECT statement with various operators, single row and multi row functions, group by and having clauses.	8
5	Introduction to web technologies: Computer Networks, HTML tags and CSS, Implementation of Java Scripts, Operators and control structures, function and dialog boxes, DOM element.	8
6	Software Engineering – Basics, SE models and approaches, Requirement developing activities, software design and construction, software testing, introduction to user experience, Project categories and project management phases, software quality.	8

Text books:

Java: The complete reference	7th Edition	Herbert Schildt.	McGraw-Hill
Database System Concepts	5th Edition	Silberschatcz, Korth, Sudarshan	McGraw-Hill Education
Software Engineering: A Practitioner's Approach	6hEdition	Roger Pressman	McGraw Hill Higher Education

VI Semester
CT2373– OE III: Image Processing

Objectives	Outcomes
1. Overview the Fundamental concepts of Digital Image Processing 2. Explore image enhancement techniques in spatial domain and frequency domain 3. Understand the fundamental concept of image compression 4. To Study various similarity based, and dissimilarity-based image segmentation approaches. 5. Understand the basic concepts of image representation and description.	Upon successful completion of the course, the student will be able to: 6. Describe and understand Basic relationships between pixels. 7. Compare and Implement various image enhancement techniques in spatial domain and frequency domain. 8. Compare and illustrate different image compression techniques to understand the advantage of image compression 9. Identify and demonstrate the applications of similarity based and dissimilarity-based approaches for image segmentation. 10. Interpret and illustrate various representation techniques.

Unit No.	Contents	Max. Hrs.
1	Introduction: Fundamental Steps in Image Processing, Elements of DIP systems, A Simple Image Model, Sampling and Quantization, Some Basic Relationships between Pixels.	5
2	Image Enhancement in the Spatial Domain: Introduction to Spatial domain, Basic Gray Level Transformations, Histogram Processing, Histogram Equalization, Spatial Domain Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	6
3	Transforms: Introduction to the Fourier Transform, Discrete Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, Typical Applications. Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters.	6
4	Image Compression: Fundamentals of Image compression, coding redundancy, spatial and temporal redundancy, Irrelevant Information, Measuring Image Information, Image compression models, Various compression methods.	6
5	Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.	6
6	Image Representation: Chain Codes, Polygonal Approximations, Signatures, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to various color image processing models.	6

Text Books:

1. Digital Image Processing by Rafael C. Gonzalez and Richard, E. Woods, 3rd edition, Prentice Hall.
3. Digital Image Processing by Jayaraman, S. Esakkirajan, T. Veerakumar, publication Tata McGrawHill.

VI Semester

CT2373– OE III: Image Processing

Reference Books:

2. Fundamentals of Digital Image Processing by A.K.Jain, Prentice Hall.
2. Image Processing Principles & Applications by Tinku Acharya &Ajoy K. Ray, Willey Inter-Science.

VI Semester
CT2374– OE III: Operating System Concepts

Objectives	Outcomes
1. To understand the concepts of Linux and its potential. 2. To get a knowledge of shells	Upon successful completion of the course, the ent will be able to: 1. Use LINUX operating system. 2. Write Shell scripts

Unit No.	Contents	Max. Hrs.
1	Introduction: History of Linux and Unix, Linux Overview, Linux releases, open linux	6
2	Linux Commands and Filters : Mkdir, CD, rmdir, pwd, ls, who, whoami, cat, more, fail, head, concept of, mv, chmod, grep,wc, comm., split, sort, diff, kill, write, wall, merge, mail, news	5
3	Shell: The command line special characters and file arguments, standard input/output and redirection, pipes, redirecting and piping with standard errors, shell scripts, jobs.	5
4	Linux file Structure: Linux files, file structure, listing displaying and printing files, managing directories, file and directory operations.	5
5	Vi Editor: Vi editing commands advanced Vi editing commands, line editing commands, options in Vi.	6
6	System Administration: System management, managing users, installing and managing devices, floppy disk management, file system administration, backups.	6

Text Books

1. Linux – The Complete Reference by Richard Peterson, Tata McGraw Hill, New Delhi
2. Linux – Install and Configuration Black Book by Die Annleblanc and Issac Yates, IDG Books India Private Ltd., Delhi
3. Unleashed Linux by Tech Media Publishers.

VI Semester

CT2375– OE IIII: Introduction to Salesforce

Objectives	Outcomes
1. To realize the concepts and principles of Salesforce CRM. 2. To appreciate the role and changing face of Salesforce CRM as an IT enabled function. 3. To have knowledge of a CRM implementation in aura framework by understanding the business case and importance of implementing such a system in an organization.	Upon successful completion of this course, the student will be able to: 1. Employ the knowledge of customer-centered organization and implement the integral processes within an organization that are automated and how does the automation create predictability and efficiencies. 2. Represent a customize a CRM application for organization to suit their business needs. 3. Determine CRM strategies by understanding customers' preferences for the long-term sustainability of the Organizations.

Unit No.	Contents	Max. Hrs.
1	Introduction to Cloud: Definition of Cloud Computing, Cloud Architecture, Cloud Types, Service models, Deployment models, Examining the Characteristics of Cloud Computing, Benefits of cloud computing, Disadvantages of cloud computing.	8
2	CRM Concepts and its tools: Definition, History, Key Benefits, Service Level Agreements (SLAs), creating and managing effective SLAs. Architecture, Service Nature of Salesforce, Features, Products and its overviews, Traditional CRM vs. Salesforce CRM.	7
3	CRM Administration and Data Model Design: Lightning and classic UI and differences, Creation of org, Object Manager, App Manager, Setup, App creation, tabs, Types of Objects, Data Types, Sandboxes, Understanding Relationships and its limitations, Types of Relationship and their differences, Junction Object, formulas, Dependency picklist fields, Validation Rules.	7
4	Data Management with CRM Tool: Record details, List Views, Filters, Actions Page layouts, Compact Layouts, Introduction to Workflows, email templates, Limitation of workflows, approval processes, Process Builder, Lightning Flow, Community Creation, Reports and Dashboards.	8
5	Security Model: Introduction to Profiles and Permission Set, Overview of Data Security, Control access to org, object, field, record, OWD, Role and Roles Hierarchy, Sharing Rule, Sharings Objects, Apex Sharing.	7
6	CRM Tool Development: Introduction to Apex, Collections, SOQL and SOSL, DML Operations. Lightning Aura Component: Introduction to Aura component, Advantages, attributes handling in aura component.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Salesforce CRM: The Definitive Admin Handbook Paperback	2nd	Paul Goodey	Packt Publishing Limited
2	Customer Relationship	1st (2013)	Alok Kumar Rai	Prentice Hall of India

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

	Management Concept & Cases			Private Limted
3	Customer Relationship Management	1st (2012)	V. Kumar & Werner J.	Wiley

Reference Books		
SN	**Title**	**Link**
1	**CRM Tool Links (Online)**	**http://help.salesforce.com**

VI Semester
CT2381– OE IV: Soft Computing

Objectives	Outcomes
1. Understand the applications of soft computing in various domains. 2. Have an appreciation of Fuzzy logic and its applications. 3. Gain an understanding of Rough Set theory and its usage as soft computing. 4. Develop an understanding of single-objective optimization problems using gas. 5. Introduce artificial neural networks and its applications	Upon successful completion of the course, the students will be able to: 1. Reveal different applications of soft computing to solve problems from different domains 2. Demonstrate Fuzzy logic and its applications 3. Explain Rough Set theory and its usage as soft computing 4. Relate single-objective optimization problems using GAs. 5. Describe Artificial neural networks and its applications

Unit No.	Contents	Max. Hrs.
1	Introduction to Soft Computing: Concept of computing systems, Soft computing versus Hard computing, characteristics of Soft computing, some applications of Soft computing techniques, Learning Process, Overview of Supervised and un-supervised learning, Single and Multi-Layer Network, Associative Memory	6
2	Introduction to Fuzzy Logic: Introduction to Classical Sets, Fuzzy sets, Fuzzy membership functions, properties and operations on Fuzzy sets	6
3	Fuzzy Relations: Fuzzy relations, propositions, rules, and inferences, Fuzzy logic controller design, Defuzzification, some applications of Fuzzy logic	7
4	Rough Set Theory: Fundamental concepts: Information system or information table, In-discernibility relation, Approximations, Decision tables and decision algorithms, Dependency of attributes, Reduction attributes in information system, Applications of rough set theory	7
5	Genetic Algorithms: Concept of Genetic algorithm, basic terminologies in Genetic algorithm, GA operators, stopping criteria for genetic algorithm, solving single-objective optimization problems using Gas, advantages and limitations of GA, applications of GA	8
6	Artificial Neural Network: Introduction to Biological neurons and it's working, simulation of biological neurons to problem solving, different ANN architectures, training techniques for ANNs, Applications of ANNs to solve some real life problems	7

Text Books:
Principles of soft computing, S, N, Sivanandam, S. N. Deepa (Wiley)

Reference Books:
An Introduction to Genetic Algorithm, Melanic Mitchell (MIT Press)
Fuzzy set theory: Foundations and Applications, George J. Klir

VI Semester
CT2382– OE IV: Software Testing

Objective	Outcome
1. Understand Software testing fundamentals / principles. 2. Learn systematic approach to software testing using strategies. 3. Explore Methods and tools of testing software.	Upon successful completion of this course, the student will be able to: 1. Formulate problem by following Software testing life cycle. 2. Design Manual Test cases for Software Project. 3. Demonstrate utilization of testing automation though testing tool.

Unit No.	Contents	Max. Hrs.
1	Basic concepts of Testing: Need of Testing, Basic concepts-errors, faults, defects, failures, objective of testing, central issue in testing, Testing activities, V-Model, Sources of information for test cases, Monitoring and Measuring Test Execution, Test tools and Automation, Limitation of Testing.	6
2	Unit Testing: Concepts of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Tools for Unit Testing.	5
3	Control Flow Testing: Outline of Control Flow Testing, Control Flow Graphs, Path in Control Flow Graph, Path selection criteria, All path coverage criteria, Statement coverage, Path coverage.	6
4	Data Flow and System Integration Testing: Introduction Data flow testing, Data flow graph, Data flow testing criteria, Fundamentals of System Integration: Types of interfaces and interface errors, System integration testing, Software and Hardware integration.	5
5	System Testing: Taxonomy of system test, Basic Test, Functionality test, Robustness test, Performance test, Scalability test, Stress test, Load and Stability test, Reliability test, Regression test, Documentation Test.	6
6	Test Design: Test cases, Necessity of test case documentation, Test case design methods, Functional specification-based test case design, Use case bases, application based test case design, level of test execution.	6

Text Books:

1.Software Testing and Quality Assurance by Kshirsagar Naik and Priyadarshini Tripathi (Wiley)
2.Software Testing Concepts and Tools by Nageswara Rao Pusuluri (Dream Tech Press)
3.Software Testing Principles, Techniques and tools, 1stEdition, by M.G. Limaye McGraw Hills

Reference Books:

1. "Foundations of Software Testing" 2 E by Aditya P. Mathur, Pearson Education
2. Software Testing Tools by Dr. K. V. K. K. Prasad (Dream Tech).

VI Semester
CT2383– OE IV: Internet Technology

Objective	Outcome
1. To understand the current topics in Web & Internet technologies. 2. To learn fundamental tools and technologies for web design 3. To understand various threats and security hazards on internet	Upon successful completion of this course, the student will be able to: 1. Describe the basic concepts for network implementation. 2. Comprehend the technologies and effectively deal with programming issues relating to web page creation 3. Figure out the various security hazards on the Internet and need of security measures.

Unit No.	Contents	Max. Hrs.
1	Introduction: Overview, Network of Networks, Intranet, Extranet and Internet. World Wide Web: Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Review of TCP/IP: Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. Internet Routing Protocol: Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail: POP3, SMTP.	6
2	HTML: Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value. Extensible Markup Language (XML): Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts: Introduction, Environment Variable, GET and POST Methods.	6
3	JavaScript: Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object - string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies: Definition of cookies, Create and Store a cookie with example. Java Applets: Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications	6
4	Internet Telephony: Introduction, VoIP. Multimedia Applications: Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV. Search Engine and Web Crawler: Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.	6
5	Threats: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Network security techniques: Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH).	6
6	Firewall: Introduction, Packet filtering, Stateful, Application layer, Proxy.E-Commerce and security: issues including symmetric and asymmetric key, encryption and digital signature, authentication, Emerging trends, virtual reality over the web, etc.	6

Text Books

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013.
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011.

VI Semester
CT2384– OE IV: Multimedia and Animation

Objectives	Outcomes
1. Gain fundamental knowledge of multimedia. 2. Understand the technologies in multimedia and animation. 3. Learn the basics of animation	Upon successful completion of the course, the student will be able to: 1.To understand multimedia basics - hardware and software. 2.To develop skills in design, illustration, image manipulation, graphic designing, video editing, visual effects and game designing. 3. To develop the skills in animation software.

Unit No.	Contents	Max Hrs.
1	Multimedia definitions, CD-ROM and the multimedia highway. Applications of multimedia, introduction to making multimedia, the stages of project, requirements to make good multimedia, multimedia skills and training, the multimedia tech.	7
2	Multimedia hardware, Macintosh and windows production platforms, hardware peripherals, connections, memory and storage devices, input devices output hardware, communication devices, media software, basic tools, making instant multimedia authoring tools.	6
3	Multimedia building blocks –text-using text in multimedia, computers and text, font editing and design tools, Sound-the power of sound , multimedia system sound, Digital audio, preparing digital audio files, Audio file format, images-Making still Images, Color, Image file format, video-Broadcast video standard, Analog video, Digital video, optimizing video files for CDROM	7
4	What is meant by Animation, why we need Animation, History of Animation, Uses of Animation. Types of Animation, Principles of Animation, Some Techniques of Animation, and Animation on the WEB, Special Effects, and Creating Animation.	6
5	Creating Animation in Adobe Animate: Introduction to Animate –Working with the Timeline and Frame-based Animation-Working with the Timeline and Tween-based Animation –Understanding Layers–Action script.	6
6	3D Animation & its Concepts, Types of 3D Animation, Skeleton & Kinetic, 3D Animation Texturing and Lighting of 3D Animation, 3D Camera Tracking, Applications & Software of 3D Animation.	7

Text Books:

1. Multimedia Making Work by Tay Vaughan (TMH), 3rd Ed.
2. Principles of Multimedia by Ranjan Parekh, 2007, TMH.
3. Multimedia Technologies by Ashok Banerji, Ananda Mohan Ghosh, McGraw Hill Publication.

VI Semester

CT2384– OE IV: Multimedia and Animation

Reference Books:

1. Multimedia systems design by K. Andleigh, K. Thakkrar, Phi Pub.
2. Multimedia: Computing, Communications & Applications by Raif Stein Metz and Kiara Nahrstedt.
3. Advanced Multimedia Programming by Steve Rimmer, McGraw Hill Pub.

VI Semester

CT2385– OE-IV: Current Trends and Technologies

Objective	Outcome
1. Gain fundamental knowledge of electronic communication. 2. Understand the technologies in Internet, e-Technologies & e-Learning. 3. Learn the basics of Green Computing and its implementation in industries 4. Develop the understanding of concepts in Social Media.	Upon successful completion of this course, the student will be able to: 1. Use the basics of internet for deployment of various servers and recourses. 2. Design and implement technologies for e-Commerce and e-Learning. 3. Choose appropriate implementation of Green Computing. 4. Make use of Social Networking properly and securely.

Unit No.	Contents	Max Hrs.
1	Fundamentals of Communications: Types of communication-Wired, wireless, mobile, Modes of transmission: Simplex, Half Duplex, Full Duplex, Multiplexing techniques, History and evolution of wireless and mobile systems, Transition and characteristics of 1G, 2G, 3G, 4G, Spectrum, regulations, and frequency allocation	7
2	Fundamental of INTERNET: History, Internet working, Connections, Internet services, The World Wide Web, Tools for the WWW, Web servers, Web browsers, Web page makers and editors, Plug-ins and delivery vehicles.	6
3	e-Technologies: Electronic Commerce: Framework, Media Convergence of Applications, Consumer, Applications, Organization Applications, Electronic Payment Systems: Digital Token, Smart Cards, Credit Cards, Risks in Electronic, Payment System, Designing Electronic Payment Systems, Electronic Data Interchange (EDI): Concepts, Applications, (Legal, Security and Privacy) issues, EDI and Electronic Commerce, Standardization and EDI, EDI Software, Implementation, EDI Envelope for Message Transport, Internet-Based EDI.	7
4	e-Learning: Definition, Introduction, Types of e-Learning: Learner-led e-Learning, Facilitated e-Learning, Instructor-led e-Learning, Embedded e-Learning, Telemonitoring And e-Coaching E-Learning Models: WBT, CBT, LMS, LCMS, Virtual School Systems, E-Learning Tools And Technologies: e-mail, Online Discussion, Chat and Instant Messaging, Voting, Whiteboard, Application Sharing, Conferencing, Online Meeting Tools, Case study.	6
5	Green Computing: Introduction, Why....Green Computing? Approaches to Green Computing-Virtualization, Power Management, Power supply, Storage, Video Card, Display, IT Equipment, Recycling, Remote Conferencing & Telecommuting Strategies, Product longevity, Resource allocation, Terminal servers, Operating system support, How to Implement? Industrial implementations of Green Computing- Blackle, Fit-PC, Zonbu computer, Sunray thin client.	6
6	Social Networking: Definition, Overview of Social Networking Sites, Types of Social Networking Sites: General purpose, Niche. Advantages of Social Networking Sites, Drawbacks of Social Networking Sites, Features and Need of Social Networking, Security Issues with Social Networking Sites, Case Studies	7

VI Semester

CT2385– OE-IV: Current Trends and Technologies

Text Books:

1. Impact of E-Business Technologies on Public and Private Organizations by OzlemBak, Nola Stair.
2. Mobile Computing by Tomasz Imielinski , Henry F. Korth .
3. Broadband telecommunications technology by Byeong Gi Lee, Minho Kang, Jonghee Lee.

Reference Books:

1. Introduction to broadband communication systems by Cajetan M. Akujuobi, Matthew, N. O. Sadiku.
2. E-Learning Tools and Technologies William Hortan, Katherine Hortan,Wiley Pub
3. Internet (Use of Search Engines Google & Yahoo etc).

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

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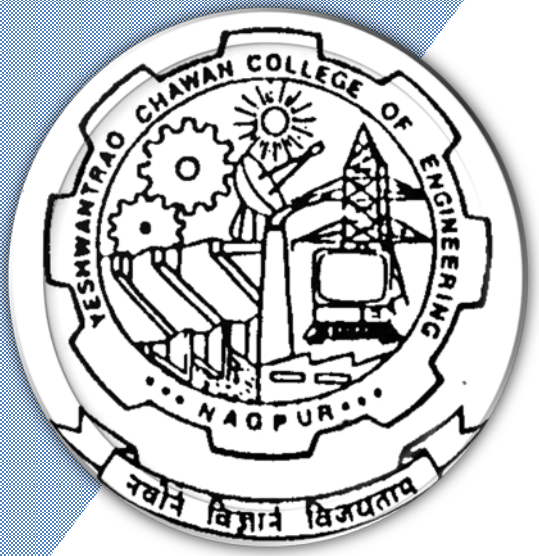

Bachelor of Engineering

SoE & Syllabus 2020

7th & 8th Semester

Computer Technology

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CT-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	CT2401	Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	CT2402	Lab: Artificial Intelligence	**P**	0	0	2	2	1		60	40	
3	7	PC	CT2403	Network Security	**T**	3	0	0	3	3	30	20	50	3 Hours
4	7	PE		Professional Elective-III	**T**	3	0	0	3	3	30	20	50	3 Hours
5	7	PE		Professional Elective-IV	**T**	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		Lab:Professional Elective-IV	**P**	0	0	2	2	1		60	40	
7	7	PE		Professional Elective-V	**T**	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	CT2409	Mini Project	**P**	0	0	4	4	2		60	40	
9	7	STR	CT2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -III

1	7	PE-III	CT2411	PE III: Neural Network & Fuzzy Logic
2	7	PE-III	CT2412	PE III: Adhoc Wireless Network
3	7	PE-III	CT2413	PE III: Information Retrival System
4	7	PE-III	CT2414	PE III: Human Computer Interaction
5	7	PE-III	CT2415	PE III: Business Intelligence and Applications

Professional Electives -IV

1	7	PE-IV	CT2421	PE IV: Pattern Recognization
	7	PE-IV	CT2422	PE IV: Lab: Pattern Recognization
2	7	PE-IV	CT2423	PE IV: Cyber Forensic
	7	PE-IV	CT2424	PE IV: Lab: Cyber Forensic
3	7	PE-IV	CT2425	PE IV: Machine Learning
	7	PE-IV	CT2426	PE IV: Lab: Machine Learning
4	7	PE-IV	CT2427	PE IV: Design Patterns
	7	PE-IV	CT2428	PE IV: Lab: Design Patterns
5	7	PE-IV	CT2429	PE IV: Mobile Communication
	7	PE-IV	CT2430	PE IV: Lab: Mobile Communication
6	7	PE-IV	CT2431	PE IV: Software Project Management
	7	PE-IV	CT2432	PE IV: Lab: Software Project Management
7	7	PE-IV	CT2433	PE IV: Numerical Computing
	7	PE-IV	CT2434	PE IV: Lab: Numerical Computing

Professional Electives -V

1	7	PE-V	CT2435	PE V: Cloud Computing
2	7	PE-V	CT2436	PE V: Parallel Programming
3	7	PE-V	CT2437	PE V: Data Mining
4	7	PE-V	CT2438	PE V: Embedded Systems
5	7	PE-V	CT2439	PE V: Operations Research
5	7	PE-V	CT2440	PE V: Bioinformatics

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.05	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

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SoE No. CT-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Computer Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	CT2451	Major Project	P	0	0	12	12	9		60	40	
2	8	STR	CT2452	Extra curricular Activity Evaluation	P	0	0	0	0	1		100		
					TOTAL	**0**	**0**	**12**	**12**	**10**				
					GRAND TOTAL	**85**	**0**	**48**	**133**	**163**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

VII Semester
CT2401 - Artificial Intelligence

Objective	Course Outcome
1. To understand fundamental concepts in Artificial Intelligence, its applications, techniques, related fields and different types of AI agents. 2. To describe different searching algorithms in AI (uninformed, informed, heuristic, constraint satisfaction) 3. To explain different knowledge representation approaches and their fundamentals 4. To understand AI planning and scheduling operations. 5. To comprehend various uncertain reasoning techniques and its applications.	**Upon successful completion of the course, the student will be able to:** 1. Describe different concepts of AI, and illustrate working of different types of intelligent agents and co-relate them in real life. 2. Differentiate between searching algorithms and apply appropriate algorithm to solve real life problems as well as in gaming domain. 3. Select appropriate knowledge representation technique to represent real life facts. 4. Analyze planning approaches and its operation for real life problem. 5. Demonstrate the working knowledge of reasoning in the presence of incomplete and/or uncertain information.

Unit No.	Contents	Max. Hrs.
1	Introduction: AI , History, Overview, Intelligent Agents, Performance Measure, Rationality, Structure of Agents, Problem-solving agents, Problem Formulation, Uninformed Search Strategies	6
2	Informed (Heuristic) Search and Exploration, Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions, inventing admissible Heuristic functions, Local Search algorithms, Hill-climbing, Simulated Annealing	8
3	Constraint Satisfaction Problems, Backtracking Search, variable and value ordering, constraint propagation, intelligent backtracking, local search for CSPs, Adversarial Search, Games, The minimax algorithm, Alpha-Beta pruning, Imperfect Real-Time Decisions	7

4	Knowledge Based Agents, Logic, Propositional Logic: Inference, Equivalence, Validity and Satisfiability, Resolution, Forward and Backward Chaining, First Order Logic: Models for first order logic, Symbols and Interpretations, Atomic sentences, complex sentences, Quantifiers, Inference in FOL, Unification, Forward Chaining, Backward Chaining, Resolution	7
5	Planning, Language of planning problems, planning with state-space search, forward and backward state-space search, Heuristics for state-space search, partial order planning, planning graphs, planning with propositional logic	7
6	Uncertainty, Handing uncertain knowledge, rational decisions, basics of probability, axioms of probability, inference using full joint distributions, independence, Baye's Rule and conditional independence, Bayesian networks, Semantics of Bayesian networks, Exact inference in Bayesian Networks.	5

SN	Title	Authors	Publisher
1	Artificial Intelligence A Modern Approach	S. Russell and P. Norvig.	Pearson Education
1	First course in AI	Deepak Khemani	McGraw Hill
2	Artificial Intelligence	E. Rich and K. Knight and Shivashankar B. Nair.	McGraw Hill

SN	Title	Authors	Publisher
1	Introduction to Artificial Intelligence and Expert System	D. W. Patterson,	PHI
2	Artificial Intelligence	George F. Lugar,	Pearson Education
3	Expert Systems: Design and Development	J.Durkin, Macmillan	Prentice Hall

VII Semester
CT2402 – Lab. : Artificial Intelligence

Sr. No.	List of Experiment
1	Write a family tree program to include following rules 1. M is the mother of P if she is a parent of P and is female 2. F is the father of P if he is a parent of P and is male 3. X is a sibling of Y if they both have the same parent. 4. Then add rules for grandparents, uncle-aunt, sister and brother.
2	Write a program to implement DFS (for 8 puzzle problem or Water Jug problem or any AI search problem).
3	Write a program to implement BFS (for Missionaries and Cannibal Problem)
4	Write a program to Implement Heuristic (Steepest Ascent) Search for Tic-Tac-Toe game problem.
5	Write a program to Implement Min-Max/Alpha Beta Pruning Algorithm for game solving.
6	Write a program to Implement Best First search for Travelling Salesman Problem
7	Write a program to Implement A* Algorithm.
8	Write a Program to solve 8 Queen Problem.
9	Write Program for Resolution algorithm.
10	Write a Program to Implement Naive Bayes Classifiers .

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VII Semester
CT2403 – Network Security

Objective	Course Outcome
Students will be able to: 1. Understand the security threats aimed at computer network and describe various security mechanisms and services to counter them. 2. study cryptographic mathematics to solve network security problems. 3. study of various cryptographic algorithms 4. Understand different security protocols at various layers of network model	Upon successful completion of the course, the student will be able to: 1. Identify threats to network security , associated attacks and countermeasures against attack. 2. Use appropriate mathematical techniques in cryptography. 3. Apply various algorithms/ mechanisms to formulate appropriate solution. 4. Use of different security protocols at various networking layers.

Unit No.	Contents	Max.
1	Introduction: Security goals, cryptographic attacks, Services and mechanism, techniques. Mathematics of cryptography : Integer arithmetic, modular arithmetic, matrices, linear congruence. Mathematics of symmetric key cryptography: Algebraic structure, GF(2^n) Fields	7
2	Traditional symmetric key ciphers: Introduction, substitution ciphers, Transposition ciphers, stream and block ciphers. Introduction to modern symmetric-key ciphers: Modern block ciphers, modern stream ciphers.	7
3	DES, AES, Encipherment using modern symmetric key ciphers: Use of modern block ciphers, use of stream ciphers: RC4. Mathematics of asymmetric key cryptography: Primes, primality testing, factorization, Chinese remainder theorem, Exponentiation and logarithms. Asymmetric key cryptography: RSA,	8
4	Message integrity and authentication: Message integrity, Random oracle model, message authentication. Cryptographic hash functions: Introduction, Description of MD hash family, Digital signature: Comparison, process, services, attacks on digital signature, Digital signature schemes. Entity authentication: Introduction, passwords, Challenge-Response, Zero knowledge, Biometric. Key management: Symmetric key distribution, Kerberos, symmetric key agreement, Public key distribution.	8

5	Security at application layer : E-mail, PGP, S/MIME. Security at transport layer: SSL architecture, four protocols, SSL message formats, Transport layer security. Security at network layer IPSec : Two modes, two security protocols, security association, security policy, ISAKMP	6
6	System security: Description of the system, Users, Trust and trusted systems, Buffer overflow and malicious software, malicious programs, worms, viruses, Intrusion detection systems, Firewalls: Definitions, construction and working principles	6

Text Books

SN	Title	Authors	Publisher
1	Cryptography and Network Security	Behrouz A. Forouzan, and Debdeep Mukhopadhyay	McGraw-Hill Publication

Reference Books

SN	Title	Edition	Authors	Publisher
1				
2				
3				

VII Semester
CT2411 – PE III: Neural Network & Fuzzy Logic

Objective	Course Outcome
1. Understand the fundamentals of biological neural network and artificial neural network 2. Understand the architecture of feed forward and feedback word neural networks. **3.** Understand the operations and properties of classical crisp set and fuzzy set theory with arithmetic operations **4.** Understand defuzzification methods used in fuzzy controller system	Upon successful completion of the course students will be able to: 1. Illustrate the fundamentals of Biological Neural Network and Artificial Neural Network with its working 2. Develop the solution for problem based on ANN using feed forward and Feed backward architecture 3. Comprehend the various concepts of fuzziness involved in fuzzy set theory and solve the problems based on it 4. Formulate fuzzy inference system using fuzzification and defuzzyfication methods

Unit No.	Contents	Max. Hrs.
1	**Fundamentals concepts and models of artificial neural systems:** Biological neurons and their artificial models, models of artificial neural networks, learning and adaptation, neural network learning rules, overview of neural networks, Programming exercise.	7
2	**Single-layer perceptron classifiers:** Discriminant functions, linear machine and minimum distance classification, training and classification using the discrete perceptron: algorithm and example, single layer continuous perceptron networks for linearly separable classification.	7
3	**Multi-layer feedback networks:** linearly non-separable pattern classification, delta learning rule. Feed forward recall and error back-propagation training, learning factors, Hopfield networks, Applications of Neural Networks.	6
4	**From classical (CRISP) sets to fuzzy sets:** introduction crisp sets: an overview, fuzzy sets: basic types, fuzzy sets: basic concepts, characteristics and significance of the paradigm shift. Fuzzy sets versus crisp sets, representation of fuzzy sets, alpha cuts, cardinality, Operations on fuzzy sets: types of operations, fuzzy complements, fuzzy intersection : T-norms, fuzzy unions: T-Conorms, Distinction between Probability, Fuzzy and Random System.	7

5	Linguistics variables, linguistic edges, Fuzzy relations, Binary Operation on a single set, projection and cylindrical extension, Extension principles for fuzzy sets, Fuzzy Arithmetic:fuzzy numbers, arithmetic operations on fuzzy numbers, Fuzzy Equations.	6
6	Defuzzification methods, design fuzzy rule base, Fuzzy Inference Systems: Mamdani Vs Sugeno, Steps in design of a fuzzy controller, applications of fuzzy logic.	6

Text Books

SN	Title	Authors	Publisher
1	Introduction to Artificial Neural System	J. M. Zurada	Jaico Publishing House, India
2	Fuzzy logic & Neural Network	T. J. Ross	Tata McGraw hill

Reference Books

SN	Title	Authors	Publisher
1	Principal of Soft Computing	S. N. Sivanandam & S. N. Deepa	Wiley India Pvt. Limited
2	Fuzzy Sets & Fuzzy Logic Theory and Applications	George J. Klir & Bo Youn	world scientific

VII Semester
CT2412 – PE III: Adhoc Wireless Network

Objective	Course Outcome
1. Understand the design issues and application areas of Ad hoc network. 2. Understand design issues and operation of protocols at each layer 3. Introduce Quality of Service and energy management techniques in Ad-hoc network.	**On completion of this course, the student will be able to** 1. Identify the need of Adhoc network compare infrastructure base and infrastructure less wireless network 2. Identify the design issues involved in the design of protocols at each layer, Compare and classify different protocols 3. Classify QoS approaches and Identify the need of energy management in ad hoc network.

Unit No.	Contents	Max. Hrs.
1	Adhoc Wireless Networks: Introduction, Issues in Ad hoc wireless Networks, Ad hoc Wireless Internet.	4
2	MAC Protocols for Ad hoc Wireless Networks: Introduction, issues in designing MAC protocol, Design goals of MAC protocols, classification, Contention based protocols: MACAW. Floor acquisition multiple access Protocols. Contention based protocols with reservation mechanism: Distributed Packet reservation multiple access protocol, Collision avoidance Time allocation protocol. Contention based MAC protocols with scheduling mechanism: Distributed priority scheduling and medium access in ad hoc networks.	6
3	Routing Protocols for Ad hoc Wireless Networks: Introduction, Issues in designing routing protocol, classification, table driven routing protocols: DSDV, cluster head gateway switch routing protocol. On demand routing protocols: DSR, AODV. Hybrid routing protocols: core extraction distributed routing protocol, Zone routing protocol. Routing protocols with efficient flooding mechanisms, hierarchical routing protocols, Power aware routing protocols.	6
4	Multicast routing in adhoc wireless networks: Introduction, Issues in designing multicast routing protocol, operation of multicast routing protocols, An architecture reference model, classification, Tree based multicast routing protocol: Bandwidth efficient multicast routing protocol, Multicast routing protocol based on zone routing, Multicast core extraction distributed Ad hoc routing, MAODV. Mesh based multicast routing protocols:	6

	on demand multicast routing protocol, Dynamic core based multicast routing protocol. Energy efficient Multicasting: Energy efficient reliable broadcast and multicast protocols, A distributed power aware multicast routing protocol. Multicasting with Quality of Service guarantees, Application dependent multicast routing.	
5	Transport layer and security protocols: Introduction, Issues in designing transport layer protocol, design goals of transport layer protocol, Classification of transport layer solutions, TCP over ad hoc wireless networks, Other transport layer protocols for ad hoc wireless network, security in ad hoc wireless network, network security requirements, Issues and challenges in security provisioning, Network security attacks, Key management, Secure routing in AD hoc Wireless networks: Requirements of secure routing protocol, security aware ad hoc routing protocol.	6
6	Quality of service and energy management in Ad hoc Wireless networks: Introduction, Issues and challenges in providing Quality of service, classification of Quality of service solutions. Introduction to energy management, Need for energy management, classification, Battery management schemes, transmission power management schemes, system power management schemes.	5

SN	Title	Authors	Publisher
1	Ad Hoc Wireless Networks Architecture and protocols	C. Siva Ram Murthy, B. S. Manoj.	Pearson Publication.

SN	Title	Authors	Publisher
1	Ad hoc Networking	Charles E. Perkins	Addison Wesley.
2	The hand book of ad hoc wireless networks	Mohammad Ilyas	CRC press.

VII Semester
CT2413 – PE III: Information Retrival System

Objective	Course Outcome
1. To provide an overview of Information Retrieval. 2. To introduce students about insights of the several topics of Information retrieval such as – Boolean retrieval model, Vector space model, Latent semantic indexing, XML and Image retrieval model. 3. To provide comprehensive details about various evaluation methods.	**On completion of this course, the student will be able to** 1. understand different Information retrieval models. 2. know about evaluation methods of the information retrieval model. 3. know the challenges associated with each topic

Unit No.	Contents	Max. Hrs.
1	**Introduction to Information retrieval**: Information retrieval process, Indexing, Information retrieval model, Boolean retrieval model **Dictionary and Postings:** Tokenization, Stop words, Stemming, Inverted, index, Skip pointers, Phrase queries	7
2	**Tolerant Retrieval** : Wild card queries, Permuterm index, Bigram index, Spelling correction, Edit distance, Jaccard coefficient, Soundex **Term Weighting and Vector Space Model:** Wild card queries, Permuterm index, Bigram index, Spelling correction, Edit distance, Jaccard coefficient, Soundex	7
3	**Evaluation**: Precision, Recall, F-measure, E-measure, Normalized recall, Evaluation problems **Latent Semantic Indexing**: Eigen vectors, Singular value decomposition, Low rank approximation, Problems with Lexical Semantics	7
4	**Query Expansion** : Relevance feedback, Rocchio algorithm, Probabilistic relevance feedback, Query Expansion and its types, Query drift **Probabilistic Information Retrieval**: Probabilistic relevance feedback, Probability ranking principle, Binary Independence Model, Bayesian network for text retrieval	6
5	**XML Indexing and Search**: Data vs. Text-centric XML, Text-Centric XML retrieval, Structural terms	6
6	**Web Information Retrieval** Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS.	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Information Retrieval	-	Christopher D. Manning, Raghavan and Schutze,	Cambridge University Press,2008

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Natural Language Processing And Information Retrieval	-	Tanveer Siddiqui and U. S. Tiwary	Oxford Higher Education,2008

VII Semester
CT2414 – PE III: Human Computer Interaction

Objective	Course Outcome
The student should be able to 1. To study and understand interface design tools, and demonstrate the Interaction between the human and computer components 2. To study and understand the screen designing and its various concepts with design rules 3. To study and understand software tools related to HCI process. 4. To understand the interaction devices.	**On completion of this course, the student will be able to** 1) Apply the knowledge of human components for interaction with computer 2) To understand basics of Computer components functions regarding interaction with human. 3) Demonstrate Understanding of Interaction between the human and computer Components using screen designing concept. 4) To Produce Implementation supports for HCI by using various tools.

Unit No.	Contents	Max. Hrs.
1	Introduction: The human: Human memory, Thinking reasoning and problem solving, Individual differences, Psychology and the design of interactive systems ,Interaction and paradigms: Models of interaction, Frame work and HCI, Ergonomics, Interaction styles, Elements of the WIMP(windows, icons, pointers, menus) interface, interactivity, The context of the interaction, paradigms for interaction	7
2	Interaction Design: What is interaction design, Good and poor design, The process of design, User focus, Scenarios, Navigation design, Understanding the problem space, Conceptualizing the design space, Theories, models and frameworks, Screen design and layout, Interaction and prototyping	7
3	HCI in software process and Design rules: The software life cycle, Usability engineering, Iterative design and prototyping, Design rationale, Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns	7
4	Implementation supports and Evaluation techniques: Elements of windowing system, Programming application, Using toolkits, User interface management systems, What is evaluation? Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, choosing evaluation methods, analytical evaluation	7

5	Universal Design and User Support: Universal design principles, Multi-modal interaction, Design for diversity, Requirements of user support, Approach to user support, Adaptive help systems, Design user support systems	7
6	Cognitive Models and Distributed Cognition: Goal and task hierarchies, Linguistics models, The challenge of display-based system, Physical and device models, Cognitive architectures, Scientific Foundation, Description, Case Study	7

Text Books

SN	Title	Authors	Publisher
1	"Human - Computer Interaction"	Alan Dix, Janet Fincay, Gregory D. Abowd and Russell Bealg,	Pearson Education, 2003.
2.	"Designing the user interface",	Ben Shneiderman	Pearson Education Asia, 2004

Reference Books

SN	Title	Authors	Publisher
1	"Interaction Design",	Preece and Rogers, Sharp	Wiley-India, 2008.
2	"The essential guide to user interface design",	Wilbert O Galitz	Wiley DreamTech, 2009

VII Semester
CT2421 – PE IV: Pattern Recognization

Objective	Course Outcome
1. The study of Pattern Recognition to equip the students with the brief knowledge of Statistical. 2. Decision Theory, Image processing, clustering, different error at pattern recognition, decision making techniques and application of pattern recognition in different fields.	1. Apply Pattern Recognition techniques for recognition. 2. Know and Apply knowledge of Statistical Decision Theory. 3. Perform Image processing concepts on images. 4. Understand and apply clustering concepts on raw 5. Apply decision making techniques.

Unit No.	Contents	Max. Hrs.
1	Introduction: Statistical Decision Theory, Image Processing and Analysis, Probability-probabilities of events, random variables, joint distribution & densities.	7
2	Moments of random variables, estimation of parameters from samples, minimum risk estimators.	7
3	Non parametric decision Making- Histograms, kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate functions, minimum squared error, estimation functions, choosing a decision making technique.	7
4	Linear Classifier Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm, Least Squares Methods, Mean Square Estimation Revisited, Support Vector Machines .	6
5	Feature Generation Introduction, Basis Vectors and Images, The Karhunen-Loeve Transform, The Singular Value Decomposition, Independent Component Analysis, The Discrete Fourier Transform, The Haar Transform.	6
6	Clustering-Introduction, hierarchical clustering, partition clustering.	6

Text Books

SN	Title	Authors	Publisher
1	Pattern recognition & Image Processing	Ealr Gose, Richard Johnson daugh & Steve Jost	PHI
2	Pattern Classification	Richard O. Duda, Peter E. Hart and David G. Stork	John Wiley

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	Pattern recognition	Sergios Theodoridis, Konstantinos Koutroumbas	Academic Press

VII Semester
CT2422 – PE IV: Lab. : Pattern Recognization

Sr. No.	List of Experiment
1	Enhance an image using Average Filter.
2	Detect the edges using Sobel operator.
3	Plot a histogram of a given image.
4	Classify an objects based on adadptive desion boundary technique.
5	Classify an objects based on nearest neighbor classification techniques.
6	Implement The Perceptron Algorithm.
7	WAP to implement SVM.
8	Extract features using ICA.
9	Extract features using DFT.

VII Semester

CT2423 – PE IV: Cyber Forensic

Objective	Course Outcome
1. To Comprehend different modern techniques with respect to Computer System and various accepts of Information security 2. To Comprehend different forensic tools used in cyber forensics 3. To Understand different legal techniques and aspects for securing data 4. To Understand the process of compilation of report writing tools and techniques used in digital forensics.	1. Investigate hardware parts of a computer system for evidences 2. Use different tools for data acquisition and duplication for forensic study 3. Securely store data and evidence collected 4. Create report of forensic investigation made

Unit No.	Contents	Max. Hrs.
1	Types of Cyber Crime, Security Attacks, Overview of computer forensics in today's world, computer hardware basics, Computer forensics investigation process, understanding hard disks and file systems, Types of computer forensics.	6
2	Computer forensic: Data acquisition and duplication, defeating anti-forensics techniques, operating system forensics, Log analysis and event viewer, File auditing, identifying rogue machines, Malware forensic Database forensic.	6
3	IT fraud, Recovery of deleted files, Live Data collection and investigating Linux environment. Password recovery (tools like John the ripper, L0phtcrack, and THC-Hydra), email crimes.	6
4	Network forensics, investigating web attacks, Gathering Tools to create a response toolkit. Hidden files and unauthorized access points. Analyzing network traffic, sniffers Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap, Netscan etc.	6
5	Mobile Forensics, Live Data collection and investigating on android, ios, windows environment, Investigating report generation, investigation process, acquisition types, tools, report generation	6
6	Forensics report writing and presentation, Case studies	6

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Incident Response & Computer Forensics	Mandia, K., Prosise, C., Pepe, M.	Tata-McGraw Hill
2	Guide to Computer Forensics and Investigations	Bill Nelson, Amelia Phillips, Frank Enfinger, and Chris Steuart	Thomson Learning

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	File System Forensic Analysis	Brian Carrier	Wesley
2	Digital Evidence and Computer Crime	Eoghan Casey	Academic Press
3	Windows Forensic Analysis DVD Toolkit (Book with DVD-ROM),	Harlan Carvey	Syngress Publication
4	EnCE: The Official EnCase Certified Examiner Study Guide	Steve Bunting	Sybex Publication

VII Semester
CT2424 – PE IV: Lab. : Cyber Forensic

Sr. No.	List of Experiment
1	Study practical on cyber-crime and generation of Hash values on file system
2	Perform data accusation and imaging on digital evidences
3	Perform recovery and data carving on digital evidence
4	Explore and analyses tools on Email analysis an investigation
5	Password recovery tools, from RAR, DOC, PDF, windows password
6	Mobile forensics SIM card analysis
7	Mobile data Analysis
8	Vulnerability Analysis on Windows
9	Report and Evidence Submission using Tools

VII Semester
CT2425 – PE IV: Machine Learning

Course Objectives	Course Outcomes
1. The basic concepts of machine learning and the relative strengths and weaknesses of different machine learning methods. 2. To understand the concepts of different types of machine learning algorithms and how to apply learning algorithms to sample. 3. To understand the different methods of evaluation of machine learning algorithms 4. To understand different ensembling methods and new techniques like deep and shallow learning.	**Upon successful completion of the course students will be able to:** 1. Interpret machine learning techniques suitable for a given problem 2. Apply machine learning techniques to solve the problems 3. Compare machine learning techniques 4. Evaluate different machine learning techniques

Unit No.	Contents	Max. Hrs.
1	Introduction, machine learning classes (i.e., supervised, unsupervised and reinforced), well posed and ill posed learning problems, designing a learning system, perspective and issues in machine learning, applications	6
2	Introduction, Factors, Response, and Strategy of Experimentation, Guidelines for Machine Learning Experiments, Cross-Validation and Resampling Method, Measuring Classifier Performance, Interval Estimation, Hypothesis Testing, Assessing a Classification Algorithm Performance, Comparing Two Classification Algorithms, Comparing Multiple Algorithms: Analysis of Variance, Comparison over Multiple Datasets	8
3	Learning a class from Bayesian learning, learning theory (bias/variance tradeoffs; VC theory; large margins), Generative/discriminative learning, parametric/non-parametric learning linear and logistic regression, svm	7
4	Introduction, Density Estimation, Clustering Dimensionality reduction, PCA, kernel methods	7

5	Introduction, decision tree representation, appropriate problems for Decision Tree learning, the basics decision tree learning algorithm, hypothesis space search, inductive bias in decision tree learning, issues in decision tree learning.	6
6	Ensemble methods, Introduce the concepts behind deep learning and benefits of deep over shallow networks, introduce the concepts of reinforcement learning	6

SN	Title	Authors	Publisher
1	Introduction to Machine Learning	Ethem Alpaydin	The MIT Press
2	Machine Learning	Tom Mitchell	McGraw-Hill Science/Engineering/Math

Reference Books:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning. http://research.microsoft.com/enus/um/people/cmbishop/prml/.
2. R. Sutton and A. Barto, An Introduction to Reinforcement Learning (http://webdocs.cs.ualberta.ca/~sutton/book/ebook/thebook.html)
3. C. Szepesvari, Algorithms for Reinforcement Learning (http://www.sztaki.hu/~szcsaba/papers/RLAlgsInMDPslecture.pdf)
4. Deep learning:Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning (http://www.deeplearningbook.org/)

VII Semester
CT2426 – PE IV: Lab. : Machine Learning

Sr. No.	List of Experiment
1	Implementation of basic concepts of performance evaluation
2	Implementation of hypothesis testing for the given problems.
3	Implementation of Naive bayes Algorithm for the given problem.
4	Implementation of Nearest neighbour algorithm.
5	Implementation of SVM
6	Implementation of Clustering algorithm.
7	Implementation of PCA
8	Implementation of decision tree
9	Project

VII Semester
CT2427 – PE IV: Design Patterns

Objective	Course Outcome
• The aim of the course is to appreciate the idea behind Design Patterns in handling common problems faced during building an application • This course covers all pattern types from creational to structural, behavioral to concurrency and highlights the scenarios when one pattern must be chosen over others.	• Create software designs that are scalable and easily maintainable • Use creational design patterns in software design for class instantiation • Use structural design patterns for better class and object composition • Use behavioral patterns for better organization and communication between the objects • Use refactoring to compose the methods for proper code packaging, to better organize the class responsibilities of current code

Unit No.	Contents	Max. Hrs.
1	Introduction to Design Patterns and Observer Pattern:Basics of Design patterns, Description of design patterns, Catalog and organization of catalog, design patterns to solve design problems, selection of design pattern, Use of design patterns.	8
2	Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Creational Patterns	7
3	Structural Pattern: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy, Discussion of Structural Patterns	7
4	Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns	6
5	A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation, Summary	6
6	Complexity Analysis of Design Patterns, Methods to analyze the complexity of design patterns, Implementation techniques and applications of design pattern in game design, product design,	6

Text Books				
	Title	**Edition**	**Authors**	**Publisher**
1	Head First Design Patterns,		Eric Freeman and Elisabeth Freeman	
2	Design Patterns Explained		Shalloway and Trott	

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Pattern's in JAVA Vol-I		Mark Grand	Wiley DreamTech.
2	Pattern's in JAVA Vol-II		Mark Grand	Wiley DreamTech.
3	Introduction to design Patterns in C++ with Qt		Alan Ezust, Paul Ezust	

VII Semester
CT2428 – PE IV: Lab. : Design Patterns

Sr. No.	List of Experiment
1	Write a java program to create a shape and concrete class implementing these interfaces. (factory pattern).
2	Write a java program to create a single object class. (singleton pattern).
3	Write a java program to create an abstract class shape and concrete classes extending the shape class. (Prototype design pattern).
4	Write a java program to create an adapter class media adapter which implements the media player interface and uses advance media player object to play required format (adapter design pattern).
5	Write a java program to create employee class to add department level hierarchy and print all employees. (Composite design Pattern)
6	Write a Java Program to create Shape interface and add a Shape Decorator Class an additional feature as Red Shape Decorator and give output as Red Shape Circle or Rectangle(Decorator Pattern)
7	Write a java program to create draw api interface which is acting as a bridge implementer and concrete classes redcircle, greencircle implementing drawapi interface.(bridge design pattern).
8	Write a java program to create a Shape interface and concrete classes implementing the Shape interface. A facade class Shape Maker is defined as a next step.(Façade Pattern)
9	Write a java program to create two objects , Stock which gives command and Broker which invokes the object and implement the interface Order.(Command Pattern)

VII Semester
CT2429 – PE IV: Mobile Communication

Objective	Course Outcome
1. To study wireless networks its standards and protocol 2. Understand different generations of wireless network	1. Select appropriate standards for the given situation 2. Illustrate the generations of telecommunication systems in wireless network 3. Develop an application using different tools

Unit No.	Contents	Max. Hrs.
1	Introduction to wireless communication, introduction to cellular system, wireless transmission: frequencies for radio transmission, signal prorogation. Introduction to medium access control: TDMA, CDMA GSM: System architecture protocols, localization and calling, handover, Modulation Techniques.	5
2	Wireless LAN: IEEE 802.11, Bluetooth, Zigbee etc. Satellite Systems: GEO, LEO, MEO routing, localization and handover Mobile network Layer: Mobile IP, dynamic host, configuration protocol, adhoc networks, IPv6. Mobile transport layer: traditional TCP, indirect TCP & mobile TCP	6
3	2G-Global System for mobile communication (GSM) Introduction, GSM Architecture, Database and Data Elements, GSM Interfaces, GSM Protocol Architecture, GSM Versions	5
4	2G: IS95 cellular system (CDMA): Introduction, Motivation for CDMA to use in Mobile Communication, IS95 cellular System (CDMA) forward Channel, Reverse Channel Parameters of CDMA, wireless Local Loop Radio System. 4G LTE, 5G Introduction, LIFI	5
5	2.5 G: General Packet Radio service (GPRS) Introduction, Advantages of GPRS, GPRS Application, GPRS Architecture, GPRS Interfaces Logical Channels in GPRS, Protocol Architecture, Internetworking with IP Networks, GPRS terminals	6
6	3G: Universal Mobile Telecommunication System (UMTS) Introduction, UMTS Services, UMTS Architecture, UMTS Core Network, 4G introduction, Architecture of wireless Application protocol (WAP), Issues of Mobile Application.	6

SN	Title	Authors	Publisher
1	Mobile communication	Jochen Schiller	Addison Wesley pub
2	Mobile Communication Systems	KrzysztofWesolowski	Wiley Publication
	Wireless Communication principles & Practice	T.S.Rappaport	PHI pub

SN	Title	Authors	Publisher
1	Mobile communications Design Fundamentals	William C.Y.Lee	John Wiley & Sons pub

VII Semester
CT2430 – PE IV: Lab. : Mobile Communication

Sr. No.	List of Experiment
1	Installation of JDK1.6 and SDK1.3.
2	Study of JDK (Eclipse) Tool kit and software development kit.
3	Study of WML: Wireless Markup Language and its examples.
4	Develop an application in Android to store contacts in mobile handheld device.
5	Develop an application in Android to read an user input text.
6	Develop a Standup Timer in an Android that acts as a simple, stand-up meeting stop watch.
7	Study of Wireless Application protocol (WAP)
8	To study Pervasive Computing.

VII Semester
CT2431 – PE IV: Software Project Management

Objective	Course Outcome
1. To learn basic concepts project contract and to get an overview of various activities under project planning. 2. To understand techniques for cost benefit analysis And risk evaluation. 3 To understand project scheduling and various network planning models. 4. To understand Risk Management, Risk Planning and control. 5. To understand various activities like visualizing progress, earned value analysis etc. under monitoring and controlling of a project. 6. To understand the role of continuing training and learning, to improve group working and to select appropriate leadership styles	1. To understand basic concepts about project, project management and project planning. 2. To assess given requirements and perform cost benefit analysis. 3. To create a project schedule using some network planning model for given requirements. 4. To identify and create a risk management plan for given requirements. 5. To perform earned value analysis for given requirements and current completion state of project. 6. To form teams for any given exercise, work as a team and understand leadership qualities.

Unit No.	Contents	Max. Hrs.
1	Introduction to Software Project Management: Project Definition, Contract Management, Activities Covered By Software Project Management, Overview of Project Planning, Stepwise Project Planning	8
2	UNIT II Project Evaluation: Strategic Assessment, Technical Assessment, Cost Benefit Analysis, Cash Flow Forecasting, Cost Benefit Evaluation Techniques, Risk Evaluation.	7
3	Activity Planning: Objectives, Project Schedule, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass, Backward Pass, Activity Float, Shortening Project Duration, Activity on Arrow Networks.	7
4	Risk Management: Risk Management, Nature Of Risk, Types Of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning And Control.	6
5	Monitoring and Control: Creating Framework , Collecting The Data , Visualizing Progress, Cost Monitoring, Earned Value, Prioritizing Monitoring, Getting Project Back To Target, Change Control, Managing Contracts, Introduction, Types Of Contract, Stages In Contract Placement, Typical Terms of A Contract, Contract Management, Acceptance.	6

6	Managing People and Organizing Teams: Introduction, Understanding Behavior, Organizational Behaviour: A Background, Selecting The Right Person For The Job, Instruction In The Best Methods , Motivation, The Oldman – Hackman Job Characteristics Model, Working In Groups– Becoming A Team, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety.	6

SN	Title	Authors	Publisher
1	"Software Project Management",	Bob Hughes, Mikecotterell,	Tata McGraw Hill.

SN	Title	Authors	Publisher
1	Managing Global Projects,	Ramesh, Gopalaswamy	Tata McGraw Hill
2	"Software Project Management",	Royce,	Pearson Education.
3	"Software Project Manangement in Practive",.	Jalote,	Pearson Education

VII Semester
CT2432 – PE IV: Lab. : Software Project Management

Sr. No	List of Experiment
1	Introduction to Software Project Management fundamentals.
2	To analyze requirements for a given case study.
3	To create a WBS for the given case study.
4	To perform risk management for the case study – 1.
5	To perform risk management for the case study – 2
6	Overview of Planning tool.
7	To create Project Schedule for the case study -1
8	To create Project Schedule for the case study -2.
9	To perform cost benefit analysis for case study
10	To study contract management and contract document.

VII Semester
CT2433 – PE IV: Numerical Computing

Objective	Course Outcome
1. To understand basics of error induced in numerical computation 2. To develop numerical algorithms and skills to implement algorithms to solve mathematical problems on the computer 3. Learn technologies to solve integration numerically 4. Understand techniques to solve differential equations and systems of equations for convergence of iteration method.	1. Apply appropriate formula to find different types of error in numerical computation and mitigate it. 2. Choose and apply appropriate *numerical* techniques for problem solving interpret the *results* and assess accuracy. 3. Apply appropriate techniques for numerical integration 4. Demonstrate basics of conditioning of problems and stability of numerical algorithms

Unit No.	Contents	Max. Hrs.
1	Introduction to numerical computing: Characteristics of Numerical computing, Approximations and errors in numerical computations, types of errors, analysis, error estimation, numerical instabilities in computation, convergence (convergence of iterative method)	6
2	Roots of Non-linear equations: Methods of solutions, Iterative methods, Horner‟s rule, Bisection method, Regula Falsi method, Iteration method, Newton Raphson method, Secant method	8
3	Solutions to System of Linear Algebraic Equations: Existence of Solution, Solution By Elimination, Cramers rule, Basic Gauss Elimination Method, Gauss Elimination With Pivoting, Gauss – Jordan Method, Tringularization Methods, Choleskey‟s Method, Gauss Siedel method of iteration. Round Off Errors And Refinement, Ill – Conditioned System, Matrix Inversion Method.	8
4	Interpolation and Approximation: Linear interpolation and high order interpolation using Lagrange and Newton Interpolation methods, finite difference operators and interpolation polynomials using finite differences.	8
5	Numerical Differentiation and Integration: Numerical differentiation and errors in numerical differentiation, NewtonCotes formulae, trapezoidal rule, Simpson‟s rule, Double integrals by Trapezoidal and Simpson rule, Romberg Integration.	8
6	Numerical Solution of Ordinary Differential Equation: Solution By Taylor‟s Series, Picard‟s Method Of Successive Approximation, Euler‟s Method, Error Estimates For The Euler Method, Runge-Kutta Method for 2nd and 4th order, Predictor-Corrector Methods	8

SN	Title	Authors	Publisher
1	Introductory Methods of Numerical Analysis	Sastry, S. S	Prentice- Hall of India, New Delhi (2002).

SN	Title	Authors	Publisher
1	Numerical Methods	E. Balagurusamy	Tata McGraw hill.
2	Schaum's Outlines: Numerical Analysis	-	Tata McGraw Hill Publishing Co. Limited.
3	Numerical Computational Methods	P.B. Patil, U.P. Verma	Narosa Publishing, New Dellhi, 2006

VII Semester
CT2434 – PE IV: Lab. : Numerical Computing

S.N	List of Practicals
1	To find the absolute, relative percentage error in given function when: i. Three terms ii. Five terms are considered. The given function is: $y = e^x$
2	To find solution for Algebraic and Transcendental equation using Bisection Method.
3	To find solution for Algebraic and Transcendental equation using Regula Falsi Method.
4	To find solution for Algebraic and Transcendental equation using Newton Raphson Method
5	To find solution of Linear System of equations using Gauss Elimination Method.
6	To find solution of Linear System of equations using Gauss - Siedal Method of Iteration.
7	To Implement Lagrangian method of interpolation.
8	To calculate numerical Differentiation using Newton's Forward Interpolation formula
9	To calculate Integration using Simpson's rule/Trapezoidal Rule

VII Semester
CT2435 – PE V: Cloud Computing

Objective	Course Outcome
1. Understand cloud architecture and identify various parameters. 2. Identify and explore cloud computing stack and various cloud framework. 3. To understand and apply abstraction and virtualization in the cloud context. 4. Explore cloud infrastructure and understand cloud management lifecycle. 5. Classify various cloud security management standards and study various cloud applications methodologies	1. Explain software and hardware support for enterprise and cloud computing. 2. Perform data modeling for enterprise and cloud knowledge bases. 3. Design enterprise and cloud software applications. 4. Implement and run distributed and cloud applications. 5. Ensure security and privacy in enterprise and cloud application while implementing cloud applications methodologies.

Unit No.	Contents	Max. Hrs.
1	**Introduction to Cloud Computing**: Defining Cloud Computing; Cloud Types and different models-The NIST model, The Cloud Cube Model, Deployment models, Service models; Examining the Characteristics of Cloud Computing; Benefits of cloud computing; Disadvantages of cloud computing; Assessing the Role of Open Standards.	8
2	**Cloud Architecture, Services and Applications**: Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Saas Vs. Paas, Using PaaS Application Frame works, Software as a Service, Identity as a Service, Compliance as a Service.	7
3	**Abstraction and Virtualization**: Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hyper visors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.	7
4	**Exploring Cloud Infrastructures**: Managing the Cloud-Administrating the Clouds, Management responsibilities, Lifecycle management Cloud Management Products, Emerging Cloud Management Standards, Understanding Service Oriented Architecture-Introducing Service Oriented Architecture.	8

5	**Managing & Securing the Cloud:** Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, the security boundary, Security service boundary, Security mapping, Brokered cloud storage access, Establishing Identity and Presence.	7
6	**Advance Clouds and Case Studies**: Cloud Computing Cost Analysis, basic, Selecting an IaaS Provider, Capacity Planning and Disaster, Recovery in Cloud Computing, AWS Cloud architectural principles, basic/core characteristics of deploying and operating in the AWS Cloud, the key services on the AWS Platform and their common use cases, Define the billing, account management, and pricing models, Introduction to Amazon EC2. Case Studies: Microsoft Azure, Dropbox.	8

SN	Title	Authors	Publisher
1	Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online.	Michael Miller	Springer
2	Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc.	Rajkumar Buyya, James Broberg, Andrzej Goscinski,	A John Wiley & Sons, Inc. Publication

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	Mastering cloud computing	Rajkumar buyya, Christian vecchiola, S Thamarai Selvi	Tata Mc-Graw Hill Education Private Limited
2	Cloud Computing a Practical Approach	Anthony T .Velte, Toby J. Velte, Robert Elsenpeter	Tata Mc-Graw-HILL
3	Cloud computing bible	Barrie sosinsky	Wiley publishing
4	https://cloud.google.com/appengine/docs https://www.chef.io/solutions/cloud-management/ https://aws.amazon.com/documentation https://dev.twitter.com/overview/documentation https://developers.facebook.com/ https://www.cloudfoundry.org/ https://puppet.com/blog/implement-a-message-queue-your-cloud-applicati		

VII Semester
CT2436 – PE V: Parallel Programming

Objective	Course Outcome
1. To provide basics of concepts of parallel computing 2. To understand principles of parallel algorithm design 3. To understand performance measuring metrics for parallel system 4. To understand basics of thread programming 5. To familiarize with different directives of parallel programming framework i.e OpenMp 6. To understand concepts of Dynamic Programming formulations w.r.t parallel perspective	1. identify areas where parallel computing is applicable 2. implement parallel version of different algorithms using thread programming and openMp 3. find the speedup factor by analyzing parallel programs 4. develop real life applications using parallel programming

Unit No.	Contents	Max Hrs.
1	**Introduction to Parallel Computing:** Motivating Parallelism , Applications, Parallel ProgrammingPlatforms: Implicit Parallelism: Limitations of Memory System Performance, Dichotomy ofParallel Computing Platforms, Physical Organization of Parallel Platforms, CommunicationCosts in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact ofProcess Processor Mapping and Mapping Techniques**.**	6
2	**Principles of Parallel Algorithm Design**: Preliminaries Decomposition Techniques,Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods forContaining Interaction Overheads, Parallel Algorithm Models, Basic Communication operations:One to All Broadcast and All to One Reduction, All to All Broadcast and Reduction, All Reduceand Prefix Sum Operations, Scatter and gather, All to All Personalized Communication, CircularShift, Improving the Speed of Some Communication Operations	7
3	**Analytical Modeling of Parallel Programs:**Analytical Modeling of Parallel Programs: Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time andMinimum Cost Optimal Execution Time,Asymptotic Analysis of Parallel Programs, OtherScalability Metrics,	7

4	**Programming Shared Address Space Platforms**: Programming Using the Message Passing Paradigm: Principles of Message PassingProgramming, The Building Blocks: Send and Receive Operations , MPI: the Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation,Collective Communication and Computation Operations, Groups and Communicators.	8
5	**Programming Shared Address Space Platforms**: Thread Basics, Why Threads? OpenMP: aStandard for Directive Based Parallel Programming, Dense Matrix Algorithms: Matrix VectorMultiplication, Matrix Matrix Multiplication, Issues in Sorting on Parallel Computers, BubbleSort and its Variants s	5
6	**Dynamic Programming:**Dynamic Programming: Overview of Dynamic Programming, Serial Monadic DP Formulations,Monadic DP Formulations, The Longest Common Subsequence Problem, Serial Polyadic DPFormulations, All Pairs Shortest Paths Algorithm**.**	6

SN	Title	Authors	Publisher
1	Introduction to Parallel Computing,	Ananth Grama	Pearson Education

SN	Title	Authors	Publisher
1	Fundamental of Paralle Processing,	Harry F. Jordan, Gita Alaghband,	Pearson Education
2	Parallel Programming	Michael Allen, Barry Wilkinson	Pearson Education

VII Semester
CT2437 – PE V: Data Mining

Objective	Course Outcome
1. To understand the concepts related to knowledge extraction and data preparation 2. To comprehend the concepts of association rule mining 3. To appreciate the working of supervised algorithms for data analysis 4. To understand various advanced data mining techniques	1. Use the data preprocessing techniques to prepare data for knowledge extraction 2. Apply the association rule mining on data 3. Apply various supervised techniques to mine the data 4. Describe various advanced concepts and techniques of data mining

Unit No.	Contents	Max. Hrs.
1	**Introduction to data mining (DM):** What is data mining, Related technologies - Machine Learning, DBMS, OLAP, Statistics Data Mining Goals, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications, Data pre-processing, Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies	8
2	**Data mining algorithms: Association rules** Motivation and terminology, Example, Basic idea: item sets, generating item sets and rules efficiently, Advanced Association Rule Techniques, Measuring the Quality of rules Correlation analysis	7
3	**Classification** Basic learning/mining tasks, inferring rudimentary rules: 1R algorithm, Decision trees, Covering rules, accuracy and error measures, evaluation of the accuracy of a classifier	7
4	**Prediction** The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbour), Linear models, Neural Network Prediction methods: Linear and nonlinear regression, Logistic Regression	6

5	**Cluster Analysis** Clustering: Problem Definition, Clustering Overview, Evaluation of Clustering Algorithms, Partitioning Clustering -K-Means Algorithm, K-Means Additional issues, PAM Algorithm; Hierarchical Clustering – Agglomerative Methods and divisive methods, Basic Agglomerative Hierarchical Clustering, Strengths and Weakness; Outlier Detection, Clustering high dimensional data	6
6	**Advanced techniques, Data Mining software and applications** Text mining: extracting attributes (keywords), structural approaches (parsing, soft parsing). Bayesian approach to classifying text, Web mining: classifying web pages, extracting knowledge from the web, Data Mining software and applications	6

SN	Title	Authors	Publisher
1	Data Mining practical Machine Learning Tools And Techniques	Mark A. Hall Ian H. Witten ,Eibe Frank	ELSEVIER
2	Data Mining –Concepts and Techniques"	Jiawei Han & Micheline Kamber	ELSEVIER

SN	Title	Authors	Publisher
1	Data Mining Techniques	Arun K Pujari	

VII Semester
CT2438 – PE V: Embedded Systems

Objective	Course Outcome
Students will be able to: 1. To understand the types of processors & architectures used, design & co-design concepts used in ES. 2. To empower students to perform a rigorous analysis of a given problem, while taking into account the classical constraints of an embedded system. 3. To understand the concepts of Real Time Operating System. 4. To make students capable of deciding the type of operating system to use in ES. 5. Provide skills in embedded C programming.	Upon successful completion of the course, the student will be able to: 1. Use the basics of ES, decide the components of a particular ES. 2. Design & implement the hardware & software and integrate them to develop the final device. 3. Distinguish real-time embedded systems from other systems 4. Choose proper type of OS for the proposed embedded device. 5. Choose proper microcontroller / microprocessor for a particular ES design. 6. Develop the program for core functionality & communication of ES with other devices.

Unit No.	Contents	Max. Hrs.
1	Embedded Systems concepts and definition, Embedded System design: Requirement analysis, Hardware and Software Design, co-design, I/O interface co-design for distributed embedded system, Applications of Embedded system.	7
2	Embedded Computing platform Software Development tools and debugging technologies Host and Target machines, Cross Assemble &Cross Compiler, Linker/Loader for embedded software, study and use of simulator, EPROM emulator, In Circuit Emulator, concept of tool chain.	7
3	Concept of Real Time Operating System, Real Time IO, R/T Multitasking & multithreading processes, RTOS Task Scheduling models Inter-task Communication, memory management.	8
4	Overview of Embedded Operating Systems, Real Time operating System, Handheld operating system, Some Representative Embedded Systems.	8

5	ARM Architecture Block Diagram, Pin Description Memory Organization, Register Description, I/O Ports, Interrupts	6
6	Thumb Instruction Set and Programming Timers, Serial communication, interfacing with analog and digital circuits.	6

SN	Title	Authors	Publisher
1	"Introduction to Embedded Systems",	Shibu. K. V,	Tata Mcgraw Hill

SN	Title	Authors	Publisher
1	"Embedded System Design"	Steve Heath	Elsevier,
2	"An Embedded Software Primer"	David E. Simon	Pearson Education,

VII Semester
CT2439 – PE V: Operations Research

Objective	Course Outcome
1. To understand the meaning, purpose and tools of Operation Research, study the different phases involved in solving Operation Research problems, its application and limitations in business and industrial organization. 2. To understand and formulate Linear Programming problem, perform graphical analysis of the linear programming problem and solve the problem graphically, understand and solve Linear Programming problem by using different Simplex Methods (Simplex, Big M, 2 Phase, etc.). 3. To understand the concepts of duality in Linear Programming problem, properties of dual, and Integer Programming concepts and solve Linear Programming problem using dual method. 4. To understand different Allocation models (Assignment and Transportation models) and use them to solve various real life problems using different methods for solving assignment and transportation problems. 5. To understand different kind of restrictions on transportation model, degeneracy, study and apply sequencing and scheduling methods to solve real life problems. 6. To understand and solve the problem of constrained optimization using Karush-Kuhn-Tucker conditions. Study and use different Operation Research tools for solving optimization problem and applying different Operation Research models using this tools. eg. Mathematica.	Upon successful completion of the course, the student will be able to: 1. To describe at an intuitive level, the process of operations research. 2. To solve Linear Programming problems from the description of the real systems using different Operation Research models. 3. To solve Linear Programming problem using duality and find alternative constraints. 4. To solve Assignment and Transportation problem so as to optimize the results of allocation models. 5. To solve sequencing and scheduling problem. 6. To use the mathematical tools that are needed to solve optimization problem.

Unit No.	Contents	Max. Hrs.
1	**MODELING APPROACH** Definitions, Characteristics, Scope and Limitations of OR, phases of OR modeling OR tools and techniques of OR	8
2	**LINEAR PROGRAMMING** Linear Programming, assumptions and formulation of LP model, solution of LPP by graphical method, simplex method, Dual Simplex Method, Two Phase Simplex Method, Big M Method, Duality in LP	7
3	**ALLOCATION MODELS** Assignment models: Definition and assumptions, formulation and solution, multiple optimum solutions, prohibited assignment	7
4	**ALLOCATION MODELS** Transportation model Definition, Solution of Transportation Model, prohibited and preferred routes, and degeneracy in transportation problem.	6
5	**INTEGER PROGRAMMING** Definition, applications, Branch and Bound Method to solve Travelling Salesman Problem.	6
6	**Machine Sequencing:** n jobs through two machines, n jobs through three machines, n jobs through m machines, two jobs through m machines sequencing problem. Constrained Optimization: Karush-Kuhn-Tucker Conditions for Constrained Optimization, exposure to tools e.g. Mathematica	6

SN	Title	Authors	Publisher
1	Optimization technique	Radrin	pearson ,Ed. Publication
2	Problems in Operation Research	P.K.Gupta & Man Mohan	Khanna Pub.

SN	Title	Authors	Publisher
1	Introduction to Operation research	Hiller & Liberman	
2	Operation Research	Kantiswaroop & Gupta	S.Chand Pub
3	Principles of Operation Research	Wagner	PHI Pub.
4	Mathematical Models in Operation Research	J. K. Sharma	Mac millan Pub.

VII Semester
CT2440 – PE V: Bioinformatics

Objective	Course Outcome
1. To understand various kinds of biological data 2. To provide concepts of mathematics and statistics for handling biological data 3. To understand working computational algorithms and biological tools	1. To interpret various kinds of biological data for understanding etiology of disease 2. To develop algorithms for handling biological data 3. To use various biological tools for handling biological data

Unit No.	Contents	MaxHrs.
Prerequisite: Basic knowledge of Biology, Mathematics and Statistics		
1	Introduction to molecular biology, Probability and theoretical distributions, various biological database and tools in computational biology (NCBI, EMBL etc.), data acquisition for computational analysis.	6
2	Introduction to computational algorithms, sequence alignment, Smith-Waterman algorithm (local alignment), Needleman-Wunsch algorithm (global alignment), one-to-one sequence alignment, one-to-many sequence alignment, many-to-many sequence alignment	7
3	BLAST (online/offline), BioEdit software, BLASTZ, MUMmer for genome alignment, Phylogentic tree analysis, DNA pattern search using suffix-tree analysis, longest common substring search, introduction to online tools like ClustalW, clustal omega for multiple sequence alignment and phylogenetic tree construction	7
4	Computational analysis of next generation sequencing (NGS) data, alignment of NGS reads, identification and annotation of mutations, software tools for variant identification, differentially expressed gene analysis using RNAseq data.	8
5	Basic concepts in Statistical Genetics, mutation models, principal component analysis in genetics, linear mixed models in genetics, major public data source like HapMap	5
6	Case study for various biological tools	6

SN	Title	Authors	Publisher
1	Fundamentals of Bioinformatics	Harisha S.	Wiley
2	A Textbook of Bioinformatics Information-theoretic Perspectives of Bioengineering and Biological Complexes	Perambur S Neelakanta	World Scientific

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	**https://www.ncbi.nlm.nih.gov/**		
2	Bioinformatics : Sequence and Genome Analysis	David W. Mount	CBS Publishers

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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BE SoE and Syllabus 2020

Computer Technology

VIII Semester

CT2451 - Major Project

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices. 5. To analyze and design RCC & steel structures, draw and prepare cost estimates of civil engineering structures.	On successful completion of the course students will be able to: 1. Demonstrate a sound technical knowledge of their selected project topic. 2. Undertake problem identification, formulation and solution. 3. Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team. 4. Communicate effectively to discuss and solve engineering problems.
Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 **PSO** : i,ii,iii	

The group of students will continue to work for the project allotted previously and will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

VIII Semester
CT2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
1. To expose to culture and tradition. 2. To provide opportunity for student to perform and present their hidden talent, still and art. 3. To nurture hobbies. 4. To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits. 5. To develop creative talent, self-confidence, sense of achievement. 6. To be able to design process on environmental, social, political, ethical, health and safety. 7. To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	1. An ability to work initially as well as part of team to achieve set goals. 2. An ability to work to serve society and for betterment of society. 3. An ability to communicate with people at large.
Mapped Program Outcomes : 5,6,7,9,10,11	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.

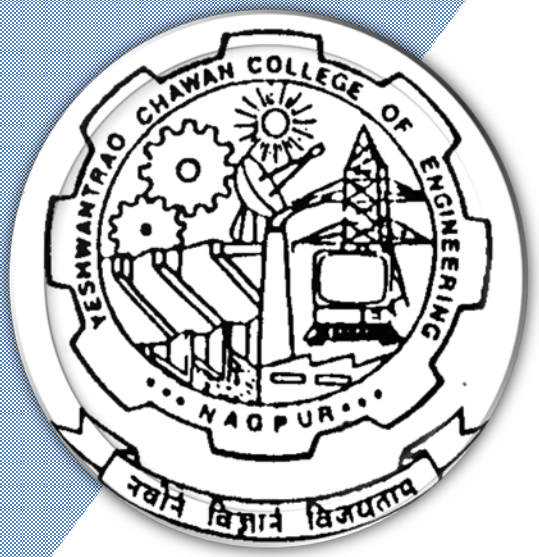
Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology

SoE & Syllabus 2020

3rd to 8th Semester

Information Technology

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

SoE No. IT-202.1

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
				Third Semester										
1	3	BS	GE2201	Engineering Mathematics III	**T**	3	0	0	3	3	30	20	50	3
2	3	PC	IT2201	Digital Circuits & Microprocessors	**T**	3	0	0	3	3	30	20	50	3
3	3	PC	IT2202	Digital Circuits & Microprocessors Lab	**P**	0	0	2	2	1		60	40	
4	3	PC	IT2203	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3
5	3	PC	IT2204	Object Oriented Programming Lab	**P**	0	0	2	2	1		60	40	
6	3	PC	IT2205	Data Structures and Program Design-I	**T**	4	0	0	4	4	30	20	50	3
7	3	PC	IT2206	Data Structures and Program Design-I Lab	**P**	0	0	2	2	1		60	40	
8	3	PC	IT2207	Computer Architecture & Organization (Self - Learning-Online)	**T**	3	0	0	3	3	30	20	50	3
9	3	PC	IT2208	Software Lab	**P**	0	0	2	2	1		60	40	
				TOTAL THIRD SEM		**16**	**0**	**8**	**24**	**20**				
				Fourth Semster										
1	4	BS	GE2206	Discrete Mathematics and Probability Theory	**T**	3	0	0	3	3	30	20	50	3
2	4	PC	IT2251	Data Structures and Program Design-II	**T**	3	0	0	3	3	30	20	50	3
3	4	PC	IT2252	Data Structures and Program Design-II Lab	**P**	0	0	2	2	1		60	40	
4	4	PC	IT2253	Computer Networks	**T**	4	0	0	4	4	30	20	50	3
5	4	PC	IT2254	Computer Networks Lab	**P**	0	0	2	2	1		60	40	
6	4	PC	IT2255	Operating Systems	**T**	3	0	0	3	3	30	20	50	3
7	4	PC	IT2256	Operating Systems Lab	**P**	0	0	2	2	1		60	40	
8	4	PC	IT2257	Theory of Computation	**T**	3	0	0	3	3		60	40	
				TOTAL FOURTH SEM		**16**	**0**	**6**	**22**	**19**				
				Audit Courses										
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT	**A**	3	0	0	3	0				
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
3	4	HS	AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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SoE No.
IT-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Fifth Semester														
1	5	HS	GE2312	Fundamental of Economics	**T**	3	0	0	3	3	30	20	50	3
2	5	PC	IT2301	Data Base Management Systems	**T**	3	0	0	3	3	30	20	50	3
3	5	PC	IT2302	**Lab :** Data Base Management Systems	**P**	0	0	2	2	1		60	40	
4	5	PC	IT2303	Software Engineering (Self -Learning-Online)	**T**	3	0	0	3	3	30	20	50	3
5	5	PE		**Professional Elective - I**	**T**	3	0	0	3	3	30	20	50	3
6	5	PE		**Lab : Professional Elective-I**	**P**	0	0	2	2	1		60	40	
7	5	OE		**Open Elective-I**	**T**	3	0	0	3	3	30	20	50	3
8	5	OE		**Open Elective-II**	**T**	3	0	0	3	3	30	20	50	3
9	5	STR	IT2310	**Industrial Visit and Learning**	**P**	0	0	0	0	1		100		
				TOTAL FIFTH SEM		**18**	**0**	**4**	**22**	**21**				

Professional Electives -I

1	5	PE-1	IT2311	PE I: Web Programming
	5	PE-1	IT2312	PE I: Lab.: Web Programming
2	5	PE-1	IT2313	PE I: Data Analysis and Statistics
	5	PE-1	IT2314	PE I: Lab.: Data Analysis and Statistics
3	5	PE-1	IT2315	PE I: Customer Relationship Management
	5	PE-1	IT2316	PE I: Lab. Customer Relationship Management
4	5	PE-1	IT2317	PE I: Mobile Operating System
	5	PE-1	IT2318	PE I: Lab. Mobile Operating System

Open Electives -I

1	5	OE I	IT2321	OE I: Industry 4.0
2	5	OE I	IT2322	OE I: Core JAVA
3	5	OE I	IT2323	OE I: Introdcution to Data Science

Open Electives -II

1	5	OE-II	IT2331	OE II: Introduction to Machine Learning
2	5	OE-II	IT2332	OE II: Information Security
3	5	OE-II	IT2333	OE II: Concepts in Web Programming

Audit Courses											
1	5	HS	AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

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Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

SoE No. IT-202.1

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Sixth Semester														
1	6	HS	GE2311	Fundamentals of Management	**T**	3	0	0	3	3	30	20	50	3
2	6	PC	IT2351	Design & Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3
3	6	PC	IT2352	**Lab:** Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
4	6	PC	IT2353	Principles of Compiler Design	**T**	3	0	0	3	3	30	20	50	3
5	6	PC	IT2354	**Lab:** Principles of Compiler Design	**P**	0	0	2	2	1		60	40	
6	6	PE		**Professional Elective - II**	**T**	3	0	0	3	3	30	20	50	3
7	6	PE		**Lab : Professional Elective-II**	**P**	0	0	2	2	1		60	40	
8	6	OE		**Open Elective-III**	**T**	3	0	0	3	3	30	20	50	3
9	6	OE		**Open Elective-IV**	**T**	3	0	0	3	3	30	20	50	3
				TOTAL SIXTH SEM		**18**	**0**	**6**	**24**	**21**				

List of Professional Electives-I & II

Professional Electives -II				
1	6	PE-2	IT2361	PE II::Machine Learning
	6	PE-2	IT2362	PE II:Machine Learning Lab
2	6	PE-2	IT2363	PE II: Business Intelligence
	6	PE-2	IT2364	PE II: Lab.: Business Intelligence
3	6	PE-2	IT2365	PE II: Internet of Things
	6	PE-2	IT2366	PE II: Lab.: Internet of Things
4	6	PE-2	IT2367	PE II: Big Data Analytics
	6	PE-2	IT2368	PE II: Lab. Big Data Analytics

Open Electives -III

1	6	OE-III	IT2371	OE-III : Industry 4.0
2	6	OE-III	IT2372	OE-III : Core JAVA
3	6	OE-III	IT2373	OE-III : Introdcution to Data Science

Open Electives -IV

1	6	OE-IV	IT2381	OE-IV: Introduction to Machine Learning
2	6	OE-IV	IT2382	OE-IV: Information Security
3	6	OE-IV	IT2383	OE-IV: Concepts in Web Programming

Audit Courses											
1	6	HS	AU2130	YCCE Communication Aptitude Preparation (YCAP6.3) for CT, IT, CSE	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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Information Technology

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						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Seventh Semester														
1	7	PC	IT2401	Data Mining	**T**	3	0	0	3	3	30	20	50	3
2	7	PC	IT2402	Lab.: Data Mining	**P**	0	0	2	2	1		60	40	
3	7	PC	IT2403	Principles of Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3
4	7	PE		Professional Elective III	**T**	3	0	0	3	3	30	20	50	3
5	7	PE		Professional Elective IV	**T**	3	0	0	3	3	30	20	50	3
6	7	PE		Lab.: Professional Elective IV	**P**	0	0	2	2	1		60	40	
7	7	PE		Professional Elective V	**T**	3	0	0	3	3	30	20	50	3
8	7	PE		Professional Elective VI	**T**	3	0	0	3	3	30	20	50	3
9	7	STR	IT2409	Mini Project	**P**	0	0	4	4	2		60	40	
10	7	STR	IT2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
				TOTAL SEVENTH SEM		**18**	**0**	**8**	**26**	**24**				

List of Professional Electives-III, IV,V & VI

Professional Electives -III				
1	7	PE-3	IT2411	PE III: Cloud Computing
2	7	PE-3	IT2412	PE III:Real Time Systems
3	7	PE-3	IT2413	PE III: Network Security
4	7	PE-3	IT2414	PE III: Information Retrieval
Professional Electives -IV				
1	7	PE-4	IT2421	PE IV: Neural Network and Fuzzy Logic
	7	PE-4	IT2422	PE IV: Lab.: Neural Network and Fuzzy Logic
2	7	PE-4	IT2423	PE IV: Ethical Hacking and Cyber Forensics
	7	PE-4	IT2424	PE IV:Lab:Ethical Hacking and Cyber Forensics
3	7	PE-4	IT2425	PE IV: Human Computer Interaction
	7	PE-4	IT2426	PE IV: Lab:Human Computer Interaction
4	7	PE-4	IT2427	PE IV: Parallel Computing
	7	PE-4	IT2428	PE IV: Lab: Parallel Computing
Professional Electives - V				
1	7	PE-5	IT2431	PE V: Digital Image Processing
2	7	PE-5	IT2432	PE V: Distributed Systems
3	7	PE-5	IT2433	PE V: Coding Standardand and Technical Documentation
4	7	PE-5	IT2434	PE V: Introduction to Deep Learning
5	7	PE-5	IT2435	PE V: Wireless Sensor Network

Professional Electives - VI				
1	7	PE-6	IT2441	PE VI: Advanced Computer Architecture
2	7	PE-6	IT2442	PE VI: Mobile Communication
3	7	PE-6	IT2443	PE VI: E-commerce
4	7	PE-6	IT2444	PE VI: Natural Language Processing

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

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Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						47				
				Eighth Semester										
1	8	STR	IT2451	Major Project	P	0	0	12	12	9		60	40	
2	8	STR	IT2452	Extra curricular Activity Evaluation	P	0	0	0	0	1		100		
				TOTAL EIGHTH SEM		0	0	12	12	10				
				GRAND TOTAL		86	0	44	130	162				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA** = for Practical : MSPA will be 15 marks each

Chairperson	Dean (Acad. Matters)	June 2022	1.05	Applicable for AY 2022-23 Onwards
		Date of Release	Version	

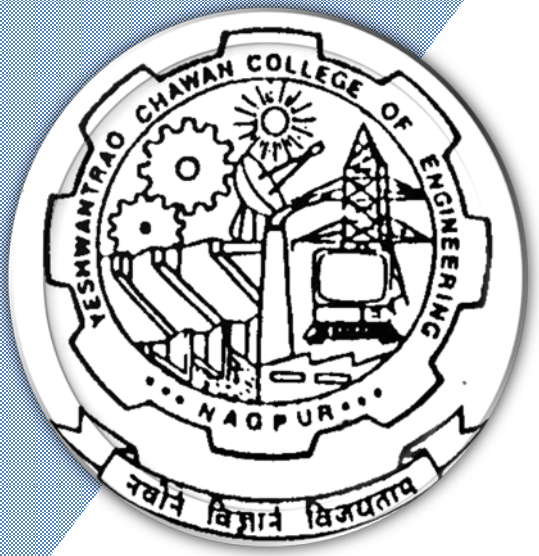
Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of **Technology**

SoE & Syllabus 20**20**

3rd Semester

Information Technology

III Semester
GE2201- Engineering Mathematics III

Objective	Course Outcome
The aim of this paper is to integral transform namely Laplace ,Z-transform and their methods of solution and partial differential equation with simple applications and to introduce the essential concepts of optimization techniques.	With the completion of this syllabus students will be familiar with Laplace ,Z-transform and their methods of solutions and partial differential equation with simple applications and essential concepts of optimization techniques and use these mathematical techniques in variety of technical, business, industry optimization problems.

UNIT-1: Finite Differences **[8 hrs]**

Difference table; Operators E and ∆, Central differences, Factorials notation Numerical differentiation and integration, Difference equations with constant coefficients.

UNIT- 2: Laplace Transform **[7 hrs]**

Laplace Transforms: Laplace transforms and their simple properties (with proof), Unit step function Heaviside unit step function and inverse, convolution theorem, , Applications of Laplace transform to solve ordinary differential equations including simultaneous equations.

UNIT-3: Z-transform **[8 hrs]**

Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant co-efficient.

UNIT-4: Matrices **[9 hrs]**

Inverse of matrix by adjoint method and its use in solving simultaneous equations, rank of a matrix (by partitioning method) consistency of system of equation, Inverse of matrix by partitioning method Linear dependence, Linear and orthogonal transformations. Characteristics equations, eigen values and eigenvectors.Reduction to diagonal form, Cayley Hamilton Theorem (without proof) statement and verification, Sylvester's theorem, Association of matrices with linear differential equation of second order with constant coefficient.

UNIT-5: Fourier Series and Partial Differential Equation **[8 hrs]**

Fourier Series – Periodic Function and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions. **Partial Differential Equations** – PDE of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve forst and second order partial differential equations.

III Semester
GE2201- Engineering Mathematics III

UNIT-6 : Fourier Transform **[6 hrs]**

Definition : Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform, Parseval's Identity, convolution Theorem.

Text books:

Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference books:

Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John wiley& Sons
Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John wiley& Sons
Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill.

III Semester
IT2201- Digital Circuits and Microprocessors

Objective	Course Outcome
1. To acquaint students with knowledge of basic electronics using digital number systems, Boolean algebra, logic gates. 2. To understand combinational and sequential circuits and their applications in real time. 3. Students will Study the hardware and software components, different modes of working and accessing memory & I/O ports of a microprocessor based system work together to implement system–level features. 4. Students will Study the assembly language programming structure of 8086 & various types of instruction set with encoding format. Students will Study to Design & interface the memory & I/O with 8086 & Working principal of 8255 PPI	After completion of this course: 1. Student will able to be to understand designing of basic circuits using logic gates and Boolean algebra, and designing of combinational logic circuits. 2. Student will able to understand designing of counters and registers. 3. Students will be able to understand the architecture and organization of microprocessor along with instruction coding formats, addressing modes, Instructions sets of 8086. 4. Students will be able to understand the interfacing of memory And I/O with 8086 and interfacing and working principle of 8255 PPI.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	1	1	1	1	2
	Student will able to be to understand designing of basic circuits using logic gates, and basic combinational logic circuits.	2.0	2.0	2.0											
	Student will able to understand designing of counters and registers.	2	2	2.0											

III Semester
IT2201- Digital Circuits and Microprocessors

	Students will be able to understand the architecture and organization of microprocessor along with instruction coding formats.	3	2			1								2	
	Students will be able to understand the interfacing of memory And I/O with 8086 and interfacing and working principle of 8255 PPI.	3	3			2								2	3
IT															

Unit No.	Contents	Max. Hrs.
1	Basic logic circuits, Boolean laws, Simplification of function using algebraic methods, basic combinational logic circuits: Encoder, Decoder, Multiplexer, De-multiplexer, Totem pole and tristate output.	8
2	Simplification of sum of product and product of sum, K-maps (Up to 4 Variable), simplification of completely/ incompletely specified functions using K-maps & Quine McCluskey's method, Introduction to Flip Flops (RS, D, T, JK), Memory organization using Flip-Flops. Racing Condition, J-K Master Slave Flip flop. Excitation tables, Conversion of one type to another type flips flop.	8
3	Excitation tables, Introduction to sequential Circuits, Counters, Registers, Synchronous/Asynchronous Designs, modulo N counter with Reset or Clear facility, Design of Mod N counters Using K-map, Lock Free Counters.	7
4	Introduction: Internal architecture & pin diagram of 8086/8088 microprocessor, Minimum & Maximum mode, even & odd memory banks, Accessing memory & I/O ports, Memory mapping in minimum mode.	8
5	Programming with 8086/8088: Addressing Modes, Instruction set, Instruction encoding format, Timing diagram Assembler directives, 8086 programming examples, String operations, File I/O processing, Far & Near procedures, Macros, Timing & delay loops	8
6	Interfacing with 8086/8088: Memory interfacing, Programmable parallel ports, Intel 8255 PPI, Block diagram & interfacing, Modes & initialization.	6

III Semester
IT2201- Digital Circuits and Microprocessors

Text Books				
Sr. No	Title	Edition	Authors	Publisher
1	Fundamentals of Logic Design	5th Edition	Charles Roth	CENGAGE Learning
2	Fundamentals of Digital Circuits	2nd Edition	Anand Kumar	PHI
3	Digital Electronics Principles	6th edition,1998	Malvino	Career Education
4	Microprocessor & Interfacing, Programming & Hardware.	2nd Edition , 2006.	Douglas Hall	Tata McGraw Hill
5	Microcomputer System: The 8086/8088 Family, Architecture, programming & Design	2nd Edition,1986.	Y. Liu, G. Gibson	Prentice Hall of India Ltd., New Delhi
6	Advanced Microprocessors & Peripherals: Architecture, Programming & Interfacing	2006	A. Ray, K.M. Bhurchandi	Tata McGraw Hill,

III Semester
IT2202- Lab: Digital Circuits and Microprocessors

Objective	Course Outcome
1. To acquaint students with knowledge of basic electronics using Boolean algebra & logic gates. 2. To understand combinational and sequential circuits and their applications in real time. 3. Students will Study different instructions 4. Students will study the assembly language programming structure of 8086 & various types of instruction set with encoding format.	After completion of this course: 1. Student will able to be to understand designing of basic circuits using logic gates and Boolean algebra, and designing of combinational logic circuits. 2. Student will able to understand designing of counters and registers. 3. Students will be able to understand the architecture and organization of microprocessor along with instruction coding formats,addressing modes, Instructions sets of 8086. 4. Students will be able to understand the interfacing of memory And I/O with 8086 and interfacing and working principle of 8255 PPI.

Sr. No	Problem Statements
1	1. Study of Logic Gates – Discrete version & IC version: AND, OR, NOT, NAND, NOR Gates – To construct and verify the Truth Tables.
2	2.Study and configure of flip-flop, registers and counters using digital ICs. Design digital system using these circuits.
3	3. Study of Half Adder and Full Adder circuits – To Construct and verify the Truth Table.
4	To study Multiplexer and Demultiplexer circuits..
5	To study assembler, linker, MASM,TASM, 8086 Simulator and assembly language programming instructions of 8086 microprocessors.
6	To write & execute Assembly Language program to multiply two 16 bit numbers and Divide two numbers (16/8, 16/16, 8/8)
7	Write 8086 Assembly language program (ALP) to add array of N hexadecimal numbers stored in the memory. Accept input from the user.
8	To write & execute Assembly Language program to search a number in a string of N numbers.
9	.To write & execute Assembly Language program to sort out even and odd numbers from the given data string
10	.To write & execute Assembly Language program to transfer block of data from one memory block to another.

III Semester

IT2203- Object Oriented Programming

Objective	Course Outcome
Student will : 1. Learn the Concepts of Java programming language 2. Learn Java's syntax, idioms, patterns, and styles to write simple JAVA program. 3. To develop object centric thinking and to use object oriented features of JAVA to write complex programs. 4. Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development	After completion of the course students will be able to: 1. Demonstrate the understanding of Object oriented concepts. 2. Apply the programming language JAVA efficiently in object oriented software development 3. Able to analyze problem statement and identify appropriate objects and methods 4. Design and implement a small programs using classes 5. Design, develop, test, and debug programs using object oriented principles of java

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	Demonstrate the understanding of Object oriented concepts.	**3**													
CO2	Apply the programming language JAVA efficiently in object oriented software development	**3**	**3**												
CO3	Able to analyze problem statement and identify appropriate objects and methods		**3**	**3**											
CO4	Design and implement a small programs using classes		**3**	**3**											
CO5	Design, develop, test, and debug programs using object oriented principles of java			**3**											
		3	**3**	**3**											

III Semester
IT2203- Object Oriented Programming

Unit No.	Contents	Max. Hrs.
1	**UNIT I** : Introduction to Object oriented programming, Introduction to Java as OOP language: Importance of java, Parts of the java language, Java Environment, Structure Of A Java Program. Building blocks of java, Data types, Variable declarations ,operators and Assignments ,control structures, objects and classes, Declaring Classes and objects, Creating Classes and objects, methods, argument passing, Recursion, this keyword, constructors ,Visibility control	08
2	**UNIT II** : Java as OOP language, Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances)	07
3	**UNIT III** : Arrays, Strings Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Wrapper Classes,	08
4	**UNIT IV** : exception handling mechanism: Fundamentals exception types, uncaught exception, try-catch Block, displaying description of an exception, multiple catch clauses, nested try-catch statements, throw, throws, finally, built in exceptions, creating own exception subclasses,	07
5	**UNIT V** : Collection Vector and Framework: Introduction to collection framework, Vectors, Array List, Linked list, Hashset, Treeset, Hashmap	07
6	**UNIT VI** : IO Steam, applets and Thread: Introduction to stream classes, use of stream classes, I/O stream, bytes stream, character stream, pre-defined stream, reading console input, reading character, reading string, writing console output, the print write class, reading & writing files, transient and volatile modifiers, Introduction to applets, applet lifecycle, creating and executing applets, Introduction to multithreading, life cycle of Thread, Runnable interface and Thread class.	08

Text Books			
Sr.No	Title	Authors	Publisher
1	Thinking in Java	Bruce Eckel	Prentice Hall
Reference Books			
1	Java2 Complete Reference	Herbert Schildt	McGraw-Hill
2	Programming with Java	E. Balagurusamy	TATA McGraw-Hill

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III Semester
IT2204- Lab : Object Oriented Programming

Objective	Course Outcome
Be able to use the JAVA SDK environment to create, debug and run simple JAVA programs.	Design, develop, test, and debug programsusing object oriented principles using java s.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	Design, develop, test, and debug programs using object oriented principles using java														

Sr. No	Experiments Base On
1.	Introduction of JAVA Programming Environment
1.	Data Types and Control Structures
2.	Class and constructor
3.	Overloading
4.	Overriding
5.	Interface
6.	Arrays and String
7.	Exception
8.	Collection
9.	Applet

III Semester
IT2205- Data Structures and Program Design- I

Objective	Course Outcome
1. Given knowledge about structured programming. 2. Students should develop skills to create error free and efficient programs; by applying data -structures fundamentals and program analysis techniques	Upon successful completion of this course, students will be able to: 1. Comprehend programming constructs like function, array, string, pointer, structure, file and also understand basic data structures like list, stack, queue. 2. Apply appropriate data structures in problem solving. 3. Analyze the performance of operations performed on data structures. 4. Design application by using data structures for real world problems.

Unit No.	Contents	Max. Hrs.
1	functions, parameter passing techniques, recursion, Scope rules, Storage Classes, pointers, dynamic allocation	5
2	Arrays and strings, representation of 1D, 2D arrays in memory, sparse matrices, polynomial representation and operations, Structure, union, file handling	5
3	Time and space complexity algorithm, Abstract Data Type (ADT), ordered list, implementation using array and its operations, Stack, Queues and its operations	7
4	Applications of stacks and queues, Priority Queues, Circular Queue, Dequeue	
5	Linked list: implementation of linked list using arrays and pointers, operations on singly, doubly and circular linked list, linked stack and queue	6
6	Generalized list, Skip list, applications of linked list	5

Text Books/Reference Book

Sr. No.	Title	Authors	Publisher
1	The C Programming Language	Brian W. Kernighan and Dennis M. Ritchie	Prentice Hall of India
2	Programming in ANSI C	E. Balaguruswamy	Tata McGraw-Hill
3	How to Solve it by Computer	R. G. Dromey	Pearson Education
4	Data Structures & Program Design in C	Robert Kruse, G. L. Tondo and B. Leung	PHI-EEE
5	Data Structures	Seymour Lipschutz	Tata McGraw-Hill
6	Fundamentals of Data Structures in C	Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed	W. H. Freeman and Company.

III Semester
IT2206- Lab : Data Structures and Program Design- I

Objective	Course Outcome
1. Given knowledge about structured programming. 2. Students should develop skills to create error free and efficient programs; by applying data -structures fundamentals and program analysis techniques	Upon successful completion of this course, students will be able to: 1. Comprehend programming constructs like function, array, string, pointer, structure, file and also understand basic data structures like list, stack, queue. 2. Apply appropriate data structures in problem solving. 3. Analyze the performance of operations performed on data structures. 4. Design application by using data structures for real world problems.

Sr. No	Problem Statements
1	Program for counting number of digits in a random number
2	Program for generating list of random numerals and print them in words
3	Program to print Pascal's triangle 1 1 1 1 2 1 1 3 3 1 1 4 6 4 1 1 5 10 10 5 1
4	Program for finding GCD of two numbers using factorial method
5	Program for finding GCD of two numbers using recursion. Also, print number of recursive calls.
6	Program for allocating memory dynamically for single dimensional array and sort it using quick sort and merge sort
7	Program for allocating memory dynamically for two-dimensional array printing it in spiral manner.
8	Program to create linked list of cell phone with any 3 attributes as data fields and print it
9	Program to create file for storing details of all the items needed for playing any game of your choice also perform display, insertion of new record at any location, deletion of any record
10	Program to implement stack and print MAX data item from it

III Semester
IT2207- Computer Architecture and Organization

Objective	Course Outcome
Student will able to 1. Study the fundamentals and advance concepts of computer architecture and organization. 2. understand control unit operations and performances issues. 3. Study and apply the different arithmetic operation including the algorithms & implementation for fixed-point and floating-point numbers. 4. Study the hierarchical memory system including cache memories and virtual memory.	**Students will be able to** 1. Describe the fundamentals and advance concept in computer organization and its relevance to classical and modern problems of computer design. 2. Write control sequence for Instructions also understand performances issue in processor and memory. 3. Understand the different methods used by processor for arithmetic calculations, perform arithmetic operations and understand the storage format for floating point numbers. 4. Understand the storage of computer system, how to speed up the operation of system, different issues of cache, main memory and virtual memory.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	Describe the fundamentals and advance concept in computer organization and its relevance to classical and modern problems of computer design.	3												3	
CO2	Write control sequence for Instructions also understand performances issue in processor and memory.	3	2											3	
CO3	Understand the different methods used by processor for arithmetic calculations ,perform arithmetic operations and understand the storage format for floating point numbers	3	3											3	
CO4	Understand the storage of computer system, how to speed up the operation of system, different issues of cache, main memory and virtual memory.	3	2											3	

III Semester
IT2207- Computer Architecture and Organization

Unit No.	Contents	Max. Hrs.
1	Basic Structure of Computer Hardware and Software: Functional Units, Basic Operational Concepts, addressing methods and machine program sequencing : Memory Locations , addressing and encoding of information, Main memory operation . Instruction Format, limitations of Short word- length machines, High level language considerations	7
2	Processing Unit: Some fundamental concepts, Single, two, three bus organization, Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instruction, Instruction sequencing, addressing modes. Case study – instruction sets of some common CPUs.	8
3	Hardwired Control : Design Micro-programmed Control: Microinstructions, Grouping of control signals, Micro program sequencing, Micro Instructions with next Address field, Perfecting microinstruction, Emulation, Bit Slices. Case study – design of a simple hypothetical CPU	7
4	Arithmetic: Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction , Arithmetic and Branching conditions, Multiplications of positive numbers, Signed- Operand multiplication, fast Multiplication, Booth's Algorithm, Integer Division, Floating point numbers and operations.	8
5	The main Memory: some basic concepts, semiconductor RAM memories, Memory system consideration, semiconductor ROM memories, Multiple module memories and interleaving, Cache Memory, Mapping techniques, Replacement algorithms, write policies Virtual memories, memory management requirements.	8
6	Computer Peripherals: I/O Devices, I/O device interface, DMA, Interrupt handling Role of interrupts in process state transitions, I/O device interfaces – SCII, USB Introduction to Pipelining, Throughput and speedup, pipeline hazards Introduction to parallel processors.	7

Text Books			
Sr. No	Title	Authors	Publisher
1	Computer Organization and Design: The Hardware/Software Interface	David A. Patterson and John L. Hennessy	5th Edition Elsevier.
2	Computer Organization and Embedded Systems	Carl Hamacher .	McGraw Hill Higher Education 6th Edition
3	Computer architecture and organization	Carl Hamacher	McGraw Hill Higher Education 4th Edition
Reference Books			
1	Computer Architecture and Organization	John P. Hayes,	WCB/McGraw-Hill 3rd Edition
2	Computer Organization and Architecture: Designing for Performance	by William Stallings,	10th Edition Pearson Education.
	Computer System Design and Architecture	Vincent P. Heuring and Harry F. Jordan,	2nd Edition Pearson Education

III Semester
IT2208- Lab: Software Lab

Course Learning Objective	Course Outcomes
1. Understanding data types, data structures, control , and Loop statements in Python. 2. Learn def function definitions, and modules. 3. Learn basic object oriented concepts using Python. 4. Developing applications in Python using customized and built in modules and packages.	After learning the course, the students will be able to 1. Understand the basic data types, built in data structures, control statements and loops and write simple programs in Python 2. To understand the concepts of functions modules and packages and write complex programs using them. 3. To understand defining and handling Python objects and develop classes required for the given application 4. To develop a useful application in Python.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	Understand the basic data types, built in data structures, control statements and loops and write simple programs in Python	3													
CO2	To understand the concepts of functions modules and packages and write complex programs using them.	3	1												
CO3	To understand defining and handling Python objects and develop classes required for the given application	3	1												
CO4	To develop an useful application in Python	2	2	2	1	1				2			2	1	1

Contents:

Module 1: Introduction: Build-in Data types: Data type & Variables, Python numbers, Python Strings, Python built in data structures: Lists, Dictionaries, Tuples, Sets, Arrays. Datatype conversion. Statements: Assignment statement, import statement, print statement, input statement, Python Control Statements: if, if – else, elif statements, Loop statements: For, while, continue and break, try and except statement, raise, with statements, case statement.

Module 2: Python Functions, Modules and Packages: The def statement, returning values, parameters, arguments, local variables, global variables and global statement, doc strings for functions, Mathematical Function, Generating Random numbers, File Handling.

Module 3: Python Object and Classes: A simple class, defining methods, member variables, The constructor, calling methods, adding inheritance, class variables, class methods and static methods, Interfaces, New-style classes, Doc strings for classes, Private members, Python Operator Overloading, Python inheritance and polymorphism, Exception Handling, Python Modules.

Module 4: Developing applications in Python using built in and customized modules and packages.

III Semester
IT2208- Lab: Software Lab

Sr. .	Topics to be Covered	Sample Problem Statement
1.	Demonstration of Build-in Data types: Data type & Variables, Python numbers	Write a Python program to compute the roots of a quadratic equation
2.	Demonstration of Python Lists.	Write a Python program to perform following operations: **i)** Insertion of element in a given list **ii)** Deletion of element from the given list
3.	Demonstration of different Statements: Assignment statement, import statement, print statement, input statement	Write a Python program to find square root of a number
4.	Demonstration of control statements: if, if – else, elif statements	Write a Python program to enter day number (1-7) and print the corresponding day of week name using if else. (e.g 5 then Friday)
5.	Demonstration of Loop statements: For, while, break, continue	Write a Python program to print all prime numbers from 1 to 100 (using nested loops, break and continue)
6.	Demonstration of try and except statement, raise, with statements, case statement	Write a Python program which take character as input and determine about vowels and consonants using case statement.
7.	Demonstration of Python Functions: The def statement, returning values, parameters, arguments	Write a Python program using user defined function to find the sum of following series. 1/1! + 2/2! + 3/3! + ……1/N!
8.	Demonstration of Python Mathematical Function	Write a Python Program to implement some mathematical functions
9.	Demonstration of Python File Handling	Write a Python program to read data from "Input.txt" file using File Input Class and write output to "Output.txt" using File Output class.
10.	Demonstration of Python Object and Classes: A simple class, defining methods, member variables	Write a program to define a class Employee with four data members such as Emp_name, Emp_id, Salary and department_id. Define appropriate methods to initialize and display the values of data members. Also calculate Gross salary of employee based on Basic Salary, TA, DA and HRA of employee
11.	Demonstration Python inheritance	Create a class Account that stores the customer name, account, number and type of account. From this derive the classes Current-acct and Saving-acct to make them more specific to their requirement. Include necessary methods in order to achieve the following tasks: (a) Accept deposit from a customer and update the balance. (b) Display the balance (c) Compute and deposit interest. (d) Permit withdrawals (e) Check the minimum balance, impose penalty, if necessary and update the balance
12.	Demonstration of Python Exception Handling.	Write a program to implement Exception handling in Python.
13	Building Application	Develop some useful application in Python

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2020
4th Semester
Information Technology

IV Semester
GE2206- Discrete Mathematics & Probability Theory

Course Objective	Course Outcomes
The objective of this paper is to study mathematical , logic and set theory and their methods of solution and graph theory, group theory with simple applications and to introduce the essential concepts of probability and statistics.	• With the completion of this syllabus students will be familiar with mathematical, logic and set theory and their methods of solutions and graph theory, group theory with simple applications and essential concepts of probability and statistics and use these mathematical techniques in variety of technical, business, industry optimization problems.

UNIT I: Unit I: (PO-1, 2) **(07 Hrs)**

Mathematical, Logic & Set Theory: Statement and Notation: Negation, Conjunction, Disjunction, Tautologies, Truth Tables, Basic Concepts of Set Theory, Inclusion & equality of set, Power Set, Ordered Pairs and n-tuples, Operations on Sets ,Partial order, Equivalence relations, mathematical induction. Propositions, Predicate logic, formal mathematical systems

UNIT II: Unit II: (PO-1) **(06 Hrs)**

Relations and Functions: Relation and Ordering, Properties of Binary in a set, Relation Matrix and Graphs, Partition and Covering of a set, Equivalence relation, Partial ordering, Partially Ordered sets, Function (Definition and Introduction), Composition of functions, Inverse Functions, Characteristics function of a set.

Unit III: (PO-1) **[07 Hrs]**

Group Theory: Groups (Definitions and Examples) Subgroups and Homomorphism, Cosetsand Lagrange's theorem, Normal subgroups, Codes and Group Codes. Semi groups andMonoids (definitions and examples).Homomorphism of semigroups and monoids, Subsemi groups and monoids.

Unit IV: (PO-1) **[06 Hrs]**

Rings (Definitions and Examples): Integral domain, ring homomorphism

Fuzzy Sets and Fuzzy Logic: Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.

Unit V: (PO-1, 2) **[06 Hrs]**

Random variables and probability distribution: Random variables: discrete and continuous; probability density function of one and two variables; Probability distribution function for discrete and continuous random variables (one and two variables), Joint distributions, conditional distributions.

Unit VI: (PO-1, 2) **[06 Hrs]**

Mathematical Expectation: Definition of mathematical expectation, functions of one and two random variables, The variance and standard deviations, moment generating function other measures of central tendency and dispersion, Skewness and Kurtosis.

IV Semester
GE2206- Discrete Mathematics & Probability Theory

Text Books:

SN	Title	Authors	Edition	Publisher
1	Discrete Mathematics Structure with application to Computer Science	J. P. Tremblay & R. Manohar	23rd re-print,2005,T	Tata McGraw-Hills Publication Company Limited, New Delhi
2	Probability and Statistics	M R Spiegel, John Schiller, R. Alu Shrinivasan	2nd edition,	Tata McGraw-Hills Publication Company Limited, New Delhi
3	Advanced Engineering Mathematics	H.K. Dass	8th revised edition, 2007	S.Chand and Company Limited ,Delhi.

Reference Books:

SN	Title	Authors	Edition	Publisher
1	Discrete Mathematics	Lipschutz Schaums's Outline series	2nd edition	Tata McGraw-Hills Publication Company Limited, New Delhi
2	Discrete Mathematical structures	Bernard Kolman ,Robert C.Busby,Sharon Ross	,3rd edition,2001	Prentice Hall of India, New Delhi

IV Semester
IT2251- Data Structures and Program Design-II

Prerequisite Courses	Data Structures and Program Design-I, Programming Language C

Objective	Course Outcome
1. To understand the basic structure concept such as Abstract Data Types, Linear and Non Linear Data structures. 2. To understand the notations used to analyze the Performance of algorithms. 3. To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graph and their representations. 4. To choose the appropriate data structure for a specified application. 5. To understand and analyze various searching and sorting algorithms. 6. To write programs in C to solve problems using data structures such as array, linked lists, queues, trees, graphs, hash tables, search trees.	Upon successful completion of this course, students will be able to: 1. Understand data structures like Tree, Graph, Set, Hash table. 2. Apply appropriate data structures in problem solving. 3. Analyze the performance of operations performed on data structures. 4. Design application by using data structures for real world problems.

Unit No.	Contents	Max. Hrs.
1	Trees, binary trees: representation and traversals, Binary search Trees (BSTs), Height-balanced trees	5
2	Heap tree, Splay trees, B-trees, B+ trees. Applications of trees	7
3	Graphs: representation & traversals. Spanning trees, shortest path algorithm, topological sort	5
4	Sets: Representation and Operations. Sorting and searching	6
5	Pattern matching and Tries: Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix tries.	5
6	Hash table, File Organization, external sort	5

Text Books/Reference Book

Sr. No.	Title	Authors	Publisher
1	The C Programming Language	Brian W. Kernighan and Dennis M. Ritchie	Prentice Hall of India
2	Programming in ANSI C	E. Balaguruswamy	Tata McGraw-Hill
3	How to Solve it by Computer	R. G. Dromey	Pearson Education
4	Data Structures & Program Design in C	Robert Kruse, G. L. Tondo and B. Leung	PHI-EEE
5	Data Structures	Seymour Lipschutz	Tata McGraw-Hill
6	Fundamentals of Data Structures in C	Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed	W. H. Freeman and Company.

IV Semester
IT2252- Lab: Data Structures and Program Design-II

Prerequisite Courses	Data Structures and Program Design-I, Programming Language C

Course Learning Objective	Course Outcomes
1. To understand the basic structure concept such as Abstract Data Types, Linear and Non Linear Data structures. 2. To understand the notations used to analyze the Performance of algorithms. 3. To understand the behavior of data structures such as stacks, queues, trees, hash tables, search trees, Graph and their representations. 4. To choose the appropriate data structure for a specified application. 5. To understand and analyze various searching and sorting algorithms. 6. To write programs in C to solve problems using data structures such as array, linked lists, queues, trees, graphs, hash tables, search trees.	Upon successful completion of this course, students will be able to: 1. Understand data structures like Tree, Graph, Set, Hash table. 2. Apply appropriate data structures in problem solving. 3. Analyze the performance of operations performed on data structures. 4. Design application by using data structures for real world problems.

Sr. No	Problem Statements
1	Program for displaying nodes of linked list in reverse order using recursion
2	Implement queue using linked list
3	Program to Print the Alternate Nodes in a Linked List using Recursion
4	Program based on Binary tree: creation, display
5	Program based on Binary tree: deletion and traversals
6	Program for Heap sort
7	Program for inserting a key and searching a key in tries
8	Program for printing BFS and DFS sequence of graph
9	Program for detecting presence of cycle in given graph G
10	Program for printing topological sort of given graph

IV Semester
IT2253- Computer Networks

Objective	Course Outcome
Student will study: 1. To master the terminology and concepts of the OSI reference model and the TCP-IP reference model and types of computer networks. 2. To build an understanding of the fundamental concepts of hardware, software and types of transmission media used in computer networking. 3. To study the concepts of data link layer protocols, network interfaces, and design/performance issues in computer networks. 4. To become familiar with IP Addressing, routing algorithms, basics of Internet and network security.	After completion of the course students will be able to: 1. Students will able to explain and visualize the different aspects of networks, protocols and network design models. 2. Students will able to illustrate the different of hardware, software and types of transmission media used in computer networks. 3. Students will able to analyze various Data Link layer design issues and select appropriate routing algorithms for a network. 4. Students will able to analyze the important aspects and functions of transport layer, application layer and Cryptography in computer networking.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	Students will able to explain and visualize the different aspects of networks, protocols and network design models.	1	2	-	3	-	-	-	-	-	-	-	-	3	-
CO2	Students will able to illustrate the different of hardware, software and types of transmission media used in computer networks.	-	1	-	2	-	-	-	-	-	-	-	-	3	
CO3	Students will able to analyze various Data Link layer design issues and select appropriate routing algorithms for a network.	-	-	1	2	3	-	-	-	-	-	-	-	3	
CO4	Students will able to analyze the important aspects and functions of transport layer, application layer and Cryptography in computer networking.	1	1	-	2	-2	-	-	-	-	-	-	-	3	

IV Semester
IT2253- Computer Networks

Unit No.	Contents	Max. Hrs.
1	The use of computer networks, LAN"s, MAN"s, WAN"s. topologies and their characteristics, wireless networks, protocol hierarchies, design issues for layers, interfaces and services, connection oriented and connectionless services, service primitives relationship of services to protocols. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference model	05
2	Physical layer: theoretical basis for data communication, Guided transmission media, wireless transmission: electromagnetic spectrum, radio transmission, infrared transmission. Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.	05
3	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA	07
4	Network layer: design issues, Classful and classless Internet Addresses, subnet addressing, implementation of subnet with mask, supernetting, Address block and CIDR notation, examples. Routing algorithms, congestion control algorithms, quality of service, internetworking, network layer in Internet: IP protocol, Internet control protocols, OSPF, BGP, Internet multicasting	09
5	**Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm. Performance issues: performance problems in networks, network performance measurement.	08
6	**Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Network security: cryptography, introduction to symmetric and public key algorithms, digital signatures, authentication protocols, e-mail and web security.	06

IV Semester
IT2254- Lab : Computer Networks

Sr. No	Problem Statements
1.	To Study different types of network & networking commands in Linux.
2.	To Configure DNS Server using CISCO Packet Tracer
3.	To implement client-server application using java network programming.
4.	Write a program to perform Bit stuffing.
5.	Write a program to implement CRC.
6.	Write a program to implement Hamming Code.
7.	To Configure DHCP using CISCO Packet Tracer
8.	To Configure RIP server using CISCO Packet Tracer.
9.	To Configure Simple VLAN server using CISCO Packet Tracer.
10.	To Study campus networking of YCCE.

IV Semester
IT2255- Operating Systems

Prerequisite Courses	ITCP, Data Structures, CAO

Course Learning Objective	Course Outcomes
Student will study : 1. To understand the role, components, and designing issues associated with operating systems. 2. To understand processes and threads, CPU scheduling algorithms, and process synchronization mechanisms 3. To comprehend the concepts of memory management including virtual memory. 4. To understand issues related to file system interface and implementation, and disk scheduling.	**After undergoing this course students will be able to** 1. Understand the fundamental concepts in Operating Systems (OS) and understand how various hardware features support OS functionality. 2. Explain various OS mechanisms and policies for managing system resources. 3. Analyse algorithms and techniques for managing various OS resources in a multiprogramming and other environments. 4. Evaluate the performance of algorithms for managing various OS resources.

Unit No.	Contents	Max. Hrs.
1	**Introduction to OS:** evolution of OS, basic hardware support necessary for modern operating systems, Layered Structural of OS, Services provided by OS, system calls, Dual mode of operation. Input-output Management : Basics of I/O hardware, Polling, Interrupts and DMA.	(6)
2	**Process management:** introduction, process control block, process states, process context switch, introduction to threads, CPU scheduling, goals of scheduling, Algorithmic evaluation of CPU scheduling algorithms.	(5)
3	**Interposes communication:** process cooperation and synchronization, race condition, critical region, mutual exclusion and implementation, semaphores, classic problems of Synchronization using semaphores.	(6)
4	**File systems : introduction,** Access methods, Directory Structure disk space management and space allocation strategies, disk arm scheduling strategies: FCFS, SSTF, SCAN, CSACN, LOOK, CLOOK, Selecting a disk scheduling algorithm.	(5)
5	**Memory management techniques: -**contiguous allocation, static and dynamic partitioning, and non-contiguous, paging and segmentation, translation look aside buffer (TLB) and overheads.	(5)
6	**Virtual memory:** demand paging, page replacement algorithms, thrashing, working set model. **Deadlocks**: necessary conditions, deadlock detection, deadlock avoidance, deadlock prevention, recovery from deadlock.	(7)

Text Books			
Sr. No.	**Title**	**Authors**	**Publisher**
1	Operating system concepts	8th Edition	Silberchatz & galvin
2	Operating System	5th Edition	William Staling
Reference Books			
1	Modern operating systems	2nd Edition	A.S. Tanenbaum
2	Operating system concepts	2nd Edition	Milan MilenKovic

IV Semester
IT2256- Lab : Operating Systems

Course Learning Objective	Course Outcomes
To understand the working of Operating System services, algorithms and mechanism practically .	**Students will be able to:** 1. Understand the advanced OS commands 2. Understand the working of processes and threads and their synchronization practically. 3. Understand various algorithms and techniques used by OS for managing resources through software simulation.

Sr. No	Problem Statements
1	Study of Advanced Linux shell commands (Process management, Memory management, Networking, etc.)
2	Study of Window task manager (about its applications, processes, services, networking, performance etc.)
3	Write a program that illustrates the creation of child process using fork system call. Each child and parent Processes perform different task.
4	Write a multithreaded program to multiply two given matrices.
5	Simulate any two of the following CPU Scheduling Algorithms (One each from preemptive and non-preemptive types) : FCFS, SJF, SRTN, Round Robin, Preemptive priority, Non-preemptive priority
6	Simulate any one of the following Dynamic Memory allocation algorithms First Fit, Best Fit, Worst Fit.
7	Simulate any one of the following Page replacement algorithms: FIFO, LRU, Optimal
8	Write a program to perform Inter-Process-Communication using shared memory OR, pipes OR message queues.
9	Write a program that gives a deadlock and starvation free solution to the Dining philosophers problem using semaphores
10	Write a program to simulate Banker's Deadlock avoidance algorithm.

IV Semester
IT2257- Theory of Computation

Objective	Course Outcome
1. To understand the basic properties of formal languages & Finite Automata, regular expression and Regular Grammar 2. To study of different types of grammars and the properties of Context Free Grammar 3. To understand the basic properties of CFL & Designing of Push Down Automata 4. To understand the basic properties of Turing machine and study of Recursive Language , undeciadibility, post Correspondence problem & Recursive enumerable language	**After completion of the course students will be able to:** 1. To apply basic properties of formal languages & to construct Finite automata, to write regular expression and Regular Grammar. 2. To analyze & design different types of Grammars. 3. To apply properties of CFL & design of Push Down Automata 4. To analyze & design Turing machine & demonstrate basic concept of Recursive Language, undeciadibility, post Correspondence problem & Recursive enumerable language

Unit No.	Contents	Max. Hrs.
1	Introduction: Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Finite Automata: Design of Finite Automata, Acceptance of strings and languages, Deterministic Finite Automation , Non-Deterministic Finite Automation, Equivalence between NFA and DFA , NFA with ε-transition, Minimization of FA.	05
2	Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma for regular languages, closure properties of regular sets, properties of regular languages, Chomsky hierarchy of languages, Regular grammars, Right linear and left linear regular grammars, interconversion, Equivalence between regular grammar and FA, Interconversion between RE and RG.	05
3	Context free grammar, Derivation trees (Parse tree), Syntax tree , Ambiguous Grammar, Context Free Language (CFL), Closure properties of CFL, Simplification of CFG, Normal Forms of grammar: Chomsky Normal Form (CNF), Greibach Normal Form (GNF), CYK algorithm.	07
4	Push down automata, definition and model, acceptance of CFL by empty Stack and by final state, Design of PDA for the CFL, equivalence CFG and PDA, Inter conversion, DPDA & NDPDA.	09
5	Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Variants of Turing machines, non deterministic TMs and equivalence with deterministic TMs, context sensitive language (CSG), Linear bounded automata.	08
6	Undecidability: Church-Turing thesis, Undecidable Problems related to Recursive enumerable language and Turing Machine, post correspondence problem (PCP), Universal Turing Machine, The universal and diagonalization languages, reduction between languages and Rice's theorem, Recursive function: Basis functions and operations on them. Bounded minimization, unbounded minimization, preemptive recursive function and μ recursive function.	06

IV Semester
IT2257- Theory of Computation

Text Books				
Sr. No.	Title	edition	Authors	Publisher
01	T1: Introduction to Automata Theory, Languages and computation	2nd edition, 2000	John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman	Pearson Education Asia
02	T2: Introduction to languages and the Theory of Automata	3rd edition, 2003.	John C. Martin	Tata McGraw Hill

Reference Books				
1	R1: Elements of the Theory of Computation		Harry R. Lewis and Christos H. Papadimitriou	Pearson Education Asia
2	R2: Introduction to the Theory of Computation		Michael Sipser	PWS Publishing
3	R3: Theory of Computation	2008	O.G. Kakde	USP

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Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2020
5th Semester
Information Technology

28 June 2019

V Semester

IT 2301 - Data Base Management Systems

Objective	Course Outcome
The student should be able to 1) Understand Database management system's basic operations & design process using ER, EER diagram, SQL and with the use of Normalization. 2) Understand Transaction with ACID properties and their implementation. 3) Understand various storage structures, Query Processing and query optimization techniques to build a robust database management system. 4) Understand concurrency control mechanism using various concurrency control protocols.	**On completion of this course, the student will be able to** 1) To obtain sound knowledge in the theory, principles and applications of database management system. 2) Design and develop data model given their specifications and within performance and cost constraints. 3) Acquire and understand new knowledge, use them to develop data centric application and to understand the importance of lifelong learning. 4) Perform experiments in different disciplines of database management system.

Unit No.	Contents	Max. Hrs.
1	Introduction to Database Management System: General File System vs. DBMS, Data Abstraction, Data Independence, Keys, Data Modeling using the Entity Relationship(ER) Model, The enhanced Entity Relationship(EER) model.	8
2	Relational Model: Structure of Relational Databases, The Relational Algebra and Relational Calculus(TRC & DRC) Introduction to SQL Programming: (DDL, DML, Joins, Nested Queries/Sub Queries/Inner Queries) Integrity Constraints.	7
3	Database Design: Functional Dependency and Normalization for Relational Databases, Desirable properties of decomposition.	7
4	Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions. Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Results.	8
5	Transaction Processing: Introduction to Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels.	8
6	Concurrency control Techniques: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, and Timestamp-Based Protocols. Data Control Language: GRANT, REVOKE; Concept of Triggers and Views.	8

V Semester

IT2301 - Data Base Management Systems

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Database System	5th Edition(2006)	Elmasri & Navathe	
2	Database System Concepts	6th Edition, (2010)	Abraham Silberschatz, Henry F. Korth and S. Sudarsha	McGraw-Hill Education
3	Database Management Systems	Second Edition	Raghu Ramakrishnan, Johannes Gehrke	McGraw-Hill, 2002

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Database in Depth – Relational Theory for Practitioners		C.J. Date	O`Reilly Media, 2005
2	Database design, Application Development and Administration	4th Edition(2008)	Michael Mannino	

V Semester

IT2302- Data Base Management Systems Lab

List of Practical's

Sr. No..	Problem Statements
1	Database design using E-R Model for: Payroll processing system, Banking system Library Information System Student Information System, etc.
2	Mapping of E-R model to relational Schema and creation of Tables using DDL (Data DefinitionLanguage).
3	Modification of Database objects using DDL and DML
4	Querying the Database based on various inbuilt functions (Date Function, Numeric Function, Character Function, Conversion Function, Miscellaneous Function, etc.).
5	Querying the Database based on Set, Arithmetic and Logical operator.
6	Implementation of Joins(all types).
7	Queries based on Data Grouping Restricting and sorting.
8	To create and manipulate various database objects of the Table using Views:
9	Querying the Database based on to create triggers for various events such as insertion, updation, etc.
10	Exploring NOSQL Database.

V Semester
IT2303 - Software Engineering

Course Learning Objective	Course Outcomes
Student will study : 1. To learn the complete Software life cycle and differentiate between various models. 2. To learn various aspects of effective and efficient system design and to understand various design approaches and models. 3. To differentiate between various testing methods. 4. Comprehending the various techniques of software cost estimation and risk assessment metrics. 5. To understand UML Components 6. To understand various case studies for learning new trends of software engineering.	After completion of the course: 1. Students will be able to understand various process models and it's utility in real world, and able to design and prepare SRS documents. 2. Students will be able to understand different design models, software architecture and designs. 3. Students will **5th Semester** be able to understand and apply different testing methods for software testing and able to write good test cases. 4. Students will be able to understand Project management and use proper methods for project management. 5. Students will be able to analyze and design various UML diagrams for the problem statements. 6. Students will be able to understand and design case studies for the development and management of software.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT2303.1	Students will be able to differentiate between various process models and its utility in real world. Able to write proper SRS document	3	3	3										3	
IT2303.2	Able to Understand different design models, software architecture and designs	3												3	
IT2303.3	To understand and apply different testing methods for software testing and able to write good test	3	3											3	

	cases.														
IT2303.4	To understand Project management and use proper methods for project management.	3													
IT2303.5	Analyze and design various UML diagrams for the problem statements.	3	3	3										3	
IT2303.6	To understand and design case studies for the development and management of software.	3	3	3						3				3	
IT1305		3.0	3.0	3.0	3.0						3.0				3.0

UNIT I		**[08 Hrs.]**
Introduction to Software Engineering .A Generic View of process, and project management, Process model, CMM, Requirement Engineering : Eliciting Requirement ,Developing Use Case ,Analysis Model, Negotiation, Validation , Building the Analysis model : Requirement Analysis ,Analysis Modeling Approaches, Data Modeling		
UNIT II		**[08 Hrs.]**
Design Engineering: Design Concept, Design Model, Pattern Based Software Design, Architectural Design: Software Architecture., Data Design, Architectural style, Architectural design , Mapping Data Flow into a Software Architecture ,Component Level Design , User Interface Analysis and Design ,Interface Analysis ,Interface Design steps, Design Evaluation		
UNIT III		**[06 Hrs.]**
Testing Strategies: Strategic Approach, Strategic issues, Strategies for conventional Software, Validation Testing, Testing Tactics: White Box Testing, basic Path testing, Control Structure Testing, Black Box Testing, Object Oriented Testing Method, Testing Method applicable at class Level, Interclass Test Case Design. Metrics: Software Quality.		
UNIT IV		**[06 Hrs.]**
Project Management, KPES for project management, Metrics for Process and Projects, Project Estimation, Project Scheduling, Risk Management, Quality Management and Change Management		
UNIT V		**[07 Hrs.]**
Overview of UML, Conceptual Models of the UML, UML and Design Patterns, Applying the UML, UML Diagrams for Payroll processing systems, ATMS, small companies etc		

UNIT VI		**[05 Hrs.]**
Advanced Topics in Software Engineering: Case studies based on recent Trends, Reengineering, and CASE tools, client server software Engineering. CORBA		

Text books:				
1	Software Engineering -A Practitioner's Approach	Seventh Edition	Roger S. Pressman	McGraw Hill
2	Object Oriented Software Engineering	1st Edition,2004	Lethbridge and Pearson	Pearson Education
3	Object Oriented Software Engineering	2nd Edition,2005	Lethbridge and Pearson	Pearson Education
Reference books:				
1	Software engineering university press	10th Edition, 2014	I. Somerville	Oxford university press
2	An integrated approach to software Engineering'	3rd Edition, 1991	Dr. PankajJalota	Narosa Pub
3	The Unified Modeling Language user guide	2nd Edition(2005)	Booch, Rambaugh, Jacobson	Addison Wesley

V Semester

IT2311 - PE-1: Web Programming

Objective	Course Outcome
The student should be able to 1. Get familiar with basics of HTML, HTML tags, DHTML CSS. 2. Get familiar with client server architecture and able to develop a web application using java technologies 3. Get familiar with markup languages with their structures and syntax. 4. To get familiarised with PHP frame work	On completion of this course, the student will be able to 1. Understand the different tags of HTML and Implement interactive web pages using HTML , DHTML and CSS. 2. Understand client server architecture and Develop interactive web pages using java script and client and server side programming. 3. Understand the concept of Markup languages and Make the use of mark up languages in development of web pages. 4. Understand the concepts of PHP and Develop web applications using PHP

Unit No.	Contents	Max. Hrs.
1	Creation of web pages: HTML tags, special characters, images, tables, forms, the hyperlinks, Frames	8
2	Dynamic HTML (DHTML): Introduction, Cascading Style Sheets (CSS), DHTML Document Object Model and Collections	8
3	Scripting Languages:- Java Script objects and forms, server side and client side scripting languages	6
4	XML:XML basics, understanding mark-up languages, structures and syntax, valid Vs. Well formed XML, DTD (document type Definitions) classes, Element Type Declaration, Attribute Declarations, Limitations of DTDs, XML processor, Introduction to Schema, Complex Types, Extensible Style sheet Language Transformations (XSLT),Basics of Parsing	7
5	The importance of being asynchronous, Blocking vs. non-blocking code, Server-side JavaScript, What is Node.js?, Why use Node.js?,Features, Process Model, Setup Node.js Development Environment, Node.js Basics, Node.js Module, File System	7
6	Introduction to AngularJS, AngularJS Expressions: Numbers, Strings, Objects, Arrays, Expressions using {{ }} and ng-bind. Modules: Creating a module, adding a controller & directive, myApp.js, myCtrl.js, Loading library. Directives: Data Binding, ng-init, ng-repeat, ng-app & ng-model directives, custom directives.2 way binding, Validating User Input, Status, ng-empty, ng-touched, ng-valid, ng-pending. Data Binding: Synchronization between model and view. AngularJS Controllers: ng-controller, Controller Methods, External Files.Scope: $scope, understanding the scope, $rootScope	6

V Semester
IT2311 - PE-1: Web Programming

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	The Complete Reference HTML and XHTML		Thomas A.Powell	McGraw Hill Pub
2	Learning angular JS		Dayley, Brad Dayley	

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites		Robin Nixon	

V Semester

IT2312 - PE-1: Lab Web Programming

List of Practical's

Sr. No..	Problem Statements
1	Program based on HTML Tags
2	Program based on Table Tag
3	Program based on HTML Forms
4	Program based on CSS
5	Program based on JavaScript
6	Program based on JavaScript (Advanced)
7	Program based on Node JS(Linear)
8	Program based on Node JS(Advanced)
9	Program based on Angular JS (Linear)
10	Program based on Angular JS (Advanced)

V Semester
IT2313 - PE-1: Data Analysis and Statistics

Objective	Course Outcome
The student should be able to 1. Know basics of data analysis using statistics and probability. 2. Become familiar with different statistical methods. 3. Determine parameters given in problem statement, analyze it and find the solution and Draw inference from obtained solutions and know applications of data analysis. 4. Use and explore a tool to perform data analysis using it	On completion of this course, the student will be able to 1. Apply fundamental concepts of statistics and probability for data analysis(PO1-3) 2. Apply appropriate statistical methods on simple datasets(PO2-3) 3. 3.Formulate and solve problems in a systematic manner and Interpret output obtained from statistical analysis on datasets.(PO2-3, PO4-3) 4. Obtain hands on experience with some popular software (like R)for analysis and visualization of data (PO2-3,PO4-3,PO5-3)

Unit No.	Contents	Max. Hrs.
1	INTRODUCTION TO STATISTICS & PROBABILITY: Statistics,–Definition, Types. Types of variables–organizing data , Descriptive Measures. Basic definitions and rules for probability, conditional probability independence of events, Baye's theorem, and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.	6
2	SAMPLING DISTRIBUTION: Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques.	7
3	ESTIMATION THEORY: Estimation: Point and Interval estimates ,confidence intervals ,calculating interval estimates for population parameters of large sample and small samples, determining the sample size	6
4	TESTING OF HYPOTHESIS: Hypothesis testing: statistical hypothesis null hypothesis, tests of hypothesis and significance, type I and type II errors, one tailed and two tailed tests , p-value one sample tests for means and proportions of large samples (z-test), one sample tests for means of small samples (t-test), Chi-square tests for goodness of fit. Analysis of variance.	7
5	NON-PARAMETRIC METHODS: Sign test for paired data. Rank sum test. Mann –Whitney U test and Kruskal Wallis H test. One sample run test, rank correlation. Kolmogorov-Smirnov –test.	7
6	REGRESSION and CORRELATION: Estimation of regression line by least square method, linear and multiple regressions, Correlation analysis, Time series analysis: components of Time series, Variations in time series, trend analysis.	7

V Semester
IT2313 - PE-1: Data Analysis and Statistics

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Probability and Statistics ,	Third edition .	Murray R. Spiegel, John J.Schiller, R AluSrinivasan	Mc Graw Hill education
2	Statistics for Management, ,	7th edition	Levin R.I. and Rubin D. S.	Prentice Hall India Pvt.Ltd., New Delhi, 2001

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Business forecasting	8th Edition	John Hanke,Dean W. Wichern	Prentice Hall India

V Semester

IT2314 - PE-1:Lab Data Analysis and Statistics

List of Practical's

Sr. No..	Problem Statements
1	Introduction to R, R Objects , R datasets, packages , R installation and executing basic commands in R
2	Using objects in R- vectors, lists, arrays ,matrices ,tables ,data frames .
3	Data import / export using R
4	Demonstrate Statistical functions using R- Measurement of Central tendency and Dispersion and frequency distribution
5	Demonstrate Finding probability and probability distribution using R
6	Demonstrate sampling and sampling distribution using R
7	Demonstrate Hypothesis testing using R
8	Demonstrate linear and multiple Regression using R
9	Demonstrate Visualization using R

V Semester

IT2315 - PE-1: Customer Relationship Management

Objective	Course Outcome
The student will study 1. To understand the principles of CRM and concepts of Salesforce CRM 2. To Understand object, Tabs and Security Features in Salesforce CRM 3. To Understand Automated Business Process and Approval Process in CRM 4. To Understand Advanced Featured in Salesforce CRM	On completion of this course, the student will be able to 1. Analyze and Evaluate the CRM and Concepts of Salesforce CRM 2. Understand and Apply the Security Features of Salesforce CRM 3. Analyze and Evaluate the Automated Business Process and Approval Process in CRM 4. Understand and Apply the Advanced Features in Salesforce CRM

Unit No.	Contents	Max. Hrs.
1	**Introducing the Force.com Platform**. - Introduction to the Force.com Platform. The Basics of an App's User Interface. The Benefits of a Force.com Data-Centric, Collaborative Apps, The Technologies Behind a Force.com Platform App, Multitenant Architecture, A Metadata-Driven Development Model, Apex . Custom User Interface Mobile, AppExchange.	7
2	**Objects and Tabs:** Introduction to Objects ,The Position Custom Object, Introducing Tabs , Setup Detail Pages and Related Lists ,Introduction to Fields , Advanced Fields, Data Validation, and Page Layouts , Adding Advanced Fields , Introduction to Picklists , Field Dependencies , Dependent Picklist ,Custom Formula Fields , Dynamic Default Values , Validation Rules ,Page Layouts , Page Layout Editor Group Fields Edit Field Properties , Page Layouts , Compact Layouts.	7
3	**Relationships:** Introduction to Relationship Custom Fields, Page Layout Properties, Record Highlights, Introduction to Search Layouts, Additional Search Layouts Managing Review Assessments, Introduction to Roll-Up Summary Fields, Many-to-Many Relationship, Customizing Related Lists in a Many-to-Many Relationship.	6
4	**Securing and Sharing Data:** Controlling Access to Data in App, Data Access Concepts. Controlling Access to Objects, Introduction to Profiles ,Standard Profiles ,Introduction to Permission Sets ,Profiles and Permission Sets ,Introduction to Field-Level Security ,Controlling Access to Records, , Set Org-Wide Defaults, Introduction to Hierarchies ,Comparing Roles, Profiles, and Permission Sets ,Role, Introduction of Sharing Rules , Define a Public Group ,Define Sharing Rules ,Introduction to Manual Sharing , Manual Sharing Rule ,Displaying Field Values and Page Layouts According to Profile ,Overriding Sharing with Object Permissions ,Delegated Administration Groups .	8
5	**Automating Business Processes**: Introduction to Process Builder, Process Builder: A Closer Look Creating a Process That Updates Field Values, Introduction to Queues, Introduction to Scheduled Actions, Email Alerts, Introduction to Email Templates, Introduction to Approvals, Planning for Approval Processes. Analyzing Data with Reports and Dashboards, Introduction to Reports, Report Formats	7
6	**Apex and Lightning Aura:** Introduction to Apex, Collections, SOQL and SOSL, DML Operations, Controllers In APEX Using Apex Class and Triggers, Asynchronous APEX, Batch APEX, Introduction to Aura component, attributes handling in Aura component.	7

V Semester

IT2315 - PE-1: Customer Relationship Management

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Force.com Platform Fundamentals An Introduction to Custom Application Development in the Cloud		Phil Choi, Chris McGuire Caroline Roth	salesforce.com
2	Salesforce Handbook Paperback – 20 Mar 2011		Wes Nolte, Jeff Douglas	Publisher: Lulu.com

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Salesforce CRM: The Definitive Admin Handbook Paperback –	Second Edition	Paul Goodey	Packt Publishing Limited

V Semester

IT2316 - PE-1:Lab Customer Relationship Management

Objective	Course Outcome
Student will study: 1. To Understand object, Tabs and Security Features in Salesforce CRM 2. To Understand Automated Business Process and Approval Process in CRM	After completion of the course students will be able to: 1. Understand and Apply the Security Features of Salesforce CRM 2. Analyze and Evaluate the Automated Business Process and Approval Process in CRM

List of Practical's

Sr. No..	Problem Statements
1	Demonstrate the Standard and Custom Objects
2	Demonstrate the Page Layout Model
3	Demonstrate the Master Detail and Lookup Relationship
4	Demonstrate the OWD, Object and Record Level Securities
5	Demonstrate the Profiles, Roles and Permission Sets
6	Demonstrate the Sharing and Manual Sharing Rules
7	Demonstrate Field Level Securities
8	Demonstrate the Approval Process and Process Builder
9	Demonstrate the Reports and Dashboard
10	Demonstrate the Standard and Custom Controller
11	Write a Program to Demonstrate the Apex Triger
12	Demonstrate the Lighting Component.

V Semester

IT2317 - PE-1: Mobile Operating System

Course Learning Objective	Course Outcomes
Student will able: 1. Understand different Mobile Operating Systems and to learn the Android platform architecture. 2. To have basic requirement & different controls for design & development of mobile app. 3. Gain an understanding data management & inter application communication. 4. To learn application configuration & publishing.	After completion of the course: 1. Compare different flavors of mobile operating system and their specific features. 2. Create an application using different controls. 3. Prepare a project which can manage data and can communicate with native application 4. Publish the designed application which can handle multiple devices with different configurations

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	Compare different flavors of mobile operating system and their specific features.	3	2	3	3									3	
2	Create an application using different controls.	3	2	3	3									2	
3	Prepare a project which can manage data and can communicate with native application		2		3									3	
4	Publish the designed application which can handle multiple devices with different configurations			3	3									2	
IT		3	2	3	3									2.	

UNIT I		**[06 Hrs.]**
Mobility Technology Trends, Mobile Ecosystem Overview, Mobile Devices Overview, Mobile Development, Methodology, Wireless Networks Overview, Proximity Technologies		

UNIT II		**[06 Hrs.]**
Introduction to Android: Android Overview, Introduction to activities/Fragments, Introduction to s, broadcast receivers and content providers, Android Application Structure, Source Files, Resources, Assets and Manifest. IDE Usage: Basic IDE Operation (Eclipse), Project Creation and Handling (App Creation through Wizard), Running App on AVD and Device, DDMS and Debugging. User Interface Designing-1: Layout Overview, Linear Layout, Relative Layout, Frame Layout, Widgets (UI Controls) Overview and Text View, Image View, Button.		
UNIT III		**[08 Hrs.]**
User Interface Designing-2: Notification Bar, Toast and DSialog, Listview, and Adapter, View Reusability, Spinner and Comples View. Broadcast Receivers: Broadcast receivers overview, Manifest Registration vs Component Registration, Unregistration, SMS Event Receiver, Boot Event Receiver and NetworkEvent Receiver. Service: Service Overview, Service Lifecycle, Service Usage Applicability and Message Binder, Action Bar and Context Menu.		
UNIT IV		**[06 Hrs.]**
Data Management: Data Storage Overview, Persistent v/s Local, Shared Preferences, Internal Storage and SQLite Database, Threads and Processes: Thread, Process overview, Async Task, Loaders, Handlers, Intent: Intent, Intent Filters and Intent Resolution, Component Activations: Activity Stack, Launch Modes and Activity Flags		
UNIT V		**[06 Hrs.]**
Inter Application Communication: Inter app Communication requirement overview and Intents Based. Communication with Native application: Gallery, Camera, SMS App and Contacts, Content Providers: Content Provider Overview, Need and Usage, Content Provider Structure. Network Communication: Network Communication basics and Connecting to server/request creation, Response Formats XML/JSON and Rest/Web Services. URI Permissions, Views, Triggers		
UNIT VI		**[08 Hrs.]**
User Interface Designing-3: Style and Themes, View and Layout animation Application Configuration: Localization, Orientation and Config Change Handling, Handling multiple resolution devices, Device and Tablet consideration, Support Library. Application Publishing: Application Signing, Application Distribution, Application Publishing, Google Play		

Text books:

Sr.	Title of Book	Edition	Author	Publication
1	Professional Android Application Development	Latest edition	Reto Meier	Wiley Publishing Inc

V Semester

IT2318 - PE-1:Lab: Mobile Operating System

Sr. No.	Practical List
1	Create a dialog box having login functionality.
2	Create an application which has following features: • Show list of numbers on screen along with the type. • Bottom of the screen there should be a row that contains three elements: i. Spinner (Show the predefined phone number type like home, office, mobile, etc) ii. Text box to enter actual number iii. Button saying "Add" - Clicking on this should take the input from the first two items and add a new row item to the list. • On pressing back key (exiting from the application), it should show a confirmation dialog with appropriate title, message and two action buttons "OK" and "Cancel"
3	Create an application which has following features: • Clicking on "Cancel" should show a toast message "We are happy to be with you." and close the dialog. • Clicking on "OK" should close the dialog, exit from the application and generate a notification that says "Press me to go back to application". Then clicking on the notification should restart the application.
4	Create an application which has following features: • Launch phone contacts, display the selected contact in your application. • Try to launch Camera, Gallery & SMS application.
5	Create an application using Listview, Services, Navigation drawer & tab view
6	Create an application for changing background color based on selection from list view
7	Create an application for applying different themes on text views.
8	Create an application using Launch Modes.
9	Create an application displaying any animation.

V Semester
IT2321 - OE-1: Industry 4.0

Objective	Course Outcome
Students will: 1) Able to learn an introduction to Industry 4.0 (or the Industrial Internet) 2) Will able to understand its applications in the business world. 3) Will able to understand Business Model and Reference Architecture in Industry 4) Will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.	After completion of this course: 1) Students will be Understand the basics of IoT and basics of Industry 4.0. 2) Students will be Understand Business Model and Reference Architecture 3) Students will be able to understand the different Business issues in Industry 4.0 and how to solve them. 4) Students will be able to understand the need of Security and Fog Computing and applications of IIoT.

Unit No.	Contents	Max. Hrs.
1	Introduction to IoT: History of IOT, Concepts, Products and Examples. IOT Paradigm, The Layering concepts of IOT, IOT Communication Model, IOT Architecture, IoT Sensing and Actuation, IoT Connectivity, IoT Networking. Introduction to Industry 4.0: History, Concept, The Journey so far: Developments in USA, Europe, China and other countries, The Fourth Revolution, Compelling Forces and Challenges for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory, Globalization and Emerging Issues.	7
2	Basics of Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Life-cycle Management, Augmented Reality and Virtual Reality, Introduction to Artificial Intelligence, Big Data and Advanced Analysis, Cyber-Security in Industry 4.0, Industrial Processes, Industrial Sensing & Actuation, Industrial Internet Systems.	7
3	Business Model and Reference Architecture: IIoT-Business Models, IIoT Reference Architecture, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking.	6
4	Business issues in Industry 4.0:IIoT case studies, Opportunities and Challenges, Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world	6
5	Security and Fog Computing: Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT. Application Domains: Factories and Assembly Line, Food Industry, Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications),	7
6	Industrial IOT- Application domain: Milk Processing and Packaging Industries, Manufacturing Industries, Virtual Reality Lab, Steel Technology Lab. Facility Management, Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries. Facility Management.	7

V Semester

IT2321 - OE-1: Industry 4.0

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Industry 4.0: The Industrial Internet of Things		Alasdair Gilchrist	Apress
2	Industrial Internet of Things: Cyber manufacturing Systems		Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat	Springer

V Semester

IT2322 - OE-1: Core JAVA

Objective	Course Outcome
Student will : 1. Learn the Concepts of Java programming language 2. Learn Java's syntax, idioms, patterns, and styles to write simple JAVA program. 3. To develop object centric thinking and to use object oriented features of JAVA to write complex programs. 4. Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development	After completion of the course students will be able to: 1. Demonstrate the understanding of Object oriented concepts. 2. Apply the programming language JAVA efficiently in object oriented software development 3. Able to analyze problem statement and identify appropriate objects and methods 4. Design and implement a small programs using classes

Unit No.	Contents	Max. Hrs.
1	Introduction to Programming Methodologies, Introduction to Object oriented programming, Objects and Classes, Characteristics of OOP, Encapsulation and data Abstraction, Inheritance, Polymorphism, Dynamic Binding, Structured Versus Object oriented programming, Merits and demerits of object oriented methodology, introduction to Java as OOP language	7
2	Building blocks of java, Data types, Variable declarations, operators and Assignments, control structures, Identifying objects and classes, Declaring Classes and objects, Creating Classes and objects, methods, argument passing, Recursion, this keyword, constructors ,Visibility control	7
3	Java as OOP language, Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances)	6
4	Arrays and Strings: Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Wrapper Classes	6
5	Exception handling mechanism: Fundamentals exception types, uncaught exception, try-catch Block, displaying description of an exception, multiple catch clauses, nested try-catch statements, throw, throws, finally, built in exceptions, creating own exception subclasses	7
6	I/O Streams: Introduction to stream classes, use of stream classes, I/O stream, bytes stream, character stream, pre-defined stream, reading console input, reading character, reading string, writing console output, the print write class, reading & writing files ,transient and volatile modifiers	7

V Semester
IT2322 - OE-1: Core JAVA

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Thinking in Java		Bruce Eckel	Prentice Hall

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Programming with Java		E Balagurusamy	TATA Mc Graw-Hill
2	Java2CompleteReference		Herbert Schildt	Mc Graw-Hill

V Semester
IT2323 - OE-1: Introduction to Data Science

Course Learning Objective	Course Outcomes
Student will able: 1. To understand basic of data science and its application world around. 2. To identify and describe the methods and techniques commonly used in data science. 3. To study about data preprocessing, data preparation steps. **4.** To learn and use various data analysis tool to explore and understand data.	After completion of the course: 5. Identify and describe the methods and techniques commonly used in data science 6. Demonstrate proficiency with the methods and techniques for obtaining, organizing, exploring, and analyzing data. 7. Recognize how data analysis, inferential statistics, modeling, machine learning, and statistical computing can be utilized in an integrated capacity 8. Demonstrate the ability to clean and prepare data for analysis and assemble data from a variety of sources.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	Identify and describe the methods and techniques commonly used in data science	3	3											3	3
2	Demonstrate proficiency with the methods and techniques for obtaining, organizing, exploring, and analyzing data.	3	3	3										3	3
3	Recognize how data analysis, inferential statistics, modeling, machine learning, and statistical computing can be utilized in an 3integrated capacity	3	3	3		3								3	3
4	Demonstrate the ability to clean and prepare data for analysis and assemble data from a variety of sources.	3	3	3										3	3
IT		3	3	3		3								3	3

UNIT I		**[05 Hrs.]**
Unit – I: Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.		
UNIT II		**[05 Hrs.]**
Unit – II: Data Collection and Data Pre-Processing Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.		
UNIT III		**[06 Hrs.]**
Unit – III: Exploratory Data Analytics Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.		
UNIT IV		**[08 Hrs.]**
Unit – IV: Model Development Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.		
UNIT V		**[08 Hrs.]**
Unit – V: Model Evaluation Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.		
UNIT VI		**[08 Hrs.]**
Unit VI- Case study based on data analytics Tool(R Language,Tabelue,Python)		

Text books:

Sr.No	Title of Book	Edition	Author	Publication
1	The Intersection of IoT and Data Science", PACKT, 2016.		Jojo Moolayil, "Smarter Decisions :	
2	Doing Data Science		Cathy O'Neil and Rachel Schutt	O'Reilly, 2015.

Reference books:				
Sr.No.	Title of Book	Edition	Author	Publication
1	"Data Science and Big data Analytics"		David Dietrich, Barry Heller, Beibei Yang,	EMC 2013
2	Handbook of Research on Cloud Infrastructures for Big Data Analytics		Raj, Pethuru	IGI Globa

V Semester

IT2331 - OE-2: Introduction to Machine Learning

Objective	Course Outcome
1. To introduce basic concepts of machine learning and explain the relative strengths and weaknesses of different machine learning Methods. 2. To understand the different aspects of supervised learning 3. To understand the concepts of unsupervised learning 4. To learn to apply supervised and unsupervised learning algorithms to solve the problem	After undergoing the course, student will be able to: 1. Understand various models of supervised and unsupervised learning 2. analyze a problem and identify appropriate learning paradigm to solve it. 3. apply supervised learning for the given set of labeled samples and design the model to meet the desired output 4. apply unsupervised learning for the given set of samples, and design the model to meet the desired output

Unit No.	Contents	Max. Hrs.
1	Introduction to machine learning. What Is Machine Learning, Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Supervised and Unsupervised Learning, Reinforcement Learning, Generalization, Overfitting, and Underfitting	6
2	Supervised Learning-1: k-Nearest Neighbors, linear Models, Naive Bayes Classifiers, Decision Trees	6
3	Supervised Learning-2: Kernelized Support Vector Machines, Uncertainty Estimates from Classifiers, The Decision Function, predicting Probabilities, Uncertainty in Multiclass Classification	6
4	Unsupervised Learning: *k*-Means Clustering , Expectation-Maximization Algorithm, Supervised Learning after Clustering , Hierarchical Clustering, Choosing the Number of Clusters	6
5	Design and Analysis of Machine Learning Experiments: Factors, Response, and Strategy of Experimentation, Randomization, Replication, and Blocking, Guidelines for Machine Learning Experiments , Cross-Validation and Resampling Methods, K-Fold Cross-Validation, Comparing Two Classification Algorithms.	5
6	Advances in Machine Learning: Introduction to learning using Neural networks, shallow and deep networks.	6

V Semester
IT2331 - OE-2: Introduction to Machine Learning

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Machine Learning, Second Edition		Ethem Alpaydın	The MIT Press
2	Introduction to Machine Learning with Python, A Guide for Data Scientists		Andreas C. Müller and Sarah Guido	ORIELLY

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Machine Learning	Tom M. Mitchel	McGraw Hill	
2				

V Semester
IT2332 - OE-2: Information Security

Objective	Course Outcome
Student will able: 1. To focus on the foundations Computer Security and Threats to security 2. To understand basic concepts of Threats and Intruders. 3. To demonstrate and understand the concepts and application of Communication, Server, System , Network, Internet and cyber security and understanding standards. 4. To know the working of Server security, various System and Application Security, IT Act.	After completion of the course: 1. To provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security. 2. Students will be able to understand how to protect information and provide authentication using Communication, Server, System, Network, Internet and cyber security 3. Students will able to effectively use of encryption standards and its implementation. 4. Students will be able to understand various technologies and Internet Application with the understanding of IT Act and its protection.

Unit No.	Contents	Max. Hrs.
1	**Introduction**- Computer Security, History of Computer security, Computer Security Concepts (CIA), The OSI security architecture, security attacks, security mechanism, a model for network security, Threats to security, Computer System Security and Access Controls (System access and data access), Key Terms.	7
2	**Malicious software:** Types of Malicious software, Viruses, Virus countermeasures, Worms , Trojan horse, bombs, Trap doors, spoofs, Email virus, Macro viruses, Remedies, Intruders, vulnerabilities & threats, distributed Denial of service attack and Firewalls.	8
3	**Communication security**- Encryption, classical encryption techniques, Block cipher and data encryptions standards, advance encryption standard.Kerberos,X.509	8
4	**Server and System security**- Security for network server, web servers, mobile technologies (java and java script etc) Intrusion detection techniques, intruders, intrusion Detection, Password management, authentication.	8
5	**Network and Internet Security-** Transport-Level Security-Secure Socket Layer and Transport Layer Security, SSL Architecture. Electronic Mail security-Pretty Good Privacy, S/MIME.	7

V Semester
IT2332 - OE-2: Information Security

6	**Cyber Security:** Cybercrime and Computer Crime[Types of Computer Crime, Law Enforcement Challenges, Working With Law Enforcement], Intellectual Property[Types of Intellectual Property, Intellectual Property Relevant to Network and Computer Security], Ethical Issues [Ethics and the IS Professions, Ethical Issues Related to Computers and Information Systems],Security tools, The Information Technology ACT, 2008.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Cryptography and Network Security		William Stallings	Pearson Education
2	Computer Security: Art and Science		Matt Bishop	Addison Wesley

Reference Books

SN	Title	Edition	Authors	Publisher
1	Introduction to computer Security		Mathew Bishop	Pearson
2	Network Security: Private Communication in a Public World (Prentice Hall Series in Computer Networking and Distributed)		Charlie Kaufman, Radia Perlman, Mike Speciner	Pearson Education
3	Computer Security		Dieter Gollmann	John Wiley & Sons

V Semester

IT2333 - OE-2: Concepts in Web Programming

Objective	Course Outcome
The student should be able to 5. Get familiar with basics of HTML, HTML tags, DHTML CSS. 6. Get familiar with client server architecture and able to develop a web application using java technologies 7. Get familiar with markup languages with their structures and syntax. 8. To get familiarised with PHP frame work	On completion of this course, the student will be able to 5. Understand the different tags of HTML and Implement interactive web pages using HTML , DHTML and CSS. 6. Understand client server architecture and Develop interactive web pages using java script and client and server side programming. 7. Understand the concept of Markup languages and Make the use of mark up languages in development of web pages. 8. Understand the concepts of PHP and Develop web applications using PHP

Unit No.	Contents	Max. Hrs.
1	Creation of web pages: HTML tags, special characters, images, tables, forms, the hyperlinks, Frames	8
2	Dynamic HTML (DHTML): Introduction, Cascading Style Sheets (CSS), DHTML Document Object Model and Collections	8
3	Scripting Languages:- Java Script objects and forms, server side and client side scripting languages	6
4	XML:XML basics, understanding mark-up languages, structures and syntax, valid Vs. Well formed XML, DTD (document type Definitions) classes, Element Type Declaration, Attribute Declarations, Limitations of DTDs, XML processor, Introduction to Schema, Complex Types, Extensible Style sheet Language Transformations (XSLT),Basics of Parsing	7
5	The importance of being asynchronous, Blocking vs. non-blocking code, Server-side JavaScript, What is Node.js?, Why use Node.js?,Features, Process Model, Setup Node.js Development Environment, Node.js Basics, Node.js Module, File System	7
6	Introduction to AngularJS, AngularJS Expressions: Numbers, Strings, Objects, Arrays, Expressions using {{ }} and ng-bind. Modules: Creating a module, adding a controller & directive, myApp.js, myCtrl.js, Loading library. Directives: Data Binding, ng-init, ng-repeat, ng-app & ng-model directives, custom directives.2 way binding, Validating User Input, Status, ng-empty, ng-touched, ng-valid, ng-pending. Data Binding: Synchronization between model and view. AngularJS Controllers: ng-controller, Controller Methods, External Files.Scope: $scope, understanding the scope, $rootScope	6

V Semester
IT2333 - OE-2: Concepts in Web Programming

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	The Complete Reference HTML and XHTML		Thomas A.Powell	McGraw Hill Pub
2	Learning angular JS		Dayley, Brad Dayley	

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites		Robin Nixon	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Engineering
SoE & Syllabus 2020
6th Semester
Information Technology

28 June 2019

VI Semester
GE2311 - Fundamentals of Management

Objective	Outcomes Students will be able to
To introduce the fundamentals and legal provision of Management	Explain the Legal provision and Functions of Management.
To introduce the Human Resource and Financial practice of organization	Analyze the role of Human Resource and Financial Management in the organization.
To Introduce the Project Management	Analyze the project life cycles.
To provide knowledge of Marketing Activities of Management	Identify tools and techniques for the marketing of goods and services.

Unit – 1 - Principle of Management

Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership

UNIT-2: Legal Aspects of Management

The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company

UNIT-3: Human Resource Management

Human Resource Management-Meaning and Scope, Principles of HRD, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Grievance Redressal Procedure .

UNIT-4: Project Management

Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Tools and Techniques of Project Management, Network techniques - Introduction and Use of CPM &PERT for planning, SWOT Analysis, Project Risk Analysis, Project Control.

UNIT-5: Marketing Management

Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting

VI Semester
GE2311 - Fundamentals of Management

UNIT-6: Financial Management

Definition & Functions of Finance department, Sources of finance, Types of capital, Profit maximization vs. Wealth Maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet

Text book and Reference

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19

VI Semester

IT2351 - Design & Analysis of Algorithms

Objective	Course Outcome
The student should be able to 1. Study asymptotic notations and recurrence relation. Analysis of iterative and recessive algorithms, complexity of algorithms 2. Use of various algorithmic design techniques in problem solving 3. Performance analysis (time and space complexities) of algorithms in best, worst and average cases. 4. How to synthesize and design efficient algorithms for real world problems	**After completion of the course students will be able to** 1. Understand asymptotic analysis of iterative and recursive algorithms, complexity of algorithms 2. Apply important algorithmic design techniques for problem solving 3. Analyze the performance of algorithms 4. Synthesize and design efficient algorithms for real world problems

Unit No.	Contents	Max. Hrs.
1	Mathematical foundations, summation of arithmetic and geometric series, recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions.	8
2	Asymptotic notations of analysis of algorithms, analyzing control structures, worst case and average case analysis, amortized analysis, External Sorting, lower bound proof.	7
3	Divide and conquer basic strategy, quick sort, merge sort etc. Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.	7
4	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, optimal binary search trees, Matrix-chain Multiplication, traveling salesman problem.	8
5	Connected components, Branch and bound, Backtracking basic strategy, 8 – Queen's problem, graph coloring, Hamiltonian cycles etc.	8
6	NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP-complete, Cook's Theorem, decision and optimization problems, polynomial reduction	8

VI Semester
IT2351 - Design and Analysis of Algorithms

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Computer Algorithms	2nd Edition	Horowitz, Sahani, Rajsekharan	Silicon Press
2	Introduction to Algorithm	3rd Edition, 2009	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	MIT press
3	Fundamentals of Algorithms	1st edition,1995	Brassard, Bratley	Prentice Hall
4	The Algorithm Design Manual	2nd Edition	Steven S. Skiena	Springer

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to the Theory of Computation,	3rd Edition, 2013	Michael Sipser	Cengage Learning
2	Algorithms	1st Edition, 2006	S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani	
3	The art of Computer programming Vol. 3	2nd Edition, 1998	Donald E. Knuth	Addison-Wesley

VI Semester

IT2352- :Lab- Design & Analysis of Algorithms

List of Practical's

Sr. No..	Problem Statements
1	Implement and analyze different sorting algorithms.
2	Practical Based on Amortized Analysis
3	Practical Based on Minimum Cost Spanning Tree
4	Practical Based on An Activity Scheduling Problem
5	Practical Based on Single Source Shortest Path
6	Practical Based on Dynamic Programming
7	Practical Based on divide and conquer

VI Semester

IT2353 - Principles of Compiler Design

Objective	Course Outcome
The student should be able to 1. To study the basic concept of compiler fundamentals & design of lexical analysis 2. To study the different parsing techniques. 3. To study the construction of parsers for different CFG. 4. To study Syntax Directed Translation of different programming language constructs. 5. To study symbol table organization & error detection & recovery 6. To study code optimization & designing of code	**On completion of this course, the student will be able to** 1. Understand different phases of compilation process and lexical analyzer tool "Lex" OR "Flex" 2. Apply parsing techniques to design and implement parsers using YACC /Bison tool 3. Apply syntax directed translation scheme to programming language constructs and analyze errors in lexical and syntactic phase of compiler 4. Apply different optimization techniques in the design of compiler and generate target code

Unit No.		Max. Hrs.
1	Introduction to Abstract Model & Grammar , Introduction to Compilation Process, Compilers & Translators, Phase structure of Compiler, Role of Lex, Design of Lexical Analysis.	6
2	Specifying Syntactic Structure of Programming Language using Context Free Grammars, The role of Parser, Top-down Parsing, and Bottom up Parsing, Predictive Parsers, and Recursive Decent Parser	8
3	Construction of efficient LR Parsers (SLR, CLR & LALR), Canonical Collection of set of items and construction of Parsing table, Implementation of LR Parsing table	7
4	Syntax Directed Translation: Intermediate Code, Postfix notation, Parse tree and Syntax Trees, Three address codes, quadruples, triples, Translation of Arithmetic Expression, Boolean expressions, Control Statements. Array references, Procedure Calls, Declarations, Case Statements, Use of Compiler writing tools (Lex/Flex, Yacc /Biason).	8
5	Symbol Tables: Contents, Representing scope information. Error detection and Recovery: Error handling, Lexical-phase, Syntactic phase and semantic phase	6
6	Introduction to Code Optimization, The principle sources of optimization, Loop optimization, The DAG representation, Introductory Data Flow analysis, Introduction to Code Generation: Object programs, Problems in Code Generation, Register allocation and assignment, Code generation from DAG, Peephole optimization.	8

VI Semester
IT2353 - Principles of Compiler Design

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Compilers Principles, Techniques & Tools	2nd Edition	Alfred V. Aho , Ravi Sethi , Jeffrey D.	Addison Wesley.
2	Principles of Compiler Design	2nd Edition	Alfred V. Aho ,Jeffrey D. Ullman	Addison Wesley.

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Compiler Design	4th edition	O.G. Kakde	Laxmi Publication
2	Introduction to Compiling Techniques: First Course Using ANSI C, LEX and YACC	2nd Revised edition Edition	J.P. Bennett	Alfred Waller Ltd

VI Semester
IT2354 : Lab - Principles of Compiler Design

Course Learning Objective	Course Outcomes
Students will study: 1. To study the different phases and passes of compiler design. 2. To write a program using Lex Tool. 3. To write a program using YACC Tool	After completion of the course: 1. Students will be able to understand and apply Lex Tool for the development of program. 2. Students will be able to understand and apply YACC Tool for the development of program.

List of Practical's

Sr. No	Experiments Base On
1	LEX TOOL
2	YACC TOOL

VI Semester

IT2361 - PE-II: Machine Learning

Objective	Course Outcome
The student should be able to 1. To introduce basic concepts of machine learning and explain the relative strengths and weaknesses of different machine learning Methods. 2. To understand the different aspects of supervised learning 3. To understand the concepts of unsupervised learning 4. To understand different methods of evaluation of machine learning models	After undergoing the course, student will be able to: 1. Understand various models of supervised and unsupervised learning 2. analyze a problem and identify the machine learning algorithm appropriate for its solution 3. apply supervised learning for the given set of labelled samples and design the model to meet the desired needs 4. apply unsupervised learning for the given set of samples, and design the model to meet the desired needs

Unit No.	Contents	Max. Hrs.
1	**Introduction to machine learning**. What Is Machine Learning, Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Supervised and Unsupervised Learning, Reinforcement Learning, Generalization, Over-fitting, and Under-fitting	(6)
2	**Supervised Learning-1:** k-Nearest Neighbors, linear Models, Naive Bayes Classifiers, Decision Trees	(6)
3.	**Supervised Learning-2:** Kernelized Support Vector Machines, Uncertainty Estimates from Classifiers, The Decision Function, predicting Probabilities, Uncertainty in Multiclass Classification, multivariate classification and regression.	(6)
4	**Unsupervised Learning**: *k*-Means Clustering , Expectation-Maximization Algorithm, Supervised Learning after Clustering , Hierarchical Clustering, Choosing the Number of Clusters	(6)
5	**Design and Analysis of Machine Learning Experiments:** Factors, Response, and Strategy of Experimentation, Randomization, Replication, and Blocking, Guidelines for Machine Learning Experiments , Cross-Validation and Resampling Methods, K-Fold Cross-Validation, Bootstrapping, Measuring Classifier Performance, Hypothesis Testing, Assessing a Classification Algorithm's Performance, Comparing Two Classification Algorithms.	(5)
6	**Advances in Machine Learning**: Combining multiple learners, bagging and boosting, introduction to learning using Neural networks, shallow and deep networks.	(6)

VI Semester
IT2361 - PE-II: Machine Learning

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Machine Learning, Second Edition		Ethem Alpaydın	The MIT Press
2	Introduction to Machine Learning with Python, A Guide for Data Scientists		Andreas C. Müller and Sarah Guido	ORIELLY

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Machine Learning		Tom M. Mitchel	McGraw Hill

VI Semester

IT2362 - PE-II: Lab - Machine Learning

Course Learning Objective	Course Outcomes
To understand the working of Machine learning, algorithms practically.	Students will be able to: Implement the Machine learning algorithms to solve the given problem

Sr. No..	Problem Statements
1	Experiment on k-Nearest Neighbors, ,
2	Experiment on Naive Bayes Classifiers
3	Experiment on Decision Trees
4	Experiment on Kernelized Support Vector Machines
5	Experiment on *k*-Means Clustering
6	Experiment on Hierarchical Clustering
7	Experiment on K-Fold Cross-Validation
8	Experiment on combining multiple learners
9	Experiment on neural networks using backpropagation algorithm
10	Experiment on deep neural networks

VI Semester
IT2363 - PE-II: Business Intelligence

Objective	Course Outcome
Student will : 1. Understand the business relevance and technical basics of business intelligence (BI), knowledge management (KM), and decision support and describe how OLAP is different from OLTP. 2. Appreciate the use of SQL for BI 3. Understand principles of dimensional modeling. 4. Understand Business intelligence system architecture, its building blocks, life cycle of a typical BI project. 5. Get acquainted to BI tool	After completion of the course: 1. Students will be able to : ➢ Assemble BI as a Process, identify its application in various domains and functional area, its roles and responsibilities. ➢ Identify functions of building blocks in N_tier BI ecosystem ➢ Identify different stages in Lifecycle of a BI project. ➢ Differentiate between traditional BI and self service BI **(PO1-2)** **2.** Apply SQL as a universal language for BI (**PO23)** **3.** Model a business scenario; identify the metrics, indicators, various dimensions, and aggregation strategies and make recommendations to achieve the business goal (**PO3-3)** **4**. Obtain hands on experience with some popular BI software for analysis, reporting, visualization of results **(PO1-2, PO2-2,PO3-2,PO5-3)**

Unit No.	Contents	Max. Hrs.
1	**Introduction to Business Intelligence** What is business intelligence, why do we need BI, EIS,MIS,DSS& BI, information pyramid-data, information, Knowledge & intelligence. Basis For operational, tactical & strategic decision making , OLTP vs. OLAP, Requirement gathering in BI through business question BI in various domains and functional area.	6.
2	**SQL the universal language for Business Intelligence** Introduction to RDBMS, Language for retrieving data from a database, various clauses in a SQL retrieving data from multiple tables- joins filtering, sorting & grouping datasets, Introduction to DDL & DML statements, various built- in functions in SQL, Use of sub-queries, data dictionary and dynamic SQL.	7

VI Semester
IT2363 - PE-II: Business Intelligence

3	**Principles of Dimensional modeling** Foundation for fact based decision making, star and snowflake schema, Pros& cons of the star/snowflake schema dimensional model, Slowly changing dimension tables, Fact-less fact strategy, Time dimension.	6
4	**Business Intelligence system architecture** Need for enterprise class business intelligence infrastructure, The BI ecosystem, Building blocks of a n- tier BI system-servers & communication protocols, The central repository-metadata, Information consumption user interfaces-desktop vs. web vs. Mobile. Open architecture, Scalability, performance in BI-in memory analytics.	7
5	**BI Project Lifecycle** Typical BI project lifecycle, Requirements gathering & analysis-functional & non- functional requirements, reports and dashboards design- mock – up and storyboarding, Testing in a BI project, BI project deployment, Post production support, Applications of BI, BI best practices	7
6	**Self-service Analytics** What is Self-service Analytics, What are the use cases of self-service analytics, Business Paradigm vs IT paradigm and the Paradigm Shift with self-service analytics, Challenges of Self-service Analytics, Introduction to MicroStrategy Desktop – Overview	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Data Warehousing ETL toolkit, Indian edition.		Ralph Kimball and Margy Ross	
2	Fundamentals of Business Analytics2nd edition		R. N. Prasad, Seema Acharya	Wiley.
3	Business Intelligence: The Savvy Manager's Guide,2nd Edition		David Loshin	

Reference Books

SN	Title	Edition	Authors	Publisher
1	Business intelligence for the enterprise		Mike Biere,	IBM

VI Semester
IT2364 - PE-II: Lab - Business Intelligence

Course Learning Objective	Course Outcomes
Students will 1. Understand the SQL and details of algorithms made available by popular commercial BI Tools 2. Get acquainted with one BI tool and obtain an hands on experience with some popular BI Tool	After completion of the course: 1. Students will be able to apply SQL as a universal language for BI. 2. Students will able to obtain hands on experience with some popular BI software And demonstrate the ability to use BI tool for analysis, designing schema, reporting, visualization of results

Sr. No	Problem Statements
1	Exploring HR schema of Oracle, Implementation of queries based on range, relational operators, sorting, concatenation.
2	Implementation of queries based on character matching, aggregate functions, set operations
3	Implementation of queries based on Joins (joining 2 or more tables), sub queries.
4	a. Design a multidimensional data cube for given data Using EXCEL b. Perform OLAP- slicing operation on it
5	Creation Of Dashboard Using EXCEL
6	Exploring MICROSTRATEGY ANALYTIC DESKTOP (MSTR) : Installation Of Microstrategy Analytic Desktop And Importing Data from file, Data Wrangling (Editing Data).
7	Visualization Of Data Using different visualizations in MSTR analytic desktop, Filtering data, and delivering Insights from data
8	Create reports and Dashboard with defined insights /requirements in MSTR analytic desktop. (Sample Data to be provided)

VI Semester
IT2365 - PE-II: Internet of Things

Course Objective	Course Outcome
The student will study 1. The students will be able to describe IoT as a Process, its architecture and Management, compare and contrast old and new challenges in IoT 2. The students will be able to Apply various communication protocol and its building blocks in IoT applications. 3. The students will be able to Illustrate relevance of IoT with cloud and Web and analyze various security challenges and also evaluate various control strategies for the same 4. The students will be able to create, Design and Develop various applications based on IoT concepts	On completion of this course, the student will be able to 1. Students will able to describe various communication protocol and its building blocks. 2. Students will able to describe relevance of IoT with cloud and the application areas of IOT. 3. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor 4. Able to understand building blocks of Internet of Things and characteristics. 5. The students will study and implement IoT project by studying different IoT components, electronic board and their uses.

Unit No.	Contents	Max. Hrs.
1	Introduction to IoT: History of IOT, Concepts, Products and Examples. IOT Paradigm, The Layering concepts of IOT, IOT Communication Model, IOT Architecture, The 6LoWPAN,Domains of IOT, M2M vs IOT, Management of IOT, IOT Platforms, IOT Languages, IOT Physical Systems, Tools for IOT	8 hrs
2	IoT Communication Protocols: Protocol Standardization for IOT, Issues with IOT Standardization, M2M and WSN Protocols, SCADA and RFID Protocols, IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, Unified Data Standards.	8 hrs
3	Web of Things: Web of Things versus Internet of Things, The Two Pillars of the Web, Architecture Standardization for Web of Things, Platform Middleware for Web of Things, Unified Multitier Web of Things Architecture, Web of Things Portals and Business Intelligence	7 hrs

VI Semester
IT2365 - PE-II: Internet of Things

4	Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middleware, Cloud Standards, Cloud Providers & Systems, Mobile Cloud Computing, Cloud of Things Architecture. Models of Implementation, Service Level Agreement (SLA), Examples of Applications.	7 hrs
5	Security Aspects: Security in IOT: Introduction, Purpose, Issues, Challenges. IOT Threats to Individual and Organizations, Challenges to Secure IOT Development, Recommended Security Controls. Cybersecurity and IOT. Layered Security Protections to Defend IOT Assets.	7 hrs
6	IoT Applications: IOT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IOT electronic equipment. Use of Big Data and Visualization in IOT. Role of IOT for Increased Autonomy and Agility in Collaborative Production Environments, Resource Management in the IOT.	7 hrs

Text Books

SN	Title	Edition	Authors	Publisher
1	Internet of Things: A Hands-on-Approach		Arshdeep Bahga & Vijay Madisetti	Orient Blackswan Publisher
2	The Internet of Things: Key Applications and Protocols		Olivier Hersent, David Boswarthick & Omar Elloumi	Wiley publication

VI Semester

IT2366 - PE-II: Lab - Internet of Things

Objective	Course Outcome
Student will study: 1. The students will be able to Illustrate relevance of IoT with cloud and Web and analyze various security challenges and also evaluate various control strategies for the same 2. The students will be able to create, Design and Develop various applications based on IoT concepts	After completion of the course students will be able to: 1. Students will able to describe relevance of IoT with cloud and the application areas of IOT 2. The students will study and implement IoT project by studying different IoT components, electronic board and their uses.

List of Practical's

Sr. No..	Problem Statements
1	Study of Ardunio Kit
2	Study of Raspberry Pi Kit
3	Study of different electronics components
4	Study of different sensors in IoT
5	Case study: Smart Irrigation System using IoT and cloud
6	Case Study: IOT Car Parking System
7	Case Study: IOT Based ICU Patient Monitoring System
8	Case Study: Smart Dustbin With IOT Notifications
9	Project: Designing of Home Automation System
10	Mini Project

VI Semester
IT2367- PE-II: Big Data Analytics

Course Learning Objective	Course Outcomes
Student will able: 1. Student should able to learn and understand the basic concept, characteristics and application of Big Data. 2. To learn Concept of Distributed system with Apache Hadoop. 3. To learn application of Hadoop to solve real world problem **4.** To learn and apply machine learning	After completion of the course: 5. Understand Concept, characteristics, types of big data and its application. 6. Build and maintain reliable, scalable, distributed systems with Apache Hadoop. 7. Apply Hadoop ecosystem components to solve real world problems. 8. Apply machine learning algorithm for big data analysis.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	Understand Concept, characteristics, types of big data	Y	Y	Y	Y	y							Y	Y	Y
2	Build and maintain reliable, scalable, distributed systems with Apache Hadoop.	Y	Y	Y	Y	y							Y	Y	Y
3	Apply Hadoop ecosystem components to solve real world problems.	Y	Y	Y	Y	y							Y	Y	Y
4	Apply machine learning algorithm for big data analysis.	Y	Y	Y	Y	y							Y	Y	Y
IT															

UNIT I		**[05 Hrs.]**

Introduction to Big Data: Data, Characteristics of data and Types of digital data: Unstructured, Semi-structured and Structured, Sources of data, working with unstructured data, Evolution and Definition of big data, Characteristics and Need of big data, Challenges of big data, Data environment versus big data environment, Big Data Analysis Life Cycle.

UNIT II		**[05 Hrs.]**
Big data analytics tools and Technologies: Overview of business intelligence, Characteristics and need of big data analytics, Classification of analytics, Challenges to big data analytics. Analytical operations: Associations rules, classifications, clustering, Mahout ML, etc.		
UNIT III		**[06 Hrs.]**
Hadoop foundation for analytics: Features, Hadoop ecosystems, Evolution of Hadoop architectures Hadoop 1.0, Hadoop 2.0, Hadoop3.0, Key aspects and Components of Hadoop 3.0. Hadoop Technology Stack: Hive, Pig, Zookeeper, Swoop, oozie, flume, etc.		
UNIT IV		**[08 Hrs.]**
MapReduce and YARN framework: Introduction to MapReduce, Processing data with MapReduce, Introduction to YARN, Components YARN, Data serialization and Working with common serialization formats, Big data serialization formats		
UNIT V		**[08 Hrs.]**
NoSQL Databases: Schema-less Models, Increasing Flexibility for Data ManipulationKey Value Stores- Document Stores – Tabular Stores – Object Data Stores Hive – Sharding –-Hbase – Analyzing big data NoSQL Database Architectures.		
UNIT VI		**[08 Hrs.]**
Introduction to MongoDB key features, Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents, MongoDB Query Language.		

Text books:

Sr	Title of Book	Edition	Author	Publication
1	Big Data and Analytics	Latest Edition	Seema Acharya	Wiley, 2016
2	Professional Hadoop Solutions	Latest Edition	lublinsky, Kevin t. Smith, AlexeyYakubovich	Wiley
3	Understanding Big data	Latest Edition	Chris Eaton,Dirk derooset al.	McGraw Hill
4	BIG Data and Analytics	Latest Edition	Sima Acharya, Subhashini Chhellappan	Willey

Reference books:				
Sr.	**Title of Book**	**Edition**	**Author**	**Publication**
1	MongoDB in Action	Latest Edition	Kyle Banker,Piter Bakkum, Shaun Verch	Dream tech Press
2	HADOOP: The definitive Guide	Latest Edition	Tom White	
3	Big Data Analytics with R and Hadoop	Latest Edition	Vignesh Prajapati	Packet Publishing
4	Learning Spark: Lightning-Fast Big Data Analysis Paperback	Latest Edition	Holden Karau	

VI Semester

IT2368- PE-II:Lab: Big Data Analytics

VI Semester
IT2371 - OE-III: Industry 4.0

Objective	Course Outcome
Students will: 1) Able to learn an introduction to Industry 4.0 (or the Industrial Internet) 2) Will able to understand its applications in the business world. 3) Will able to understand Business Model and Reference Architecture in Industry 4) Will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.	After completion of this course: 1) Students will be Understand the basics of IoT and basics of Industry 4.0. 2) Students will be Understand Business Model and Reference Architecture 3) Students will be able to understand the different Business issues in Industry 4.0 and how to solve them. 4) Students will be able to understand the need of Security and Fog Computing and applications of IIoT.

Unit No.	Contents	Max. Hrs.
1	Introduction to IoT: History of IOT, Concepts, Products and Examples. IOT Paradigm, The Layering concepts of IOT, IOT Communication Model, IOT Architecture, IoT Sensing and Actuation, IoT Connectivity, IoT Networking. Introduction to Industry 4.0: History, Concept, The Journey so far: Developments in USA, Europe, China and other countries, The Fourth Revolution, Compelling Forces and Challenges for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory, Globalization and Emerging Issues.	7
2	Basics of Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Life-cycle Management, Augmented Reality and Virtual Reality, Introduction to Artificial Intelligence, Big Data and Advanced Analysis, Cyber-Security in Industry 4.0, Industrial Processes, Industrial Sensing & Actuation, Industrial Internet Systems.	7
3	Business Model and Reference Architecture: IIoT-Business Models, IIoT Reference Architecture, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking.	6

VI Semester

IT2371 - OE-III: Industry 4.0

Unit No.	Contents	Max. Hrs.
4	Business issues in Industry 4.0:IIoT case studies, Opportunities and Challenges, Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world	6
5	Security and Fog Computing: Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT. Application Domains: Factories and Assembly Line, Food Industry, Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications),	7
6	Industrial IOT- Application domain: Milk Processing and Packaging Industries, Manufacturing Industries, Virtual Reality Lab, Steel Technology Lab. Facility Management, Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries. Facility Management.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Industry 4.0: The Industrial Internet of Things		Alasdair Gilchrist	Apress
2	Industrial Internet of Things: Cyber manufacturing Systems		Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat	Springer

VI Semester
IT2372 - OE-III: Core JAVA

Objective	Course Outcome
Student will : 1. Learn the Concepts of Java programming language 2. Learn Java's syntax, idioms, patterns, and styles to write simple JAVA program. 3. To develop object centric thinking and to use object oriented features of JAVA to write complex programs. 4. Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development	After completion of the course students will be able to: 1. Demonstrate the understanding of Object oriented concepts. 2. Apply the programming language JAVA efficiently in object oriented software development 3. Able to analyze problem statement and identify appropriate objects and methods 4. Design and implement a small programs using classes

Unit No.	Contents	Max. Hrs.
1	Introduction to Programming Methodologies, Introduction to Object oriented programming, Objects and Classes, Characteristics of OOP, Encapsulation and data Abstraction, Inheritance, Polymorphism, Dynamic Binding, Structured Versus Object oriented programming, Merits and demerits of object oriented methodology, introduction to Java as OOP language	7
2	Building blocks of java, Data types, Variable declarations, operators and Assignments, control structures, Identifying objects and classes, Declaring Classes and objects, Creating Classes and objects, methods, argument passing, Recursion, this keyword, constructors ,Visibility control	7
3	Java as OOP language, Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances)	6
4	Arrays and Strings: Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Wrapper Classes	6
5	Exception handling mechanism: Fundamentals exception types, uncaught exception, try-catch Block, displaying description of an exception, multiple catch clauses, nested try-catch statements, throw, throws, finally, built in exceptions, creating own exception subclasses	7
6	I/O Streams: Introduction to stream classes, use of stream classes, I/O stream, bytes stream, character stream, pre-defined stream, reading console input, reading character, reading string, writing console output, the print write class, reading & writing files ,transient and volatile modifiers	7

VI Semester
IT2372 - OE-III: Core JAVA

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Thinking in Java		Bruce Eckel	Prentice Hall

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Programming with Java		E Balagurusamy	TATA Mc Graw-Hill
2	Java2CompleteReference		Herbert Schildt	Mc Graw-Hill

V Semester

IT2373 - OE-III: Introduction to Data Science

Course Learning Objective	Course Outcomes
Student will able: 1. To understand basic of data science and its application world around. 2. To identify and describe the methods and techniques commonly used in data science. 3. To study about data preprocessing, data preparation steps. **4.** To learn and use various data analysis tool to explore and understand data.	After completion of the course: 1. Identify and describe the methods and techniques commonly used in data science 2. Demonstrate proficiency with the methods and techniques for obtaining, organizing, exploring, and analyzing data. 3. Recognize how data analysis, inferential statistics, modeling, machine learning, and statistical computing can be utilized in an integrated capacity 4. Demonstrate the ability to clean and prepare data for analysis and assemble data from a variety of sources.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	Identify and describe the methods and techniques commonly used in data science	3	3											3	3
2	Demonstrate proficiency with the methods and techniques for obtaining, organizing, exploring, and analyzing data.	3	3	3										3	3
3	Recognize how data analysis, inferential statistics, modeling, machine learning, and statistical computing can be utilized in an 3integrated capacity	3	3	3		3								3	3
4	Demonstrate the ability to clean and prepare data for analysis and assemble data from a variety of sources.	3	3	3										3	3
IT		3	3	3		3								3	3

UNIT I		**[05 Hrs.]**
Unit – I: Introduction Introduction to Data Science – Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues.		
UNIT II		**[05 Hrs.]**
Unit – II: Data Collection and Data Pre-Processing Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.		
UNIT III		**[06 Hrs.]**
Unit – III: Exploratory Data Analytics Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA.		
UNIT IV		**[08 Hrs.]**
Unit – IV: Model Development Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot – Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.		
UNIT V		**[08 Hrs.]**
Unit – V: Model Evaluation Generalization Error – Out-of-Sample Evaluation Metrics – Cross Validation – Overfitting – Under Fitting and Model Selection – Prediction by using Ridge Regression – Testing Multiple Parameters by using Grid Search.		
UNIT VI		**[08 Hrs.]**
Unit VI- Case study based on data analytics Tool(R Language,Tabelue,Python)		

Text books:

Sr. No	Title of Book	Edition	Author	Publication
1	The Intersection of IoT and Data Science", PACKT, 2016.		Jojo Moolayil, "Smarter Decisions :	
2	Doing Data Science		Cathy O'Neil and Rachel Schutt	O'Reilly, 2015.

Reference books:

SN	Title of Book	Edition	Author	Publication
1	"Data Science and Big data Analytics"		David Dietrich, Barry Heller, Beibei Yang,	EMC 2013
2	Handbook of Research on Cloud Infrastructures for Big Data Analytics		Raj, Pethuru	IGI Globa

VI Semester

IT2381 - OE-IV: Introduction to Machine Learning

Objective	Course Outcome
1. To introduce basic concepts of machine learning and explain the relative strengths and weaknesses of different machine learning Methods. 2. To understand the different aspects of supervised learning 3. To understand the concepts of unsupervised learning 4. To learn to apply supervised and unsupervised learning algorithms to solve the problem	After undergoing the course, student will be able to: 1. Understand various models of supervised and unsupervised learning 2. analyze a problem and identify appropriate learning paradigm to solve it. 3. apply supervised learning for the given set of labeled samples and design the model to meet the desired output 4. apply unsupervised learning for the given set of samples, and design the model to meet the desired output

Unit No.	Contents	Max. Hrs.
1	Introduction to machine learning. What Is Machine Learning, Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Supervised and Unsupervised Learning, Reinforcement Learning, Generalization, Overfitting, and Underfitting	6
2	Supervised Learning-1: k-Nearest Neighbors, linear Models, Naive Bayes Classifiers, Decision Trees	6
3	Supervised Learning-2: Kernelized Support Vector Machines, Uncertainty Estimates from Classifiers, The Decision Function, predicting Probabilities, Uncertainty in Multiclass Classification	6
4	Unsupervised Learning: *k*-Means Clustering , Expectation-Maximization Algorithm, Supervised Learning after Clustering , Hierarchical Clustering, Choosing the Number of Clusters	6
5	Design and Analysis of Machine Learning Experiments: Factors, Response, and Strategy of Experimentation, Randomization, Replication, and Blocking, Guidelines for Machine Learning Experiments , Cross-Validation and Resampling Methods, K-Fold Cross-Validation, Comparing Two Classification Algorithms.	5
6	Advances in Machine Learning: Introduction to learning using Neural networks, shallow and deep networks.	6

VI Semester

IT2381 - OE-IV: Introduction to Machine Learning

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Machine Learning, Second Edition		Ethem Alpaydın	The MIT Press
2	Introduction to Machine Learning with Python, A Guide for Data Scientists		Andreas C. Müller and Sarah Guido	ORIELLY

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Machine Learning	Tom M. Mitchel	McGraw Hill	
2				

VI Semester
IT2382 - OE-IV: Information Security

Objective	Course Outcome
Student will able: 1. To focus on the foundations Computer Security and Threats to security 2. To understand basic concepts of Threats and Intruders. 3. To demonstrate and understand the concepts and application of Communication, Server, System , Network, Internet and cyber security and understanding standards. 4. To know the working of Server security, various System and Application Security, IT Act.	After completion of the course: 1. To provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security. 2. Students will be able to understand how to protect information and provide authentication using Communication, Server, System, Network, Internet and cyber security 3. Students will able to effectively use of encryption standards and its implementation. 4. Students will be able to understand various technologies and Internet Application with the understanding of IT Act and its protection.

Unit No.	Contents	Max. Hrs.
1	**Introduction**- Computer Security, History of Computer security, Computer Security Concepts (CIA), The OSI security architecture, security attacks, security mechanism, a model for network security, Threats to security, Computer System Security and Access Controls (System access and data access), Key Terms.	7
2	**Malicious software:** Types of Malicious software, Viruses, Virus countermeasures, Worms , Trojan horse, bombs, Trap doors, spoofs, Email virus, Macro viruses, Remedies, Intruders, vulnerabilities & threats, distributed Denial of service attack and Firewalls.	8
3	**Communication security**- Encryption, classical encryption techniques, Block cipher and data encryptions standards, advance encryption standard.Kerberos,X.509	8
4	**Server and System security**- Security for network server, web servers, mobile technologies (java and java script etc) Intrusion detection techniques, intruders, intrusion Detection, Password management, authentication.	8
5	**Network and Internet Security-** Transport-Level Security-Secure Socket Layer and Transport Layer Security, SSL Architecture. Electronic Mail security-Pretty Good Privacy, S/MIME.	7

VI Semester
IT2382 - OE-IV: Information Security

6	**Cyber Security:** Cybercrime and Computer Crime[Types of Computer Crime, Law Enforcement Challenges, Working With Law Enforcement], Intellectual Property[Types of Intellectual Property, Intellectual Property Relevant to Network and Computer Security], Ethical Issues [Ethics and the IS Professions, Ethical Issues Related to Computers and Information Systems],Security tools, The Information Technology ACT, 2008.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Cryptography and Network Security		William Stallings	Pearson Education
2	Computer Security: Art and Science		Matt Bishop	Addison Wesley

Reference Books

SN	Title	Edition	Authors	Publisher
1	Introduction to computer Security		Mathew Bishop	Pearson
2	Network Security: Private Communication in a Public World (Prentice Hall Series in Computer Networking and Distributed)		Charlie Kaufman, Radia Perlman, Mike Speciner	Pearson Education
3	Computer Security		Dieter Gollmann	John Wiley & Sons

V Semester
IT2383 - OE- IV: Concepts in Web Programming

Objective	Course Outcome
The student should be able to 5. Get familiar with basics of HTML, HTML tags, DHTML CSS. 6. Get familiar with client server architecture and able to develop a web application using java technologies 7. Get familiar with markup languages with their structures and syntax. 8. To get familiarised with PHP frame work	On completion of this course, the student will be able to 1. Understand the different tags of HTML and Implement interactive web pages using HTML , DHTML and CSS. 2. Understand client server architecture and Develop interactive web pages using java script and client and server side programming. 3. Understand the concept of Markup languages and Make the use of mark up languages in development of web pages. 4. Understand the concepts of PHP and Develop web applications using PHP

Unit No.	Contents	Max. Hrs.
1	Creation of web pages: HTML tags, special characters, images, tables, forms, the hyperlinks, Frames	8
2	Dynamic HTML (DHTML): Introduction, Cascading Style Sheets (CSS), DHTML Document Object Model and Collections	8
3	Scripting Languages:- Java Script objects and forms, server side and client side scripting languages	6
4	XML:XML basics, understanding mark-up languages, structures and syntax, valid Vs. Well formed XML, DTD (document type Definitions) classes, Element Type Declaration, Attribute Declarations, Limitations of DTDs, XML processor, Introduction to Schema, Complex Types, Extensible Style sheet Language Transformations (XSLT),Basics of Parsing	7
5	The importance of being asynchronous, Blocking vs. non-blocking code, Server-side JavaScript, What is Node.js?, Why use Node.js?,Features, Process Model, Setup Node.js Development Environment, Node.js Basics, Node.js Module, File System	7
6	Introduction to AngularJS, AngularJS Expressions: Numbers, Strings, Objects, Arrays, Expressions using {{ }} and ng-bind. Modules: Creating a module, adding a controller & directive, myApp.js, myCtrl.js, Loading library. Directives: Data Binding, ng-init, ng-repeat, ng-app & ng-model directives, custom directives.2 way binding, Validating User Input, Status, ng-empty, ng-touched, ng-valid, ng-pending. Data Binding: Synchronization between model and view. AngularJS Controllers: ng-controller, Controller Methods, External Files.Scope: $scope, understanding the scope, $rootScope	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	The Complete Reference HTML and XHTML		Thomas A.Powell	McGraw Hill Pub
2	Learning angular JS		Dayley, Brad Dayley	

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites		Robin Nixon	

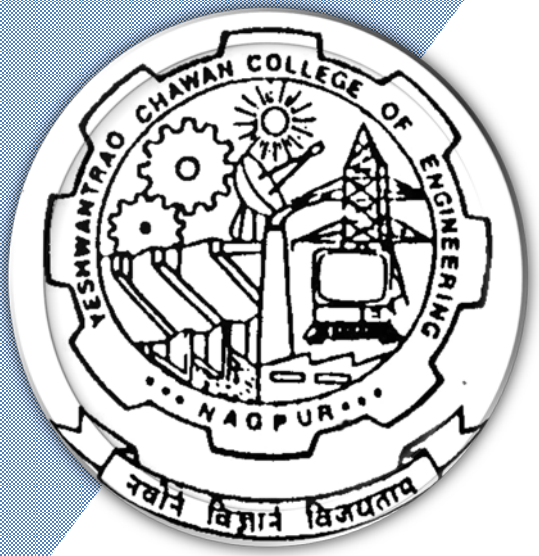
Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110



B.Tech in Information Technology

SoE & Syllabus 2020

7th & 8th Semester
Information Technology

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

SoE No. IT-202.1

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						**47**				
Seventh Semester														
1	7	PC	IT2401	Data Mining	**T**	3	0	0	3	3	30	20	50	3
2	7	PC	IT2402	Lab.: Data Mining	**P**	0	0	2	2	1		60	40	
3	7	PC	IT2403	Principles of Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3
4	7	PE		Professional Elective III	**T**	3	0	0	3	3	30	20	50	3
5	7	PE		Professional Elective IV	**T**	3	0	0	3	3	30	20	50	3
6	7	PE		Lab.: Professional Elective IV	**P**	0	0	2	2	1		60	40	
7	7	PE		Professional Elective V	**T**	3	0	0	3	3	30	20	50	3
8	7	PE		Professional Elective VI	**T**	3	0	0	3	3	30	20	50	3
9	7	STR	IT2409	Mini Project	**P**	0	0	4	4	2		60	40	
10	7	STR	IT2410	Campus Recrutment Training (CRT)	**P**	0	0	0	0	2		100		
				TOTAL SEVENTH SEM		**18**	**0**	**8**	**26**	**24**				

List of Professional Electives-III, IV,V & VI

Professional Electives -III				
1	7	PE-3	IT2411	PE III: Cloud Computing
2	7	PE-3	IT2412	PE III:Real Time Systems
3	7	PE-3	IT2413	PE III: Network Security
4	7	PE-3	IT2414	PE III: Information Retrieval
Professional Electives -IV				
1	7	PE-4	IT2421	PE IV: Neural Network and Fuzzy Logic
	7	PE-4	IT2422	PE IV: Lab.: Neural Network and Fuzzy Logic
2	7	PE-4	IT2423	PE IV: Ethical Hacking and Cyber Forensics
	7	PE-4	IT2424	PE IV:Lab:Ethical Hacking and Cyber Forensics
3	7	PE-4	IT2425	PE IV: Human Computer Interaction
	7	PE-4	IT2426	PE IV: Lab:Human Computer Interaction
4	7	PE-4	IT2427	PE IV: Parallel Computing
	7	PE-4	IT2428	PE IV: Lab: Parallel Computing
Professional Electives - V				
1	7	PE-5	IT2431	PE V: Digital Image Processing
2	7	PE-5	IT2432	PE V: Distributed Systems
3	7	PE-5	IT2433	PE V: Coding Standardand and Technical Documentation
4	7	PE-5	IT2434	PE V: Introduction to Deep Learning
5	7	PE-5	IT2435	PE V: Wireless Sensor Network

Professional Electives - VI				
1	7	PE-6	IT2441	PE VI: Advanced Computer Architecture
2	7	PE-6	IT2442	PE VI: Mobile Communication
3	7	PE-6	IT2443	PE VI: E-commerce
4	7	PE-6	IT2444	PE VI: Natural Language Processing

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.05**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

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SoE No.
IT-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Revised Scheme of Examination w.e.f. 2022-23 onward)

Information Technology

SN	Sem	Type	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
				TOTAL FIRST & SECOND SEM						47				
				Eighth Semester										
1	8	STR	IT2451	Major Project	P	0	0	12	12	9		60	40	
2	8	STR	IT2452	Extra curricular Activity Evaluation	P	0	0	0	0	1		100		
				TOTAL EIGHTH SEM		0	0	12	12	10				
				GRAND TOTAL		86	0	44	130	162				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA** = for Practical : MSPA will be 15 marks each

Chairperson	Dean (Acad. Matters)	June 2022	1.05	Applicable for AY 2022-23 Onwards
		Date of Release	Version	

VII Semester
IT2401 – Data Mining

Objective	Course Outcome
The student should be able to 1. Introduce the data mining fundamentals, different techniques and identify the scope and necessity of Data Mining for the society. 2. Understand the basic concepts of data mining functionalities, its algorithms and applications. 3. Understand the importance of mining web data, ,text data and different approaches for mining. 4. Become familiar with popular data mining tools , able to use it and perform data mining on data sets	**On completion of this course, the student will be able to** **1.** Apply basic concepts in data mining, Identify the scope and necessity of Data Mining for the society and for business applications. **2.** Apply different data mining algorithms on given data set. **3.** Analyze about appropriate data preprocessing tasks, data mining technique applicable for different type of data like web data, text data 4. Use popular data mining tool and apply the principle algorithms and techniques used in data mining, on different types of dataset, analyze their results, interpret the results using different visualization techniques.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Apply basic concepts in data mining, Identify the scope and necessity of Data Mining for the society and for business applications.	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	Apply different data mining algorithms on given data set.	2	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	Analyze about appropriate data preprocessing tasks, data mining technique	2	3	-	-	-	-	-	-	-	-	-	-	-	-

	applicable for different type of data like web data, text data														
CO4	Use popular data mining tool and apply the principle algorithms and techniques used in data mining, on different types of dataset ,analyze their results, interpret the results using different visualization techniques.	-	**2**	-	-	**3**	-	-	-	-	-	-	-	-	-

Unit No.	Contents	Max. Hrs.
1	Introduction to data mining: Data mining definitions & task, data mining on what kind of data ,Knowledge Discovery vs. Data mining, DBMS vs. Data Mining, Data mining functionalities, data mining task primitives , Major issues in data mining , applications of data mining.	5
2	Association Rule Mining: what is Frequent itemsets, closed itemsets, and association rules, frequent pattern mining, applications of Association Rule mining, The Apriori algorithm for finding frequent itemset using candidate generation, generating association rules from frequent itemsets .Improving effieciency of Apriori , FP- growth algorithm.	6
3	Classification and prediction: What is classification , prediction., Issues regarding Classification and prediction, Decision tree construction principle, Decision tree construction algorithms ID3, C4.5, Classification using decision tree Induction , naive bayes algorithm, KNN algorithm ,prediction using Linear regression.	7
4	**C**luster Analysis : What is cluster analysis, its applications, clustering paradigms, Partioning algorithms: K- means, K-medoids, Hierarchial clustering: Agglomerative and Divisive hierarchical clustering, Density based clustering -DBSCAN	7
5	Web Mining: Introduction, web content mining, web structure mining, web usage mining, mining multimedia data on web, page rank algorithm , web crawlers	6
6	Text mining:Text data analysis and Information retrieval, Unstructured texts, text mining approaches, text preprocessing ,episode rule discovery for texts, Hierarchy of categories, text clustering. Introduction to NLP	6

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Data Mining: Concepts and Techniques	Jiawei Han, Micheline Kamber and Jian Pei	Morgan Kaufmann Publishers

Reference Books			
SN	Title	Authors	Publisher
1	Introduction to Data Mining	Pang-Ning Tan, Michael Steinbach, Vipin Kumar,	Pearson Addison Wesley,
2	Discovering Knowledge in Data: An Introduction to Data Mining	Daniel T. Larose	Wiley
3	Data mining with R	Chapman and Hall	CRC press

VII Semester
IT2402- Data Mining Lab

Objective	Course Outcome
The student should be able to Become familiar with popular data mining tools , able to use it and perform data mining on data sets	**On completion of this course, the student will be able to** Use popular data mining tool and apply the principle algorithms and techniques used in data mining, on different types of dataset , analyze their results, interpret the results using different visualization techniques.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Use popular data mining tool and apply the principle algorithms and techniques used in data mining, on different types of dataset ,analyze their results, interpret the results using different visualization techniques.	-	2	-		3	-	-	-	-	-	-	-	-	-

List of Practical's

Sr. No.	Problem Statements
1	Introduction to R - fundamentals and basic data types, import / export data and **Preprocessing** on data set using R
2	Implementation of association rule mining in R
3	Implementation of Data Classification using Bayes classification **in R**
4	Implementation of Data Classification using decison tree **in R**
5	Implementation of Data Clustering using K-means in **R**
6	Implementation to PREDICT DATA using linear regression methods.
7	Mining text data using R
8	Data exploration and visualization
9	Develop one Application (eg sentiment analysis)

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B.Tech SoE and Syllabus 2020

(Revised Scheme of Examination w.e.f. 2021-22 onward)

Information Technology

VII Semester

IT2403 – Principles of Artificial Intelligence

Objective	Course Outcome
The student should be able to 1. Familiarity with AI and fundamental problem solving using AI 2. Understand the strengths and limitations of Various state-space search algorithms, and choose the appropriate algorithm for a problem. 3. Ability to implement and evaluate intelligent agents for representative AI problems – e.g., constraint satisfaction, automated theorem proving, etc. 4. Represent domain knowledge in propositional and first-order logic and in various knowledge represent 5. Ability to design intelligent agents for problem solving, reasoning, planning, and decision making. 6. Understand probabilistic reasoning techniques and use them to solve problems with noise, incomplete information, and uncertainty.	**On completion of this course, the student will be able to** 1. Students will able to understand basics of AI, apply and choose proper state space search algorithm for the given problem (1 & 2) 2. Students will able to make intelligent choices from among available algorithms and knowledge representation schemes subject to specific design and performance constraints. (3 & 4) 3. Students will able to solve problems with appropriate algorithms, perform its implementation and their experimental evaluation for incomplete and/or uncertain information (5 & 6)

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	Students will able to understand basics of AI, apply and choose proper state space search algorithm for the given problem	3	3	3	3	2									2
CO2	Students will able to make intelligent choices from among available algorithms and knowledge representation schemes subject to specific design and performance constraints.	3	3	3	3	2									2
CO3	Students will able to solve problems with appropriate algorithms, perform its implementation and their experimental evaluation for incomplete and/or uncertain information	3	3	3	3	2	3								2

Unit No.	Contents	Max. Hrs.
1	Introduction: -: What is AI?, History, Overview, Intelligent Agents, Performance Measure, Rationality, structure of agents, problem solving agents, Problem Formulation, searching for solutions – uniformed search	[08 Hrs.]
2	Informed (Heuristic) Search and Exploration, Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions, inventing admissible heuristic functions, Local Search algorithms, Hill-climbing, Simulated Annealing, Genetic Algorithms, Online search	[09 Hrs.]
3	Constraint Satisfaction Problems, Backtracking Search, variable and value ordering, constraint propagation, intelligent backtracking, local search for CSPs, Adversarial Search, Games, The minimax algorithm, Alpha-Beta pruning, Imperfect Real-Time Decisions, Games that include an Element of Chance	[09 Hrs.]
4	Knowledge Based Agents: Logic, Propositional Logic, Inference, Equivalence, Validity and Satisfiability, Resolution, Forward and Backward Chaining, Local search algorithms, First Order Logic, Models for first order logic, Symbols and Interpretations, Terms, Atomic sentences, complex sentences, Quantifiers, Inference in FOL, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.	[08 Hrs.]
5	Planning, Language of planning problems, planning with state-space search, forward and backward state-space search, Heuristics for state-space search, partial order planning, planning graphs, planning with propositional logic	[07 Hrs.]
6	Uncertainty, Handing uncertain knowledge, rational decisions, basics of probability, axioms of probability, inference using full joint distributions, independence, Baye's Rule and conditional independence, Bayesian networks, Semantics of Bayesian networks, Exact and Approximate inference in Bayesian Networks. Introduction to machine learning, Responsible AI, Explainable AI, Case studies of AI	[08 Hrs.]

Text Books

SN	Title	Authors	Publisher
1	Artificial Intelligence a Modern Approach	Russel and Norvig	Pearson Education
2	Introduction to Artificial Intelligence & Expert System	D.W Patterson	PHI

Reference Books

SN	Title	Authors	Publisher
1	Artificial Intelligence	E.Rich and K.Knight	McGraw-Hill
2	Principles of Artificial Intelligence	N.J Nilsson	Narosa
3	Artificial Intelligence	George F. Lugar	Pearson Education, 4th edition

VII Semester
IT2411 : PE-III - Cloud Computing

Course Learning Objective	Course Outcomes
1. To study the different Computing Systems with the comprehensive and in-depth knowledge of Cloud Computing. 2. To study the basics of Cloud Computing Concepts and Technology 3. To study the Cloud Computing architecture and its applications, Fundamental issues and Technologies. 4. To Study of Cloud application design considerations and its methodology 5. To Study basics of Cloud Computing Security mechanisms. 6. To Study applications of Hadoop and MapReduce in Cloud Computing	After After completion of the Course Students will be able to CO1: Understand the different computing paradigm, analyze and apply cloud computing services, deployment model for building cloud CO2: Apply the concepts and techniques in cloud computing CO3: Analyze the problems and apply design considerations for cloud application CO4: Provide the appropriate cloud computing solutions for building cloud application

CO	State ment	Mapped PO									PO1	PO1	PO1	PSO	PSO
		PO	PO	PO	PO	PO	PO	PO	PO	PO					
CO1															
CO2															
CO3															

Unit No.	Contents	Max. Hrs.
1	Overview of Computing Paradigm, Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing, Evolution of cloud computing, Business driver for adopting cloud computing, Introduction to Cloud Computing, Cloud Computing (NIST Model), History of Cloud Computing, Cloud service providers, Properties, Characteristics & Disadvantages of Cloud Computing, Benefits of Cloud Computing, Role of Open Standards.	[07 Hrs.]
2	Cloud Computing Architecture, Cloud computing stack, Comparison with traditional computing architecture (client/server), Services provided at various levels, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services, Service Models (XaaS), Infrastructure as a Service(IaaS), Platform as a Service(PaaS), Software as a Service(SaaS). Deployment Models, Public cloud Private cloud, Hybrid cloud, Community cloud	[08 Hrs.]

3	Virtualization Technology: Fundamental concepts of compute, storage, networking, desktop and Application virtualization. Types of Virtualization, Virtualization benefits, server virtualization, Block and file level storage virtualization, Hypervisors, Hypervisor management software, Infrastructure Requirements, Virtual LAN (VLAN) and Virtual SAN (VSAN) and their benefits.	[07 Hrs.]
4	Service Management in Cloud Computing, Service Level Agreements(SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling: Benefitting enormously, Managing Data: Looking at Data, Scalability & Cloud Services, Database & Data Stores in Cloud, Large Scale Data Processing	[07 Hrs.]
5	Cloud Security, Infrastructure Security: Network level security, Host level security, Application level security, Data security and Storage: Data privacy and security Issues, Jurisdictional issues raised by Data location, Identity & Access Management, Access Control, Trust, Reputation, Risk, Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business considerations	[07 Hrs.]
6	Case Study on Open Source & Commercial Clouds: Google App Engine, Microsoft Azure, Amazon EC2	[06 Hrs.]

Text Books

SN	Title	Authors	Publisher
1	Cloud Computing Bible	Barrie Sosinsky,	Wiley-India, 2010
2	Cloud Computing: Principles and Paradigms	Rajkumar Buyya, James Broberg, Andrzej M. Goscinski	WileY, 2011

Reference Books

SN	Title	Authors	Publisher
1	Cloud Computing: Principles, Systems and Applications,	Nikos Antonopoulos, Lee Gillam,	Springer, 2012
2	Cloud Security: A Comprehensive Guide to Secure Cloud Computing	Ronald L. Krutz, Russell Dean Vines	Wiley-India, 2010
3	"Cloud Computing"	Kumar Saurabh	Wiley Pub

VII Semester
IT2412 :PE-III - Real Time Systems

Objective	Course Outcome
The student should be able to 1) To understand the Real-time scheduling and schedulability analysis 2) To study and understand the concepts of priority driven scheduling and schedulability test. 3) To study and understand the concepts of execution of periodic, sporadic, and aperiodic jobs. 4) To understand Design methods for real-time systems , Formal specification and verification of timing constraints and properties	**On completion of this course, the student will be able to** 1) Understand the basics and importance of real-time systems and explain & address the fundamental problems of real-time systems; 2) Compare different scheduling algorithms and the schedulability criteria and Determine schedulability of a set of periodic tasks given a scheduling algorithm. 3) Develop algorithms to decide the admission criterion of sporadic jobs and the schedule of aperiodic jobs. 4) Integrate resource access mechanisms with the scheduling techniques and develop integrated schedulaibility criteria.

CO	Statement	Mapped PO												PSO	
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Understand the basics and importance of real-time systems and explain & address the fundamental problems of real-time systems	3.	2.												
CO2	Compare different scheduling algorithms and the schedulability criteria and Determine schedulability of a set of periodic tasks given a scheduling algorithm.		2.	2.											
CO3	Develop algorithms to decide the admission criterion of sporadic jobs and the schedule of aperiodic jobs.		3.	2.											
CO4	Integrate resource access mechanisms with the scheduling techniques and develop integrated schedulibility criteria		3.	3.											

Unit	Contents	Max.
1	**Introduction to real time systems:** The Concepts of Real-Time Systems, real time applications according to timing attributes. Hard and soft real time system: The Concept of Real-Time Tasks, Jobs & processors, release times, deadlines, timing constraint, Hard & Soft timing constraint, Hard real time systems, soft real time systems. Modeling of real time systems: Processors and Resources, Temporal Parameters of Real Time Work load, Periodic task Model, Precedence Constraints and Data Dependency. **Approach to real time scheduling:** Clock-driven approach, weighted round-robin approach, priority-driven approach, dynamic versus static systems, effective release times and deadlines, optimality of EDF & LST algorithms, Non-optimality of the EDF & LST, challenges in validating timing constraints in priority-driven systems, off line versus on-line scheduling.	6
2	**Clock driven scheduling:** Notations & assumptions, static timer-driven scheduler, general structure of cyclic schedules, cyclic executives, improving the average response time of a periodic jobs, scheduling sporadic jobs, practical consideration and generalizations, algorithms for constructing static schedules, pros-cons of clock-driven scheduling.	7
3	**Priority-driven scheduling:** Static assumptions, fixed-priority versus dynamics priority algorithms, Rate-Monotonic and Deadline-Monotonic Algorithms , maximum schedulable utilization of EDF Algorithm, optimality of the RM & DM algorithms	6
4	**Priority-driven scheduling:** A schedulability test for fixed priority tasks with short response times & with arbitrary response times, Critical Instants, Time Demand Analysis, sufficient schedulability conditions for the RM & DM algorithms.	7
5	**Scheduling aperiodic & sporadic jobs in priority-driven systems:** Assumptions & approaches, deferrable servers, sporadic servers, constant utilization, total bandwidth and weighted fair-queuing servers, slack stealing in dead-line driven systems, slack stealing in fixed-priority systems, scheduling of sporadic jobs.	8
6	**Resources and resource access control:** Assumption on resources and their usage, effects of resource contention & resource access control, non-preemptive critical sections, basic priority-inheritance protocol, basic priority-ceiling protocol, stack-based priority –ceiling protocol, use of priority-ceiling protocol in dynamic-priority systems, preemption-ceiling protocol, controlling accesses to multiple-unit resources, controlling concurrent accesses to data object.	8

Text Books			
Sr. N.	Title	Authors	Publisher
1	Real Time Systems	Jane W. S. Liu	Pearson education
Reference Books			
1	Real Time Systems	C.M. Krishna & Kang G. Shin	McGraw Pub.

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Information Technology

VII Semester

IT2413 :PE-III – Network Security

Objective	Course Outcome
The student should be able to 1) Understand basics of Cryptography and Network Security. 2) Secure a message over insecure channel by various means. 3) Learn about how to maintain the Confidentiality, Integrity and Availability of a data. 4) Understand various protocols for network security to protect against the threats in the networks.	**On completion of this course, the student will be able to** 1) Understand how to provide security of the data over the network. 2) Do research in the emerging areas of cryptography and network security 3) Understand how to Implement various networking protocols 4) Understand how to protect any network from the various threats in the world.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Understand how to provide security of the data over the network.	3													
CO2	Do research in the emerging areas of cryptography and network security	3	2	2											
CO3	Understand how to Implement various networking protocols	3	2	2											
CO4	Understand how to protect any network from the various threats in the world.	3	2												

Unit No.	Contents	Max. Hrs.
1	Introduction to security attacks - services and mechanism - introduction to cryptography - Conventional Encryption: Conventional encryption model - classical encryption techniques - substitution ciphers and transposition ciphers – cryptanalysis – steganography	6
2	Modern Block Ciphers: Block ciphers principals - Shannon's theory of confusion and diffusion - fiestal structure , data encryption standard(DES) , strength of DES , differential and linear crypt analysis of DES , block cipher modes of operations , triple DES	6
3	Confidentiality using conventional encryption - traffic confidentiality - key distribution - random number generation - Introduction to graph - ring ,Groups ,field - prime and relative prime numbers - modular arithmetic - Fermat's and Euler's theorem - primality testing ,Galois field,AES	6
4	Principles of public key crypto systems - RSA algorithm - security of RSA - key management – Diffle-Hellman key exchange algorithm - introductory idea of Elliptic curve cryptography – Message Authentication .Hash Function: Authentication requirements - authentication functions - message authentication code - hash functions - birthday attacks	6
5	Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME	6
6	IP Security: Architecture - Authentication header - Encapsulating security payloads - combining security associations - key management. Web Security: Secure socket layer and transport layer security - secure electronic transaction (SET) - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.	6

Text Books

SN	Title	Authors	Publisher
1	Cryptography and Network security Principles and Practices	William Stallings	Pearson/PHI.
2	Cryptography & Network Security	Behrouz A. Forouzan	McGraw-Hill

Reference Books

SN	Title	Authors	Publisher
1	Introduction to Cryptography with coding theory	Wade Trappe, Lawrence C Washington	Pearson
2	Modern Cryptography	W. Mao	Pearson Education

VII Semester
IT2414 - PE III: Information Retrieval

Objective	Course Outcome
1. To provide an overview of Information Retrieval. 2. To introduce students about insights of the several topics of Information retrieval such as – Boolean retrieval model, Vector space model, Latent semantic indexing, XML and Image retrieval model. 3. To provide comprehensive details about various evaluation methods.	**On completion of this course, the student will be able to** 1. Understand different Information retrieval models. 2. Know about evaluation methods of the information retrieval model. 3. Know the challenges associated with each topic

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO0	P11	PO 12	PSO 1	PSO 2
CO1	Understand different Information retrieval models.	**3**	**3**	**2**										**2**	
CO2	know about evaluation methods of the information retrieval model.	**3**	**3**	**3**										**2**	
CO3	know the challenges associated with each topic	**2**	**2**	**2**										**1**	

Unit No.	Contents	Max. Hrs.
1	**Introduction to Information retrieval**: Information retrieval process, Indexing, Information retrieval model, Boolean retrieval model **Dictionary and Postings:** Tokenization, Stop words, Stemming, Inverted, index, Skip pointers, Phrase queries	6
2	**Tolerant Retrieval** :Wild card queries, Permuterm index, Bigram index, Spelling correction, Edit distance, Jaccard coefficient, Soundex **Term Weighting and Vector Space Model:** Wild card queries, Permuterm index, Bigram index, Spelling correction, Edit distance, Jaccard coefficient, Soundex	6
3	**Evaluation**: Precision, Recall, F-measure, E-measure, Normalized recall, Evaluation problems **Latent Semantic Indexing**: Eigen vectors, Singular value decomposition, Low rank approximation, Problems with Lexical Semantics	6

4	**Query Expansion** :Relevance feedback, Rocchio algorithm, Probabilistic relevance feedback, Query Expansion and its types, Query drift	6
5	**Probabilistic Information Retrieval** :Probabilistic relevance feedback, Probability ranking principle, Binary Independence Model, Bayesian network for text retrieval	6
6	**XML Indexing and Search** :Data vs. Text-centric XML, Text-Centric XML retrieval, Structural terms **Web Information Retrieval:** Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS	5

Text Books

SN	Title	Authors	Publisher
1	Introduction to Information Retrieval	Christopher D. Manning, Raghavan and Schutze,	Cambridge University Press,2008

Reference Books

SN	Title	Authors	Publisher
1	Natural Language Processing And Information Retrieval	Tanveer Siddiqui and U. S. Tiwary	Oxford Higher Education,2008

VII Semester
IT2421 - PE IV: Neural Network and Fuzzy Logic

Objective	Course Outcome
The student should be able to 1. To familiarize with neural networks and learning methods for neural networks 2. To demonstrate neural network applications on real-world tasks 3. To introduce the ideas of fuzzy sets, fuzzy logic and to emphasize the need for fuzzy logic to model linguistic knowledge in human experts 4. To know fuzzy Arithmetic and inference techniques along with its applications 5. To understand fuzzy inference and reasoning to build systems based on fuzzy control and to understand of Neuro-Fuzzy Systems	**On completion of this course, the student will be able to** 1. To understand the working of Neural Networks as pattern classifier 2. Comprehend the Neural Networks as means for computational learning and to analyze the basic network architectures and algorithms 3. Effectively use existing software tools to solve real problems using a neural network approach 4. Apply the basics of fuzzy sets, its operations, fuzzy logic and fuzzy relation to model linguistic knowledge in human experts and to build systems based on fuzzy control and to understand the basics of fuzzy inference and reasoning

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C	To understand the working of Neural Networks as pattern classifier		3												
C	Comprehend the Neural Networks as means for computational learning and to analyze the basic network architectures and algorithms	2		3		3							3	2	
C	Effectively use existing software tools to solve real problems using a neural network approach	3		3		2							3		

C	Apply the basics of fuzzy sets, its operations, fuzzy logic and fuzzy relation to model linguistic knowledge in human experts and To build systems based on fuzzy control and to understand the basics of fuzzy inference and reasoning	3													
	IT2421	3	3	3		2.5							3	2	

Unit No.	Contents	Max. Hrs.
1	Neural Networks: History, overview of biological neuro-system, mathematical models of neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, Learning Tasks, Applications of Artificial Neural Networks	8
2	Feed forward and feedback networks, Single-layer perceptron classifiers, Discriminant functions, linear machine and minimum distance classification, training and classification using the discrete perception - ANN training Algorithms-Single layer perceptron, multi-layer perceptron, RDPTA algorithm	7
3	Multilayer feed forward networks, linearly non-separable pattern classification, delta learning rule, Feed forward recall and error back-propagation training, Hopfield learning algorithm, Self-organizing Map, Introduction to Deep Learning	8
4	Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.	7
5	Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations. Application of Fuzzy Logic: Medicine, Economics etc.	6
6	Fuzzy control, Fuzzy Inference Engines, Graphical Techniques of Inference, Fuzzyifications/ DeFuzzification, Fuzzy System Design and its Elements, Design options.	6

Text Books

SN	Title	Authors	Publisher
1	Introduction to the theory of Neural Computation	John Hertz, Anders Krogh, Richard Palmer	Addison Wesley
2	Fuzzy Logic with Engineering Applications	Timothy Ross	McGraw-Hill

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	Neuro-Fuzzy and Soft Computing: A computational Approach to Learning & Machine Intelligence	Roger Jang, Tsai Sun, EijiMizutani,.	PHI
2	Fuzzy sets and Fuzzy logic, Theory and Applications	George J. Klir and Bo Yuan	Prentice Hall
3	Soft Computing and Its Applications	R.A. Aliev, R.R. Aliev	World Scientific
4	Elements of Artificial Neural Networks	Kishan Mehrotra, C. K. Mohan, S. Ranka	Penram International Publishing (India)
5	Neural Networks and Fuzzy Systems	Bar Kosko	Prentice-Hall
6	Artificial Neural Network	B. Yegnanarayana	PHI
7	Neural Networks: A Comprehensive Foundation	Simon Haykin	PHI

VII Semester
IT2422- PE IV: Lab.: Neural Network and Fuzzy Logic

Objective	Course Outcome
The student should be able to	**On completion of this course, the student will be able to**
1. To familiarize with neural networks and learning methods for neural networks 2. To demonstrate neural network applications on real-world tasks 3. To introduce the ideas of fuzzy sets, fuzzy logic and to emphasize the need for fuzzy logic to model linguistic knowledge in human experts 4. To know fuzzy Arithmetic and inference techniques along with its applications 5. To understand fuzzy inference and reasoning to build systems based on fuzzy control and to understand of Neuro-Fuzzy Systems	1. To understand the working of Neural Networks as pattern classifier **2.** Comprehend the Neural Networks as means for computational learning and to analyze the basic network architectures and algorithms **3.** Effectively use existing software tools to solve real problems using a neural network approach 4. Apply the basics of fuzzy sets, its operations, fuzzy logic and fuzzy relation to model linguistic knowledge in human experts and to build systems based on fuzzy control and to understand the basics of fuzzy inference and reasoning

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	To understand the working of Neural Networks as pattern classifier		3												
CO2	Comprehend the Neural Networks as means for computational learning and to analyze the basic network architectures and algorithms	2		3		3							3	2	
CO3	Effectively use existing software tools to solve real problems using a neural network approach	3		3		2							3		

CO4	Apply the basics of fuzzy sets, its operations, fuzzy logic and fuzzy relation to model linguistic knowledge in human experts and To build systems based on fuzzy control and to understand the basics of fuzzy inference and reasoning	3													
		3	3	3		2.5							3	2	

List of Practical's

Sr. No..	Problem Statements
1	Design and Implement n-input NAND and NOR gates using Mc-Culloch Pits Model of a neuron
2	Implement A-Z character recognition using Feedforward Neural Network.
3	Implement clustering algorithm.
4	Design and Implement a linear classifier using SDPTA algorithm for a 3 input logical NAND Problem
5	Implement Back Propagation training algorithm, for any non-linear complex problem
6	Implement SOM algorithm, for any clustering problem
7	Development of fuzzy membership functions and fuzzy set properties
8	Development and verification of logic for fuzzy relations
9	Design of a fuzzy controller for the following system using fuzzy tool of Matlab
10	Application development using NN/Fuzzy logic

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Information Technology

VII Semester

IT1423 – PE IV: Ethical Hacking and Cyber Forensics

Objective	Course Outcome
The student should be able to 1) To learn foundations of Cyber Security and Ethical Hacking analysis using programming languages like python. 2) To learn various types of algorithms and its applications of Cyber Security and Ethical Hacking using forensic detection 3) To learn python toolkit for required for programming Cyber Security, Ethical Hacking concepts. 4) To understand the concepts of Cyber Security, Ethical Hacking Forensic detection image processing ,pattern recognition, and natural language processing	**On completion of this course, the student will be able to** 1) Understand, appreciate, employ, design and implement appropriate security technologies and policies to protect computers and digital information. 2) Identify & Evaluate Information Security threats and vulnerabilities in Information Systems and apply security measures to real time scenarios 3) Identify common trade-offs and compromises that are made in the design and development process of Information Systems 4) Demonstrate the use of standards and cyber laws to enhance information security in the development process and infrastructure protection.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Understand, appreciate, employ, design and implement appropriate security technologies and policies to protect computers and digital information	3	3	3	3									3	
CO2	Identify & Evaluate Information Security threats and vulnerabilities in Information Systems and apply security measures to real time scenarios	3	3	3										3	
CO3	Identify common trade-offs and compromises that are made in the design and development process of Information Systems													3	
CO4	Demonstrate the use of standards and cyber laws to enhance information security in the development process and infrastructure protection	3	3	3	3									3	

Unit No.	Contents	Max. Hrs.
1	Hacking windows – Network hacking – Web hacking – Password hacking. A study on various attacks – Input validation attacks – SQL in jection attacks – Buffer overflow attacks - Privacy attacks.	**07**
2	TCP / IP – Checksums – IP Spoofing port scanning, DNS Spoofing. Dos attacks – SYN attacks, Smurf attacks, UDP flooding, DDOS – Models Firewalls – Packet filter firewalls, Packet Inspection firewalls – Application Proxy Firewalls. Batch File Programming	**07**
3	Fundamentals of Computer Fraud – Threat concepts – Framework for predicting inside attacks – Managing the threat – Strategic Planning Process.	**06**
4	Understanding the Cyberspace Environment and Design Cyberspace environment and its characteristics, Developing a design approach, Planning for cyberspace operation Cyberspace Operational Approaches	**07**
5	Foundational approaches that utilize cyberspace Capabilities to support organizational missions, The pros and cons of the different approaches.	**07**
6	Cyberspace Operations Network Operations (NETOPS), Defensive Cyberspace Operations (DCO), Offensive Cyberspace Operations (OCO), Defense and Diversity of Depth network design, Operation al methodologies to conduct cyberspace operations	**06**

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Introduction of Cyber Warfare: A Multidisciplinary Approach	Paulo Shakarian	Elsevier 2013.
2	Inside Cyber Warfare: Mapping the Cyber Underworld	Jeffery carr	O'Reilly Publication December 2012
3	Cyber Warfare: Techniques, Tactics and Tools for Security Practitioners	Jason Andress	Syngress, Elsevier 2013.
4	Insider Computer Fraud	Kenneth C.Brancik	Publications Taylor & Francis Group 2008.
5	Ethical Hacking	Ankit Fadia	second edition Ma cmillan India Ltd, 2006

Reference Books			
SN	Title	Authors	Publisher
1	Cryptography, Network Security and Cyber Laws	Bernard Menezes, Cengage Learning	Oxford university press

VII Semester
IT2424 – PE IV: Lab: Ethical Hacking and Cyber Forensics

List of Practical's

Sr. No.	Problem Statements
1	TCP scanning using NMAP Tool
2	Port scanning using NMAP Tool
3	TCP / UDP connectivity using Netcat (networking utility)
4	Network vulnerability using OpenVAS
5	Web application testing using DVWA (Damn Vulnerable Web App (DVWA))
6	Manual SQL injection using DVWA(Damn Vulnerable Web App (DVWA))
7	XSS using DVWA (Damn Vulnerable Web App (DVWA))
8	Automated SQL injection with SqlMap

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Information Technology

VII Semester

IT2425 – PE IV: Human Computer Interaction

Objective	Course Outcome
The student should be able to 1. To study and understand interface design tools, and demonstrate the Interaction between the human and computer components 2. To study and understand the screen designing and its various concepts with design rules 3. To study and understand software tools related to HCI process. 4. To understand the interaction devices.	**On completion of this course, the student will be able to** 1. Apply the knowledge of human components for interaction with computer 2. To understand basics of Computer components functions regarding interaction with human. 3. Demonstrate Understanding of Interaction between the human and computer Components using screen designing concept. 4. To Produce Implementation supports for HCI by using various tools.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Apply the knowledge of human components for interaction with computer	3	3											3	
CO2	To understand basics of Computer components functions regarding interaction with human.	3	3											3	
CO3	Demonstrate Understanding of Interaction between the human and computer Components using screen designing concept.	3	3			3								3	
CO4	To Produce Implementation supports for HCI by using various tools.	3	3			3								3	

Unit No.	Contents	Max. Hrs.
1	Introduction: The human: Human memory, Thinking reasoning and problem solving, Individual differences, Psychology and the design of interactive systems ,Interaction and paradigms: Models of interaction, Frame work and HCI, Ergonomics, Interaction styles, Elements of the WIMP(windows, icons, pointers, menus) interface, interactivity, The context of the interaction, paradigms for interaction	**6**
2	Interaction Design: What is interaction design, Good and poor design, The process of design, User focus, Scenarios, Navigation design, Understanding the problem space, Conceptualizing the design space, Theories, models and frameworks, Screen design and layout, Interaction and prototyping	**5**
3	HCI in software process and Design rules: The software life cycle, Usability engineering, Iterative design and prototyping, Design rationale, Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns	**5**
4	Implementation supports and Evaluation techniques: Elements of windowing system, Programming application, Using toolkits, User interface management systems, What is evaluation? Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, choosing evaluation methods, analytical evaluation	**5**
5	Universal Design and User Support: Universal design principles, Multi-modal interaction, Design for diversity, Requirements of user support, Approach to user support, Adaptive help systems, Design user support systems	**6**
6	Cognitive Models and Distributed Cognition: Goal and task hierarchies, Linguistics models, The challenge of display-based system, Physical and device models, Cognitive architectures, Scientific Foundation, Description, Case Study	**6**

Text Books

SN	Title	Authors	Publisher
1	Human - Computer Interaction	Alan Dix, Janet Fincay, Gregory D. Abowd and Russell Bealg,	Pearson Education, 2003.
2.	Designing the user interface	Ben Shneiderman	Pearson Education Asia, 2004

Reference Books

SN	Title	Authors	Publisher
1	Interaction Design	Preece and Rogers, Sharp	Wiley-India, 2008.
2	The essential guide to user interface design	Wilbert O Galitz	Wiley DreamTech, 2009
3	User Interface Design	Soren Lauesen	Pearson Education, 2005.

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Information Technology

VII Semester

IT2426 – PE IV: Lab- Human Computer Interaction

Objective	Course Outcome
The student should be able to 1. To study and understand interface design tools, and demonstrate the Interaction between the human and computer components 2. To study and understand the screen designing and its various concepts with design rules 3. To study and understand software tools related to HCI process. 4. To understand the interaction devices.	**On completion of this course, the student will be able to** 1) Apply the knowledge of human components for interaction with computer 2) To understand basics of Computer components functions regarding interaction with human. 3) Demonstrate Understanding of Interaction between the human and computer Components using screen designing concept. 4) To Produce Implementation supports for HCI by using various tools.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Apply the knowledge of human components for interaction with computer	3	3											3	
CO2	To understand basics of Computer components functions regarding interaction with human.	3	3											3	
CO3	Demonstrate Understanding of Interaction between the human and computer Components using screen designing concept.	3	3			3								3	
CO4	To Produce Implementation supports for HCI by using various tools.	3	3			3								3	

List of Practical's

Sr. No.	Problem Statements
1	Study base on Exploration of Human-Computer Interaction (HCI) Applications in 1. Hospitality Industry. 2. e-Shopping System 3. e-Panchayat (e-Government Services) System 4. e-Hotel Reservation System 5. e-Banking System 6. Software Download System ,etc
2	Practical demonstration/implementation based on-Design analysis
3	Practical demonstration/implementation based on-Copy work
4	Practical demonstration/implementation based on-Fonts database
5	Practical demonstration/implementation based on-Style tiles
6	Personal project mockups-phase 1
7	Personal project mockups-phase 2
8	Personal project mockups-phase 3

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Information Technology

VII Semester

IT2427 – PE-IV- Parallel Computing

Objective	Course Outcome
1. To study different parallel processing architectures based on relationships between processing elements, instruction sequence, memory and interconnected networks. 2. To study and understand the concepts of dependence analysis. 3. To study and Understand, the concepts of shared and distributed memory programming using OpenMP and MPI. 4. Study and understand the concepts of GPU computing and heterogeneous parallel programming environments.	After completion of course students will be able to- 1. **Compare & Compute** speedup, efficiency, and scaled speedup of parallel computations. 2. **Analyze and resolve** the dependences in single, double and multi-level loops. 3. **Design and develop** parallel algorithms suited for Shared and Distributed memory models using Open-MP & MPI. 4. **Write** code using accelerator technologies of GPGPUs with CUDA for heterogeneous parallel programming environments.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**Compare & Compute** speedup, efficiency, and scaled speedup of parallel computations.	3	2												
CO2	**Analyze and resolve** the dependences in single, double and multi-level loops.	3	3												
CO3	**Design and develop** parallel algorithms suited for Shared and Distributed memory models using Open-MP & MPI.	3	2	3											2
CO4	**Write** code using accelerator technologies of GPGPUs with CUDA for heterogeneous parallel programming environments.	3	3			3									2

Unit No.	Contents	Max. Hrs.
1	**Introduction to parallel computing**: Need of ever increasing performance, building parallel systems, need to write parallel programs, Parallel hardware, Parallel Software, Coordinating the processes/threads, Shared-memory, Distributed-memory, Programming hybrid systems. **Parallel Programming Platforms:** Implicit parallelism, Limitation of Memory system performance, Dichotomy of parallel computing platforms, physical organization of parallel platforms, communication cost in parallel machines.	7
2	**Principles of Parallel Algorithm Design:** Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing. Methods for Containing Interaction Overheads Parallel Algorithm Models.	7
3	**Dependence Concepts*:*** Basic introduction of dependence in single loop and double loop, Loop-carried and Loop-independent dependences, Techniques for extraction of parallelism, index and iteration spaces and perfect loop nest, test for dependences, GCD test, Bound test.	7
4	**Shared-Memory Programming with OpenMP:** What is OpenMP, creating team of threads, OpenMP Memory model, thread synchronization, Directives, Sharing the Work among Threads in an OpenMP Program : Loop Construct, The Sections Construct , The Single Construct , Workshare Construct, Combined Parallel Work-Sharing Constructs ,Clauses to Control Parallel and Work-Sharing Constructs, OpenMP Synchronization Constructs ,Interaction with the Execution Environment, OpenMP Clauses : If Clause , Num threads Clause, Ordered Clause, Reduction Clause, Copyin Clause ,Copyprivate Clause ,Advanced OpenMP Constructs: Nested Parallelism , Flush Directive , Thread private Directive.	9
5	**Distributed-Memory Programming with MPI :** Compilation and execution, MPI programs ,MPI_Init and MPI_Finalize, Communicators: MPI_Comm_ size and MPI_ Comm_rank, MPI_Send ,MPI_Recv, Message matching, Semantics of MPI_Send and MPI_Recv, Dealing with I/O, Collective communication, MPI derived data types.	8
6	**Compute Unified Device Architecture (CUDA):** CUDA Architecture, Introduction to CUDA C, Kernel Call, Passing parameters, Querying Devices, Thread Cooperation: Splitting blocks, Shared Memory and Synchronization.	7

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Introduction to Parallel Computing	Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar,	Pearson Edn.
2	Dependence Concept	Utpal Banerjee	Intel Corp.
3	CUDA by Example: An Introduction to General-Purpose GPU Programming	Jason Sanders, Edward Kandrot	Addison-Wesley

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	Using OpenMP	Barbara Chapman, Gabriele Jost, Ruud van der Pas	MIT Press
2	An Introduction to Parallel Programming	Peter S. Pacheco , Morgan Kaufmann	MORGAN KAUFMANN ELSEVIER

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Information Technology

VII Semester

IT 2428- PE-IV- Lab : Parallel Computing

Objective	Course Outcome
1.To study and Understand, the concepts of shared and distributed memory programming using OpenMP and MPI. 2.Study and understand the concepts of GPU computing and heterogeneous parallel programming environments	1. **Design and develop** parallel algorithms suited for Shared and Distributed memory models using Open-MP & MPI. 2. **Write** code using accelerator technologies of GPGPUs with CUDA for heterogeneous parallel programming environments

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
1	**Design and develop** parallel algorithms suited for Shared and Distributed memory models using Open-MP & MPI.	**3**	**2**	**3**											**2**
2	**Write** code using accelerator technologies of GPGPUs with CUDA for heterogeneous parallel programming environments.	**3**	**3**			**3**									**2**

List of Practical's

Sr. No.	Problem Statements
1	Open-MP program based on Loop Constructs
2	Open-MP program based on Work Sharing Constructs (shared & Private clause)
3	Open-MP program based on Synchronization Constructs
4	Open-MP program based on Nested Parallelism
5	MPI Program based on basic MPI calls to exchange the data
6	MPI Program based on collective MPI calls
7	CUDA program based on threads and kernel
8	CUDA program based on shared memory synchronization & thread cooperation
9	CUDA program based on Constant Memory & Texture Memory
10	CUDA program based on Nested parallelism

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Information Technology

VII Semester

IT 2431- PE-V- Digital Image Processing

Objectives	Course Outcome
1. To introduce basic concept of Image processing in the spatial and frequency domain 2. To introduce basics of image representation and description. 3. To introduce the basics of color image processing, image segmentation and morphological operations on images 4. To learn various algorithms for image processing	**On completion of this course, the student will be able to** 1. Understand basic concepts of image processing, in the spatial and frequency domain 2. understand basics of image representation and description. 3. comprehend the basics of color image processing, image segmentation and morphological operations on images 4. understand various algorithms for image processing and apply them on given image data

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Understand basic concepts of image processing, in the spatial and frequency domain	3	2	3										1	
CO2	understand basics of image representation and description.	3	2	2										1	
CO3	comprehend the basics of color image processing, image segmentation and morphological operations on images	3	2											2	
CO4	understand various algorithms for image processing and apply them on given image data	3	2	2										2	

Unit	Contents	Hrs.
1	**Introduction**: Fundamental Steps in Image Processing, Elements of DIP systems, Elements of Visual Perception. Fundamentals of Image processing: A Simple Image Model, Sampling and Quantization, Basic Image operations: Subtraction, Averaging, multiplication, etc., Basic Relationships between Pixels	6
2	**Image Enhancement in the Spatial Domain**: Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Histogram Processing, Local Enhancement, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	7
3	**Image Enhancement in the Frequency Domain:** Introduction to the Fourier Transform, Discrete Fourier Transformation, Properties of DFT, Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering	7
4	**Image Segmentation**: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Hough transform, Thresholding Region-oriented Segmentation.	7
5	**Image Representation and description**: Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region, Description: Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors	6
6	**Basics of morphological Image Processing**, **Introduction to colour image processing**: colour models, pseudo colour image processing, introduction to image file formats: TIFF, JPEG, BMP, etc.	6

Notes: Assignments in TA should be based on Programming on Image Processing concepts learned.

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Digital Image Processing	Rafael C. Gonzalez and Richard E. Woods	Prentice Hall, 2007

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	Image Processing Principles & Applications	Tinku Acharya & Ajoy K. Ray	Willey Inter-Science, 2005

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Information Technology

VII Semester

IT2432 – PE-V: Distributed Systems

Objective	Course Outcome
The student should be able to 1) To study basic techniques in the design and development of Distributed Systems 2) To understand the concepts of Interprocess communication and Remote Procedure Calls. 3) Understanding solutions of the fundamental problems in distributed systems like mutual exclusion, deadlock detection, termination detection, leader election, fault tolerance,	**On completion of this course, the student will be able to** 1. Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement, etc. 2. Design and develop distributed programs using sockets and RPC/RMI. 3. Differentiate between different types of faults and fault handling techniques in order to implement fault tolerant systems. 4. Analyze different algorithms and techniques for the design and development of distributed systems subject to specific design and performance constrain

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement, etc.	2	3												
CO2	Design and develop distributed programs using sockets and RPC/RMI	3	2	2											
CO3	Differentiate between different types of faults and fault handling techniques in order to implement fault tolerant systems	3	2	3											
CO4	Analyze different algorithms and techniques for the design and development of distributed systems subject to specific design and performance constrain		3	3											

Unit No.	Contents	Max. Hrs.
1	**Architecture of Distributed Systems:** Characteristics of Distributed System, Motivation, challenges /Issues in the design & development of Distributed System. System Models: Architecture Model, System Architecture, Types of Architectural Model: Client server model, Search engine, Proxy server & caches, Variation on client server model: mobile code, mobile agents. Fundamental Models: Interaction model, failure model, Security model. **Distributed Objects & Distributed file system :** Inter-process communication, Sockets, middle ware, Group communication, and Remote procedure calls. CORBA, RMI, Distributed file system, Name services, Directory services, File Service types, download/upload model, File sharing semantics, session semantics, Server design: stateless & stateful server, Cache update policies.	6
2	**Theoretical Foundations:** Inherent limitations of distributed systems, Timing issues, clock synchronization, Network time protocol, Lamport's logical clocks, Vector clocks, Casual ordering of messages, Global state, Cuts of Distributed computation, Termination detection.	6
3	**Distributed Mutual Exclusion:** Leader election: Chang Robert Ring based leader election algorithm, Bully algorithm. Classification of mutual exclusion algorithms, Requirements and performance measures of mutual exclusion algorithms, Non Token Based Algorithms: Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm.Token Based Algorithms: Suzuki-Kasami's Algorithm, Raymond's Algorithm, Comparative performance analysis	6
4	**Distributed Deadlock Detection:** Resource vs Communication deadlocks, graph theoretic model, deadlock prevention, avoidance, detection, Issues in deadlock detection and resolution, Centralized deadlock detection algorithms, distributed deadlock detection algorithms	8
5	**Agreement Protocols:** Synchronous vs. asynchronous computations, model of process failures, authenticated vs. non-authenticated messages. A classification of Agreement problems, Solutions to Byzantine Agreement problem, Applicatons of Agreement algorithms.	8
6	**Failure recovery and Fault Tolerance:** Classification of failures. Backward and forward error recovery, Basic approaches of backward error recovery, recovery in concurrent systems, consistent set of checkpoints, synchronous check pointing and recovery, asynchronous check pointing and recovery. **Fault Tolerance:** Atomic actions and committing, commit protocols, non-blocking commit protocols, Voting protocols, Dynamic voting protocols, Dynamic Vote Reassignment Protocols.	7

Text Books			
SN	**Title**	**Authors**	**Publisher**
1	Advanced Concepts In Operating Systems: Distributed, Multiprocessor and Database Operating Systems	Mukesh Singhal and Niranjan G. Shivaratri	McGraw Hill
2	Distributed Operating Systems Concepts and Design	G Coulouris, Jean Dollimore, Tim Kindberg	Addison Wesley

Reference Books			
SN	**Title**	**Authors**	**Publisher**
1	Distributed Algorithms	Nancy Lynch	Morgan Kaufman
2	Modern Operating Systems	Andrew S. Tanenbaum	Pearson Education
3	Distributed Operating Systems: Concepts and Design	Pradeep K. Sinha	Prentice-Hall of India Pvt.Ltd

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Information Technology

VII Semester

IT2433– PE V: Coding Standard and Technical Documentation

Course Learning Objective	Course Outcomes
Student will able: 1. To learn various concepts of coding & documentstandards. 2. To learn basic programming elements of Javaprogramming. 3. To apply various technical documents needed in software development. 4. To write basics of report writing.	After completion of the course: 1. Students will be able to differentiate between various programming standards and styles of programming. 2. Students will be able to write efficient Java programs based on styles of Java. 3. Students will be able to differentiate between different patterns and standards of coding in Java. 4. Students will be able to prepare better manuals, case reports and software documents.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT2433.1	Students will be able to differentiate between various programming standards and styles of Programming	3.0	3.0	2.0											
IT2433.2	Students will be able to write efficient Java programs based on styles of Java	3.0	3.0		2.0	2.0									
IT2433.3	Students will be able to differentiate between different patterns and standards of coding in Java	3.0	3.0	2.0		2.0									
IT2433.4	Students will be able to prepare better manuals, case reports and software Documents	3.0				3.0									2.0
IT2433		3.0	3.0	2.0	2.0	2.3									2.0

Unit No.	Contents	Max. Hrs.
1	Introduction to general coding standards, Internal document Standards, Coding Standards: Indentation, Inline comments, procedure oriented programming, Object based programming, Structured Programming, Classes, Function, Subroutines, Methods, Source Files, and Variable Names.	5
2	Coding Guidelines: Line Length, Spacing, Wrapping Lines, Variable declarations, Program Statements, use of parentheses, Coding for efficiency vs. Coding for readability, Meaningful error messages, Reasonable sized Functions and Methods, Number of routines per File, Elements of Programming Style.	5
3	The elements of Java Style: Introduction, General Principles, Formatting Conventions, Naming Conventions: Package Names, Method Names, Constant Names. Documentation Conventions, Programming Conventions: Type safety, Statements & Expressions, Construction, Exception Handling, Assertions, Concurrency, Synchronization, Efficiency. Packaging Conventions.	6
4	Java Coding Standards: The Prime Directive: Naming conventions, Documentation, Java comments, Standards for member functions, Member function visibility, Documenting Member Functions, Techniques for writing clean code, standards for fields (Attributes/Properties), standards for local variables, Standards for parameters, Standards for classes, standards for Interfaces, standards for Packages, standards for Compilation Units (Source code file)	8
5	Introduction to Technical Writing: Prewriting, Writing & Rewriting, Objectives in technical writing, correspondence: Memos, Letters, Writing effective resumes, Visual appeal: document design, graphics, electronics communication: writing email, online help & websites, writing instructions & users manuals	8
6	Report strategies: writing research reports, feasibility reports, Lab reports, Progress reports, Writing proposals	8

Text books:

1	The elements of Programming Style	Brain W. Kernighan and P.J.Plauger	MGraw Hill
2	The elements of Java Style	Allan Vermeulen, Scoff W. Ambler, Greg Bumgardner, Eldon Metz, Trevor Misfeldt,Jim Shur, Cao Tieou	Cambridge University
3	Technical Writing Process & Product	T Sjaron J. Gerson & Steven M. Gerson	Prentice Hall

VII Semester
IT2441– PE VI: Advanced Computer Architecture

Objective	Course Outcome
The student should be able to 1) To understand the basic concept of different computer architecture and parallelism. 2) To study of different pipelining processor and its applications. 3) To understand the basic concept of array processor and SIMD. 4) To understand basic concept of Multiprogramming/Multiprocessing Architecture. 5) To study different data dependence for improvement of system performance. 6) To understand different techniques of parallelism and its extraction.	**On completion of this course, the student will be able to** 1) Analyze different computer architecture and its parallelism. 2) Apply different pipelining techniques in an application. 3) Discuss the basic concept of array processor and SIMD architecture. 4) Apply the knowledge of Multiprogramming/Multiprocessing processing for improvement of system performance. 5) Analyze different data flow dependent and it effects on parallelism. 6) Apply different parallelism techniques and its extractions to application

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Analyze different computer architecture and its parallelism.		2												2
CO2	Apply different pipelining techniques in an Application.	3													3
CO3	Discuss the basic concept of array processor and SIMD architecture.		2												2
CO4	Apply the knowledge of Multiprogramming/Multiprocessing processing for improvement of system performance.	3	3												3
CO5	Analyze different data flow dependent and it effects on parallelism	3													3

CO6	Apply different parallelism techniques and its extractions to application		2												3

Unit No.	Contents	Max. Hrs.
1	Introduction to parallel proc ıories and IO ɛm : Evolution of computer system, parallelism in uniprocessor system, parallel computer structure, architecture classification schemes, parallel processing application, Hierarchical memory structure, virtual memory system, memory allocation and , management, I/O subsystem.	10
2	Pipelining and vector processing : Pipeline, overlapped pipelining, instruction and arithmetic pipelining, pipelined processor, vector processing, vector processor, architecture of cray-1, parallel memory organization	8
3	Array Processor : SIMD array processor, (organization and inter connection networks), Parallel algorithms for array processor, SIMD matrix multiplication, parallel sorting on array processor, associative array processing, associative memory organization associative processors.	8
4	SIMD Computer and Multiprocessor Architecture : III IAC-IV System architecture and its applications, performance enhancement methods, parallel memory allocation, array processing, languages, multiprocessors, loosely and tightly coupled multiprocessor, time shared and crossbar interconnection networks, parallel memory organization, interleaved memory configuration.	8
5	Multiprocessing control and Data Flow Computers: Intercrosses communication mechanisms system deadlocks and protection parallel algorithms for multiprocessors, classifications of parallel algorithms data driven computing, data flow computer architecture.	8
6	Techniques for Extraction of parallelism.	5

Text Books

SN	Title	Authors	Publisher
1	Advanced Computer Architecture	Kai Hwang	McGraw-Hill

Reference Books

SN	Title	Authors	Publisher
1	Computer Architecture and Parallel Processing	Hwang & Briggs	Mc-Graw Hill Pub
2	"Computer Architecture :A Quantitative Approach"	John Hennessy David Patterson	Morgan Kaufmann

VII Semester

IT2442 – PE VI: Mobile Communication

Objective	Course Outcome
The student should be able to 1. Student will be able to study evolution of wireless telecom system. 2. Student will be able to study the concepts employed in wireless LAN systems and Protocol Architecture. 3. Student will be able to study the Ad Hoc networks and new trends in Mobile/wireless communication. 4. Student will be able to study the TCP and Mobile IP concepts.	**On completion of this course, the student will be able to** 1. Understand different wireless mobile architecture. 2. Understand control mechanism and Radio Interfaces. 3. Understand the concepts of Adhoc Network. 4. Understand the need and the trend toward mobility.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO	Understand different wireless mobile architecture	3	3												
CO	Understand control mechanism and Radio Interfaces.	3													
CO	Understand the concepts of Adhoc Network.	3		2											
CO	Understand the need and the trend toward mobility	3				2									

Unit No.	Contents	Max. Hrs.

1	Review of radio transmission, antennas, modulation & demodulation, Radio propagation. Concept of cellular working, Multiplexing in space, frequency time, Code division multiplexing, Spread spectrum medium access methods.	6
2	Wireless telecom Systems: Evolution, study of 2G system GSM. Network architecture, radio interface, System's internal interfaces, role of VLRs & HLRs. Handover algorithms, security, Operation Maintenance systems	6
3	3G Systems & beyond : Evolution towards 3G systems based on GSM & CDMA networks. Radio interface, system internal functioning, handover scenarios, security,	6
4	Wireless LAN systems : Medium access control mechanism in 802.11 networks. Radio interface, protocol architecture.	5
5	Mobile adhoc networks. Networking with a view of 4G Wireless Imperatives and Challenges ,Algorithms for routing & overall network function. Mobile satellite networks.	6
6	Support for mobility : Mobile IP, TCP for mobile hosts. Other developments in the TCP/IP stack for mobility support, Introduction to IoT, Introduction to 5G Technology.	5

Text Books

SN	Title	Authors	Publisher
1	Mobile Communications	J.Schiller	Pearson Education
2	Mobile and Personal Communication Systems & Services	Raj Pandya	Prentice Hall

Reference Books

SN	Title	Authors	Publisher
1	Mobile Ad Hoc Networking	Stefano Basagni,Marco Conti	Wiley India Edition

VII Semester

IT2443 – PE VI: E-commerce

Objective	Course Outcome
The student should be able to 1) To understand the scope of e-commerce in the realm of modern Business. 2) To learn the marketing methods& Business strategies used in e-commerce. 3) To know how the electronic data interchange and how to manage commerce solutions 4) Understand the security threats &electronic payment system	**On completion of this course, the student will be able to** **1.** Understand of contemporary ecommerce concepts and terminology, and the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web. 2. Analyze and understand the human, technological and business environment associated with e-commerce. 3. Define and analyze the concept of electronic data interchange and its legal, social and technical aspects. 4. Define and analyze the security issues over the web, the available solutions, future aspects of e-commerce security, concept of E-commerce and electronic payment system.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO	Understand of contemporary ecommerce concepts and terminology, and the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web.	2	2												
CO	Analyze and understand the human, technological and business environment associated with e-commerce.	3	3												
CO	Define and analyze the concept of electronic data interchange and its legal, social and technical aspects.	3	3				3								
CO	Define and analyze the security issues over the web, the available solutions, future aspects of e-commerce security, concept of E-commerce and electronic payment system	2	3				3							2	

Unit No.	Contents	Max. Hrs.
1	Internet &Introduction to Electronic Commerce: The basics of internet access, email, FTP, TELNET, Introduction to WWW: The basics of WWW & browsing working of Web Browser & Web Server, Web Browser architecture. Introduction to Electronic Commerce: The scope of Electronic Commerce, Definition of Electronic Commerce, Electronic Commerce and the Trade.	7
2	Business Strategy in an Electronic Age: The Value Chain System, Competitive Advantage, Business Strategy, Introduction to Stock-Keeping Unit (SK).	7
3	Business to Business Electronic Commerce: Inter-organisational Transactions, Electronic Markets, Electronic Data Interchange, EDI: EDI Technology, EDI Standards, EDI, Communication, EDI Implementation, EDI Security, EDI and Business, Inter-organisational e-Commerce.	8
4	Business to Consumer Electronic Commerce: Consumer Trade transactions, What you want, when you want it, internet e-commerce, Internet Shopping and the Trade cycle, Advantage and Disadvantage of Consumer e-commerce.	7
5	The Elements of e-Commerce & e-Business: Elements, e-Visibility, The e-shop, Online Payments, Delivering the Goods, After-Sales Service. e-Business: Introduction, Internet Bookshops, Software Supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the Net.	7
6	Security Threats to E-Commerce, Electronic Payment Systems (EPS).	6

Text Books

SN	Title	Authors	Publisher
1	E-Commerce	David Whiteley	McGrew Hill Pub
2.	Electronic Commerce	Gary P. Schneider & James T. Perry	Course Technology

Reference Books

SN	Title	Authors	Publisher
1	Teach Yourself Web Technologies -Part 1	Ivan Bayross	BPB Publications
2	Web Technologies TCP/IP Architecture, and Java Programming	Achyut S. Godbole and Atul Kahate	McGraw-Hill Education (India)

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VII Semester

IT2444 – PE VI: Natural Language Processing

Objective	Course Outcome
The student should be able to **1.** Know fundamental concepts and techniques of natural language processing (NLP). 2. Recognize the significance of pragmatics for natural language understanding. 3. Describe the application based on natural language processing	**On completion of this course, the student will be able to** 1. Understand approaches to syntax and semantics in NLP. 2. Understand the concepts behind n-gram models. 3. Understand approaches to POS tagging, Word sense disambiguation, summarization and information retrieval within NLP. 4. Understand machine learning techniques used in NLP, including hidden Markov models.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO	Understand approaches to syntax and semantics in NLP	**3**	**3**												
CO	Understand the concepts behind n-gram models	**3**													
CO	Understand approaches to POS tagging, Word sense disambiguation, summarization and information retrieval within NLP.	**3**		**2**											
CO	Understand machine learning techniques used in NLP, including hidden Markov models.	**3**				**2**									

Unit No.	Contents	Max. Hrs.
1	Introduction: What is Natural Language Processing, Brief history of the NLP, Stages of NLP,Applications of NLP, Challenges for NLP, Approaches to NLP .introduction to word tokenization, sentence segmentation, stemming, word normalization.	6
2	Language Models: The role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models.	6
3	Part Of Speech Tagging and Sequence Labeling: Lexical syntax. Hidden Markov Models. Morphology analysis(Indian languages),Accuracy measures.	6
4	Word net and Word sense Disambiguation: Supervised , unsupervised methods and semi supervised methods. Resource-Constraints WSD, Word embedding and phrase embedding.	5
5	Pragmatics Discourse: Coreferences, reference resolution, reference phenomenon, syntactic and semantic constraints on co reference.	6
6	Natural language Processing applications (Indian regional languages): Sentiment Analysis, Text Entailment, Robust and Scalable Machine Translation, Question Answering in Multilingual Setting.	5

Text Books

SN	Title	Authors	Publisher
1	Speech and Language processing	Daniel Jurafsky and James H. Martin (ISBN13: 978-0131873216)	Prentice Hall, 2008

Reference Books

SN	Title	Authors	Publisher
1	Natural Language Processing with Python	Steven Bird, ewan Klein, and Edward Loper	Reilly Media, 2009

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.Tech SoE and Syllabus 2020

(Revised Scheme of Examination w.e.f. 2021-22 onward)

Information Technology

VII Semester

IT2409– Mini Project

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.	On successful completion of the course students will be able to: 1. Understand the knowledge gained from the various courses undergone in earlier years. 2. Able to work in team and adapt professional ethics and practice and how to write technical documents in professional style, and to demonstrate the product/software to technical audience. 3. Able to evaluate and analyze critically evaluate and analyze different sources of data available in the literature. 4. Able to learn and to apply the knowledge of tools/Technology.
Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 **PSO** : i,ii	

The students group will be formed by the project coordinator, based on the field of interest project guides will be allotted to the groups. Students need to carry the literature survey and implementation under the guidance of their project guides. Project groups' needs to submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

VII Semester
IT2410 - Campus Recruitment Training (CRT)

COURSE OBJECTIVE	COURSE OUTCOMES
1. To get information about latest methodologies and techniques used in the field of civil engineering. 2. To understand current practices adopted in construction management.	1. An ability to prepare detail notes and reports. 2. An ability to communicate effectively. 3. An ability to implement the field knowledge to the practical applications.
Mapped Program Outcomes : 1,2,5,10,11	

Student would be required to undergo a practical training for two months during the summer vacation after 6th semester. They would submit a report about the same and also make the presentation for evaluation.

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B.Tech SoE and Syllabus 2020

(Revised Scheme of Examination w.e.f. 2021-22 onward)

Information Technology

VIII Semester

IT2451– Major Project (Semester Long Internship)

COURSE OBJECTIVES	COURSE OUTCOME
1. To apply knowledge of mathematics, science and engineering in a global, economic, environmental and societal context and engage in life-long learning. 2. To design a model, a system or components considering environmental, economic, social, political, ethical and sustainability and analyze and interpret the data. 3. To work on multidisciplinary teams, tackle engineering problems, understand professional and ethical responsibility and communicate effectively. 4. To apply knowledge of contemporary issues and use the techniques, skills, and modern engineering tools necessary for engineering practices.	On successful completion of the course students will be able to: 1. Understand the knowledge gained from the various courses undergone in earlier years. 2. Able to work in team and adapt professional ethics and practice and how to write technical documents in professional style, and to demonstrate the product/software to technical audience. 3. able to evaluate and analyze critically evaluate and analyze different sources of data available in the literature. 4. able to learn and to apply the knowledge of tools/Technology.
Mapped Program Outcomes : 1,2,3,4,5,6,7,8,9,10,11,12 **PSO** : i,ii	

The students will appear for the entrance examination of industry for Internship. After selection, students will join industry for a semester as a intern and will continue the project allotted by the industry and also will submit a project report based on their studies. Evaluation will be done continuously and viva voce conducted at the end of the semester.

VIII Semester
IT2452 - Extra-Curricular Activity Evaluation

COURSE OBJECTIVES	COURSE OUTCOME
1. To organize co-curricular activities to make competitive spirit, cooperation, leadership, diligence, punctuality, team spirits. 2. To develop creative talent, self-confidence, sense of achievement. 3. To be able to design process on environmental, social, political, ethical, health and safety. 4. To develop broad education to understand the impact of engineering solution in a global economic, environmental, society.	1. An ability to work initially as well as part of team to achieve set goals. 2. An ability to work to serve society and for betterment of society. 3. An ability to communicate with people at large.
Mapped Program Outcomes : 1,2,3,45,6,7,9,10,11	

Due credits will be given to the students based on their performance and involvement in different extra and co-curricular activities conducted within the college or by other organizations/ institutions. Due credit will also be given to the student if they are successful in different competitive examinations conducted by different organizations. The guidelines as given in academic regulations will be followed for evaluation.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

3rd to 6th Semester

(Department of Computer Science & Engineering

Computer Sciences & Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
TOTAL FIRST & SECOND SEM										47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CSE2201	Computer Architecture and Organisation	T	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	CSE2202	Object Oriented Programming	T	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	CSE2203	Lab: Object Oriented Programming	P	0	0	2	2	1		60	40	
5	3	PC	CSE2204	Data Structures I	T	3	0	0	3	3	30	20	50	3 Hours
6	3	PC	CSE2205	Lab: Data Structures I	P	0	0	2	2	1		60	40	
7	3	PC	CSE2206	Lab: Software Laboratory	P	0	0	2	2	1		60	40	
TOTAL						12	0	6	18	15				
Fourth Semster														
1	4	BS	GE2207	Discrete Mathematics & Graph Therory	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CSE2251	Operating Systems	T	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CSE2252	Lab:Operating Systems	P	0	0	2	2	1		60	40	
4	4	PC	CSE2253	Data Structures II	T	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	CSE2254	Lab: Data Structures II	P	0	0	2	2	1		60	40	
6	4	PC	CSE2255	Introduction to Data Analysis	T	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	CSE2256	Lab: Introduction to Data Analysis	P	0	0	2	2	1		60	40	
8	4	PC	CSE2257	Theory of Computation	T	4	0	0	4	4	30	20	50	3 Hours
TOTAL						16	0	6	22	19				
Audit Courses														
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT, CSE	T	2	0	0						
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	Dean (Acad. Matters)	Date of Release	Version

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamentals of Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	CSE2301	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	CSE2302	Lab: Database Management Systems	**P**	0	0	2	2	1		60	40	
4	5	PC	CSE2303	Design & Analysis of Algorithms	**T**	4	0	0	4	4	30	20	50	3 Hours
5	5	PC	CSE2304	Lab: Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
6	5	PE		Professional Elective-I	**T**	3	0	0	3	3	30	20	50	3 Hours
7	5	PE		Lab: Professional Elective-I	**P**	0	0	2	2	1		60	40	
8	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3 Hours
10	**5/6**	**STR**	**CSE2310**	**Seminar**	**P**	**0**	**0**	**0**	**0**	**1**		100		
					TOTAL	**19**	**0**	**6**	**25**	**23**				

Professional Electives -I

1	5	PE-I	CSE2311	PE I: Business Intelligence
	5	PE-I	CSE2312	PE I: Lab: Business Intelligence
2	~~5~~	PE-I	CSE2313	PE I: Web Technologies
	5	PE-I	CSE2314	PE I: Lab: Web Technologies
3	5	PE-I	CSE2315	PE I: Introduction to Geographical Information System
	5	PE-I	CSE2316	PE I: Lab: Introduction to Geographical Information System
4	5	PE-I	CSE2317	PE I: Mobile Operating System
	5	PE-I	CSE2318	PE I: Lab: Mobile Operating System

Open Electives -I

1	5	OE-I	CSE2331	OE I: Database System Essentials
2	5	OE-I	CSE2332	OE I: Introduction to Image Processing
3	5	OE-I	CSE2333	OE I: Programming with Python

Open Electives -II

1	5	OE-II	CSE2341	OE II: Software Testing for Beginners
2	5	OE-II	CSE2342	OE II: Introduction to Web Technology
3	5	OE-II	CSE2343	OE II: Introduction to Cloud Computing

Audit Courses											
1	5	HS	AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE, IIoT, AIDS, CSD, AIML	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamentals of Management	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	CSE2351	Computer Networks	**T**	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	CSE2352	Lab: Computer Networks	**P**	0	0	2	2	1		60	40	
4	6	PC	CSE2353	Compilers	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PC	CSE2354	Lab: Compilers	**P**	0	0	2	2	1		60	40	
6	6	PC	CSE2355	Software Engineering	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PC	CSE2356	Lab: Software Engineering	**P**	0	0	2	2	1		60	40	
8	6	PE		Professional Elective-II	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	PE		Lab: Professional Elective-II	**P**	0	0	2	2	1		60	40	
10	6	OE		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3 Hours
11	6	OE		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3 Hours
				TOTAL		**21**	**0**	**8**	**29**	**25**				

Professional Electives -II

1	6	PE-II	CSE2361	PE II: Digital Image Processing
	6	PE-II	CSE2362	PE II: Lab:Digital Image Processing
2	6	PE-II	CSE2363	PE II: Internet of Things
	6	PE-II	CSE2364	PE II: Lab: Internet of Things
3	6	PE-II	CSE2365	PE II: Neural Network and applications
	6	PE-II	CSE2366	PE II: Lab Neural Network and applications

Open Electives -III

1	6	OE-III	CSE2371	OE III: Database System Essentials
2	6	OE-III	CSE2372	OE III: Introduction to Image Processing
3	6	OE-III	CSE2373	OE III: Programming with Python

Open Electives -IV

1	6	OE-IV	CSE2381	OE IV: Software Testing for Beginners
2	6	OE-IV	CSE2382	OE IV: Introduction to Cloud Computing
3	6	OE-IV	CSE2383	OE IV: Introduction to Web Technology

Audit Courses											
1	6	HS	AU2130	YCCE Communication Aptitude Preparation (YCAP6.3) for CT, IT, CSE	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

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Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

3rd Semester

(Department of Computer Science & Engineering

Computer Sciences & Engineering

After 26# A.C.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
TOTAL FIRST & SECOND SEM										47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CSE2201	Computer Architecture and Organisation	T	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	CSE2202	Object Oriented Programming	T	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	CSE2203	Lab: Object Oriented Programming	P	0	0	2	2	1		60	40	
5	3	PC	CSE2204	Data Structures I	T	3	0	0	3	3	30	20	50	3 Hours
6	3	PC	CSE2205	Lab: Data Structures I	P	0	0	2	2	1		60	40	
7	3	PC	CSE2206	Lab: Software Laboratory	P	0	0	2	2	1		60	40	
TOTAL						12	0	6	18	15				
Fourth Semster														
1	4	BS	GE2207	Discrete Mathematics & Graph Therory	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CSE2251	Operating Systems	T	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CSE2252	Lab:Operating Systems	P	0	0	2	2	1		60	40	
4	4	PC	CSE2253	Data Structures II	T	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	CSE2254	Lab: Data Structures II	P	0	0	2	2	1		60	40	
6	4	PC	CSE2255	Introduction to Data Analysis	T	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	CSE2256	Lab: Introduction to Data Analysis	P	0	0	2	2	1		60	40	
8	4	PC	CSE2257	Theory of Computation	T	4	0	0	4	4	30	20	50	3 Hours
TOTAL						16	0	6	22	19				
Audit Courses														
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT, CSE	T	2	0	0						
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	Dean (Acad. Matters)	Date of Release	Version

Applicable for AY 2022-23 Onwards

III Semester

GE2201 - Engineering Mathematics III

Objectives	Outcomes
1. Able to find numerical solution of various mathematical equations 2. Give knowledge of Laplace transform, Fourier transform 3. Define the periodic functions in the form of Fourier series 4. Solve partial differential equations	The student will be able to: 1. Estimate the Calculus of Numerical Function. 2. Determine transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations. 3. Discuss the nature of periodic function and express it in terms of series. 4. Use appropriate method/s to solve partial differential equations.

Unit No.	Contents	Max. Hrs.
1	**Unit I: Finite Differences** **Difference** table; Operators E and Δ, Central differences, Factorials notation, Numerical differentiation and integration, Difference equations with constant coefficients.	6
2	**Unit II: Laplace Transform** **Laplace Transforms:** Laplace transforms and their simple properties, Unit step function, inverse of Laplace transform, convolution theorem, Applications of Laplace transform to solve ordinary differential equations	7
3	**Unit III: Z-transform** Z-Transform definition and properties (with proof), inversion by partial fraction decomposition and residue theorem, Applications of Z-transform to solve difference equations with constant coefficient.	6
4	**Unit IV: Fourier Series** Periodic Functions and their Fourier series expansion, Fourier Series for even and odd function, Change of interval, half range expansions	7
5	**Unit V: Partial Differential Equation** Partial Differential Equations of first order first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficients. Application of variable separable method to solve first and second order partial differential equations.	7
6	**Unit VI : Fourier Transform :** Definition: Fourier Integral Theorem, Fourier sine and cosine integrals, Finite Fourier sine & cosine Transform Parseval's Identity, convolution Theorem.	6

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition,2007	H.K. Dass	Publisher: S.Chand and Company Limited

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	John Wiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	John Wiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill
4	A text Book of Applied Mathematics	3rd edition, (2000)	P.N. and J.N. Wartikar	Pune Vidyarthi Griha Prakashan
5	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	Laxmi Prakashan

III Semester
CSE2201 : Computer Architecture and Organisation

Objective	Course Outcome
1. Understand basics of computer architecture, its components with peripheral devices, instruction set architecture 2. To introduce essentials of assembly language programming. 3. To introduce the students to inner working of CPU and its design based on hardwired and microprogrammed control unit 4. To deliver the knowledge of information representation within computers memory, and to know the hardware implementations of arithmetic operations on integers and floating point numbers 5. To study the function of each element of a memory hierarchy in view of its effects on overall system performance. 6. Learn the concepts of interrupts, I/o modules, DMA, and pipelining	On completion of the course, student will be able to 1. understand and demonstrate the basic computer architecture concepts related to the working of processors, memory systems, and input output systems. 2. differentiate among various addressing modes and develop ability to write assembly language programs. 3. comprehend information representation in computer and perform arithmetic operations using algorithms suitable for hardware implementation. 4. explain and compare techniques for improving the performance of a computer system components like CPU, main memory, input/output system and pipelining.

Unit No.	Contents	Max. Hrs.
1	Basic Structure of Computer Hardware and Software: Functional Units, Basic Operational Concepts, Bus Structures, Software, processor clock and basic performance evaluation, number systems, and arithmetic operations, Memory Locations, addressing and encoding of information, instruction and instruction sequencing, branching, condition codes, zero, one and two address instructions, RISC vs CISC computers.	6
2	Addressing modes, Stacks, and Subroutines, Processing Unit, Some fundamental concepts, Execution of a complete instruction, One, two, and three bus organization, Sequencing of control Signals, Assembly language programming.	6
3	Processor Design, hardwired control, Microprogrammed Control: Microinstructions, Grouping of control signals, Microprogram sequencing, Micro Instructions with next Address field, prefetching microinstructions.	7
4	Arithmetic (Fixed and Floating point): Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction, Arithmetic and Branching conditions, Multiplications of positive numbers,	7

	Signed- Operand multiplication, Booth's Algorithm , fast Multiplication, Integer Division algorithms, Floating point numbers and operations, IEEE floating point standards	
5	The Main Memory: Basic concepts, Memory Hierarchy, semiconductor RAM memories, Static RAM vs Dynamic RAM, semiconductor ROM memories, DDRAM, Memory system considerations, Speed , Size and Cost. Cache Memory: cache memory mapping techniques, secondary storage devices, HDD vs SSD, Performance Considerations.	6
6	Computer Peripherals, I/O modules and I/O Devices, I/O transfers : program controlled, memory mapped and I/o mapped I/O, Interrupt handling and Interrupt driven I/O, DMA. Pipelining: Basic Concepts, Data Hazards and Instruction Hazards. Introduction to GPU and GPU Computing.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Computer Organization	5th edition	V. Carl Hamacher, Zvonko Vranesic,	McGraw Hill Publications.
2	Computer Architecture: A Quantitative approach	6th edition	John L. Hennessy, David A. Patterson	MK series in computer architecture and design

Reference Books

SN	Title	Edition	Authors	Publisher
1	Computer Organization and Architecture	6th edition	Willaiam Staliing	Pearson Education
2	Computer Architecture & Organization	3rd edition	J.P. Hayes	McGraw Hill Publications

III Semester

CSE2202 : Object Oriented Programming

Objective	Course Outcome
Student will : 1. Learn the Concepts of Java programming language 2. Learn Java's syntax, idioms, patterns, and styles to write simple JAVA program. 3. To develop object centric thinking and to use object oriented features of JAVA to write complex programs. 4. Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development	After completion of the course students will be able to: 1. Demonstrate the understanding of Object oriented concepts. 2. Analyse problem statement and identify appropriate objects and methods for problem solving. 3. Make use of predefined classes and frameworks for reducing coding efforts and improving performance. 4. Apply features of object oriented programming to write programs to solve real world problems.

Unit No.	Contents	Max. Hrs.
1	Introduction to object oriented programming paradigm, procedure oriented programming vs OOP, features of OOP, benefits of OOP, defining class, instantiating a class. Declaring Classes and objects, Creating Classes and objects, methods, argument passing, Recursion, this keyword, constructors ,Visibility control	8
2	Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances)	7
3	Arrays, Strings Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Wrapper Classes	8
4	exception handling mechanism: Fundamentals exception types, uncaught exception, try-catch Block, displaying description of an exception, multiple catch clauses, nested try-catch statements, throw, throws, finally, built in exceptions, creating own exception subclasses. Introduction to multithreading, life cycle of Thread, Runnable interface and Thread class.	7
5	Collection Vector and Framework: Introduction to collection framework, Vectors, Array List, Linked list, Hashset, Treeset, Hashmap, Accessing a collection via Iterator, Comparators.	7
6	IO Steam: Introduction to stream classes, use of stream classes,I/O stream, bytes stream, character stream, predefined stream, reading console input, reading character, reading string, writing console output, the print write class, reading & writing files, transient and volatile modifiers, Introduction to AWT, Working with Windows, Graphics and Text, Introduction to Swings.	8

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Java Complete Reference	7th	Herbert Schildt	McGraw-Hill

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Thinking in Java	4th	Bruce Eckel	Prentice Hall
2	Programming with Java	-	E. Balagurusamy	TATA McGraw-Hill

III Semester

CSE2203: Lab: Object Oriented Programming

Sr. No.	Experiments based on
1	Implement the concept of Class and its data members and member functions in Java
2	Implement the concept of method overloading in Java
3	Implement the concept of class constructor and its type in Java
4	Implement the concept of Abstraction in Java
5	Implement the concept of all types of inheritance in Java
6	Implement the concept of arrays in Java
7	Implement the concept of run time polymorphism in Java
8	Implement the concept of Files in Java
9	Implement the concept of exception in Java
10	Implement the concept of swing to prepare a web application in Java

III Semester
CSE2204: Data Structures I

Objective	Course Outcome
1. To make students familiar with syntaxes and usages of various programming constructs of C language 2. To make student understand concept of abstract data types like stacks and queues 3. To make student understand file handling operations 4. To create thinking ability needed for implementation of programming logic with proper use of memory	1. To review programming concepts and understand fundamental concepts in data structures 2. To apply and analyse algorithms for performing operations on data structures 3. To Evaluate the performance of data structures and its applications. 4. Simulate the algorithms for performing operations on data structures.

Unit No.	Contents	Max. Hrs.
1	Types and operations, Iterative constructs and loop invariants, Quantifiers and loops, Structured programming and modular design, Illustrative examples, Scope rules, parameter passing mechanisms, recursion, program stack and function invocations including recursion	6
2	Overview of arrays and array based algorithms - searching and sorting: mergesort, quick sort, Sparse matrices.	7
3	Structures (Records) and array of structures (records). Database implementation using array of records. Dynamic memory allocation and deallocation. Dynamically allocated single and multi-dimensional arrays, polynomial representation.	7
4	Concept of an Abstract Data Type (ADT), Lists as dynamic structures, operations on lists, implementation of linked list using arrays and its operations. Introduction to linked list implementation using self-referential-structures/pointers.	6
5	Stack, Queues and its operations. Implementation of stacks and queues using both array-based and pointer-based structures. Applications of stacks and queues.	6
6	File organisation, examples of using file, file access methods , Hashing and collision resolution techniques	6

TEXT BOOKS:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures and Program Design in C	Robert Kruse, G. L. Tondo andB. Leung	latest edition	PHI-EEE
2	Fundamentals of Data Structures in C	Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed	latest edition	W. H. Freeman and Company.
3	How to Solve it by Computer	R. G. Dromey	latest edition	Pearson Education

Reference books:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures with C	Seymour Lipschutz	Latest	TMH

III Semester
CSE2205: Lab.: Data Structures I

Sr. No.	List of Experiment
1	C Programs for using various loop constructs
2	C Program for generating list
3	C Programs for illustrating recursion
4	C Programs for allocating memory dynamically for a single dimensional array and sorting it .
5	C Program for allocating memory dynamically for two-dimensional array , printing it
6	C Program to create a link list and print it.
7	C Program/s to create stack using array and link list
8	C Program/s to create Queue using array and link list
9	C Program to create file for storing , perform file operations
10	C Program on hashing

III Semester
CSE2206: Lab: Software Lab-I

Objective	Course Outcome
1. Understanding data types, data structures, control and Loop statements in Python. 2. Learn def function definitions, and modules. 3. Learn basic object-oriented concepts using Python. 4. Developing applications in Python using customized and built in modules and packages.	After learning the course, the students will be able to 1. Understand the basic data types, built in data structures, control statements and loops and write simple programs in Python 2. understand the concepts of functions, modules and packages and write complex programs using them. 3. understand defining and handling Python objects and develop classes required for the given application 4. develop a useful application in Python.

Unit No.	Contents	Max. Hrs.
1	Introduction: Build-in Data types: Data type & Variables,, Python Strings, Python built in data structures: Lists, Dictionaries, Tuples, Sets, Arrays. Datatype conversion. Statements: Assignment statement, import statement, print statement, input statement, Python Control Statements: if, if – else, statements, Loop statements: For, while, continue and break, try and except statement, raise, with statements.	4
2	Python Functions, Modules and Packages: The def statement, returning values, parameters, arguments, local variables, global variables and global statement, doc strings for functions, Mathematical Function, Generating Random numbers, File Handling.	3
3	Python Object and Classes: defining classes and creating classes, member variables, Doc strings for classes, Private members, Python Operator Overloading, Python inheritance and polymorphism, Exception Handling, Python Modules and packages.	2
4	Developing applications in Python using built in and customized modules and packages.	1

BOOKS:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1.	Learn Python Programming	Fabrizio Romano, Heinrich Kruger	Third Edition, 2020	PACKT Publishing
2.	Introduction to Computation and Programming Using Python	John V. Guttag	Second Edition,2016	PHI EEE(MIT Press)

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

4th Semester

(Department of Computer Science & Engineering

Computer Sciences & Engineering

After 26# A.C.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
TOTAL FIRST & SECOND SEM										47				
Third Semester														
1	3	BS	GE2201	Engineering Mathematics III	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CSE2201	Computer Architecture and Organisation	T	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	CSE2202	Object Oriented Programming	T	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	CSE2203	Lab: Object Oriented Programming	P	0	0	2	2	1		60	40	
5	3	PC	CSE2204	Data Structures I	T	3	0	0	3	3	30	20	50	3 Hours
6	3	PC	CSE2205	Lab: Data Structures I	P	0	0	2	2	1		60	40	
7	3	PC	CSE2206	Lab: Software Laboratory	P	0	0	2	2	1		60	40	
TOTAL						12	0	6	18	15				
Fourth Semster														
1	4	BS	GE2207	Discrete Mathematics & Graph Therory	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CSE2251	Operating Systems	T	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CSE2252	Lab:Operating Systems	P	0	0	2	2	1		60	40	
4	4	PC	CSE2253	Data Structures II	T	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	CSE2254	Lab: Data Structures II	P	0	0	2	2	1		60	40	
6	4	PC	CSE2255	Introduction to Data Analysis	T	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	CSE2256	Lab: Introduction to Data Analysis	P	0	0	2	2	1		60	40	
8	4	PC	CSE2257	Theory of Computation	T	4	0	0	4	4	30	20	50	3 Hours
TOTAL						16	0	6	22	19				
Audit Courses														
1	4	HS	GE2121	Env Studies for 4 Sem. CV,ME,EE,IT, CSE	T	2	0	0						
2	3	HS	AU2123	YCCE Communication Aptitude Preparation (YCAP3)	A	3	0	0	3	0				
3	4	HS	AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE	A	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	Dean (Acad. Matters)	Date of Release	Version

Applicable for AY 2022-23 Onwards

IV Semester

GE2207 – Discrete Mathematics & Graph Theory

Course Objectives	Course Outcome
The objective of this paper is to study mathematical , logic and set theory and their methods of solution and graph theory, group theory with simple applications	With the completion of this syllabus students will be familiar with mathematical , logic and set theory and their methods of solutions and graph theory, group theory with simple applications

Unit No.	Contents	Max. Hrs.
1	UNIT I: Mathematical Logic and Set Theory: Statement and Notation: Negation, Conjunction, Disjunction, Tautologies, Truth Tables, Basic Concepts of Set Theory, Inclusion & equality of set, Power Set, Ordered Pairs and n-tuples, Operations on Sets, Partial order, Equivalence relations, mathematical induction. Propositions, Predicate, logic, formal mathematical systems. (PO-1,2)	6
2	UNIT II: Relations and Functions: Relation and Ordering, Properties of Binary in a set, Relation Matrix and Graphs, Partition and Covering of a set, Equivalence relation, Partial ordering, Partially Ordered sets, Function (Definition and Introduction), Composition of functions, Inverse Functions, Characteristics function of a set.(PO-1)	6
3	UNIT III: Group Theory: Groups (Definitions and Examples) Subgroups and Homomorphism, Cosets and Lagrange's theorem, Normal subgroups, Codes and Group Codes. Semi groups and Monoids (definitions and examples). Homomorphism of semi groups and monoids, Sub semi groups and monoids.(PO-1)	7
4	UNIT IV: (PO-1) Rings (Definitions and Examples): Integral domain, ring homomorphism, ideas of ring polynomial, Field, Lattice.	7
5	UNIT V: Fuzzy Sets and Fuzzy Logic : Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic, fuzzy compliment, fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy relations.	6
6	UNIT VI: Graph Theory: Basic concepts of graph theory, Basic definitions, Paths and circuits, Reach ability and connectedness, Matrix Representation of graphs, Tree and their representation and operations, Rooted trees, Path lengths in rooted trees, Multi graphs and weighted graphs, and graph isomorphism, shortest paths in weighted graphs, Hypergraphs, transitive closure, Spanning trees, Kruskal's algorithm, Prim's algorithm.(PO-1,2,3)	7

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Discrete Mathematics Structure with application to Computer Science	23rd re-print, 2005	J. P. Tremblay & R. Manohar	Tata McGraw-Hills Publication Company Limited, New Delhi.
2	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	by.S.Chand and Company Limited Delhi.
3	Fuzy Logic with Engineering Applications	-	T. J. Ross,	John Wiley &Sons, Ltd. ISBN: 978-81-265-3126-4

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Discrete Mathematics	2nd edition	Lipschutz	by Schaums's Outline series,,Tata McGraw-Hills Publication Company Limited, New Delhi.
2	Discrete Mathematical structures	3rd edition,2001,	Bernard Kolman ,Robert C.Busby,Sharon Ross,	Prentice Hall of India, New Delhi.

IV Semester

CSE2251– Operating Systems

Objective	Course Outcome
1. To understand the role, components, and designing issues associated with operating systems. 2. To understand processes and threads, CPU scheduling algorithms, and process synchronization mechanisms 3. To comprehend the concepts of memory management including virtual memory. 4. To understand issues related to file system interface and implementation, and disk scheduling.	After undergoing this course student will be able to 1. Understand the fundamental concepts in Operating Systems (OS) and understand how various hardware features support OS functionality. 2. Explain various OS mechanisms and policies for managing system resources. 3. Analyse algorithms and techniques for managing various OS resources in a multiprogramming and other environments. 4. Evaluate the performance of algorithms for managing various OS resources.

Unit No.	Contents	Max. Hrs.
1	Introduction to OS: evolution of OS, basic hardware support necessary for modern operating systems, Layered Structural of OS, process concept, process state transitions , Services provided by OS, system calls, privileged instructions, Dual mode of operation, I/O bound and CPU bound processes, concept of multiprogramming and multiprocessing.	5
2	Process management: process control block, process context switch, process versus threads, CPU scheduling, goals of scheduling, CPU scheduling algorithms, Algorithmic evaluation of CPU scheduling algorithms, multi-queue scheduling, multithreading	6
3	Interprocess communication and Synchronization: Operations on processes, Interprocess communication, process cooperation and synchronization, race condition, critical region, mutual exclusion and implementation, semaphores, classic problems of Synchronization using semaphores, other synchronization constructs.	7
4	Memory management techniques: -contiguous allocation, static and dynamic partitioning, non-contiguous allocation, paging, translation look aside buffer (TLB) and overheads, segmentation.	6
5	Virtual memory: demand paging, page replacement algorithms, thrashing, working set model. Deadlocks: necessary conditions, deadlock detection, deadlock avoidance, deadlock prevention, recovery from deadlock.	7
6	File systems : introduction, Access methods, Directory Structure disk space management and space allocation strategies, disk arm scheduling strategies: FCFS, SSTF, SCAN, CSACN, LOOK, CLOOK, Selecting a disk scheduling algorithm.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Operating system Principles	9th Edition	A. Silberchatz and P.Galvin	John Wiley & Sons Inc.

		Jan 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

2	Operating Systems Internals and Design Principles	2nd	William Staling	Pearson

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Operating Systems: A Design-Oriented Approach	-	-Charles Crowley	McGraw Hill
2	Operating system concepts and Design	2nd	Milan MilenKovic	Tata McGraw Hill

IV Semester

CSE2252– Lab.: Operating Systems

Expt. No.	Name of Experiment / Problem Statement	Topic	CO Mapped
1	Study of Window task manager (Exploring various tabs: applications, processes, services, networking, performance)	Windows	CO-1
2	Study of Advanced Linux shell commands (Process management, Memory management, Networking, etc.)	Linux Commands	CO-1
3	Write a program that illustrates the creation of child process using fork system call. Each child and parent Processes perform different task.	Process Control	CO-1
4	Write a multithreaded program to multiply two given matrices.	Threads	CO-1
5	Simulate a) any preemptive CPU Scheduling Algorithm b) any Non-preemptive CPU Scheduling Algorithm	CPU Scheduling	CO-4
6	Write a program to perform Inter-Process-Communication using shared memory or, pipes or message queues.	Inter-Process Communication	CO-4
7	Write a program that solves two process Producer - Consumer problem with bounded buffer using semaphores. OR Write a program that gives a deadlock and starvation free solution to the Dining philosophers problem using semaphores	Semaphore	CO-4
8	Simulate a) First Fit (Static Memory allocation algorithm) and b) Worst Fit (Dynamic Memory allocation algorithm)	Memory Allocation algorithms	CO-4
9	Simulate any one of the following Page replacement algorithms: FIFO, LRU, Optimal	Page Replacement Algorithms	CO-4
10	Write a program to simulate Banker's Deadlock avoidance algorithm.	Deadlock	CO-4

IV Semester
CSE2253 – Data Structures II

Objective	Course Outcome
1. To get overview of fundamental data structures and their application 2. To explore different operations performed on various data structures 3. Understand practical implementation of different types of data structures 4. Comprehend working of advanced data structures like list, disjoint set, multidimensional trees 5. Compare different data structures	1. Create and manipulate various data structures like linked list, disjoint sets, trees, graph for real world problem 2. Apply appropriate data structure for implementation of real world applications 3. Analyze the performance of operations performed on data structures. 4. Design application by using data structures for real world problems.

Unit No.	Contents	Max. Hrs.
1	**Linked Lists**- Singly-linked lists, doubly linked lists and circular linked lists. Operations on linked list: traversal, addition, deletion of nodes, list reversal, Applications of lists in polynomial representation, multi-precision arithmetic. Multi linked structures, implementation of priority queues.	8
2	**Sets**: data structures for disjoint set representation and operations, sorting, searching	6
3	**Binary Trees:** binary trees, binary trees- basic algorithms and various traversals. Binary Search Trees (BSTs) and insertion, deletion in BSTs. Heaps and heap sort	8
4	**Balanced trees**: Height-balanced (AVL) trees, Splay tree, Red-black trees, Multi-way trees-B and B+ and applications	8
5	**Multidimensional trees :**Tries and Pattern matching algorithms	6
6	**Graphs Representation & traversals**: Spanning trees, topological sort, shortest path algorithm, all-pairs shortest paths	6

TEXT BOOKS:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures and Program Design in C	Robert Kruse, G. L. Tondo andB. Leung	latest edition	PHI-EEE
2	Fundamentals of Data Structures in C	Ellis Horowitz, Satraj Sahni and Susan Anderson-Freed	latest edition	W. H. Freeman and Company.
3	How to Solve it by Compute	R. G. Dromey	latest edition	Pearson Education

Reference books:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures with C	Seymour Lipschutz	Latest	TMH

IV Semester
CSE2254 – Lab.: Data Structures II

Sr. No.	List of Experiment
1	Program/s based on operations on singly linked list
2	Program/s based on operations on doubly linked list
3	Program based on Binary trees- traversal
4	Programs based on Binary search tree
5	Programs based on Tries
6	Program based on Balanced trees
7	programs based on Graph operations - traversal

IV Semester
CSE2255 – Introduction to Data Analysis

Course Learning Objectives	Course Outcomes
1. To introduce the basic statistical formulae and visualization techniques 2. To comprehend the concepts of probability and probability distribution 3. To understand the concepts of sampling, sampling distribution and estimation 4. To understand the concept of hypothesis testing	Upon successful completion of the course students will be able to: 1. Apply fundamental concepts of statistics and probability for data analysis(PO1-3) 2. Apply appropriate statistical methods on simple datasets(PO2-3) 3. Formulate and solve problems in a systematic manner. (PO2-3) 4. Conduct investigation and Interpret output obtained from statistical analysis on datasets (PO4-3) 5. Obtain hands on experience with some popular software (like R)for analysis and visualization of data(PO4-3,PO5-3)

Unit No.	Contents	Max. Hrs.
1	INTRODUCTION TO STATISTICS & PROBABILITY: The role of statistics. Grouping and displaying data. Measures of central tendency and dispersion, Basic terminology in probability, probability rules, Probabilities under conditions of statistical independence, probabilities under conditions of statistical dependence.	6
2	PROBABILITY DISTRIBUTION: What is probability distribution, random variables, use of expected value in decision making, and various probability distributions :Binomial, Poisson, Uniform and Normal distributions.	6
3	SAMPLING DISTRIBUTION: Introduction to sampling distributions, sampling distribution of mean and proportion, application of central limit theorem, sampling techniques. ESTIMATION THEORY: Estimation: Point and Interval estimates ,confidence intervals ,calculating interval estimates for population parameters of large sample and small samples, determining the sample size	7
4	TESTING OF HYPOTHESIS: Introduction, null hypothesis, tests of hypothesis and significance, type I and type II errors, one tailed and two tailed tests, p-value one sample tests for means and proportions of large samples (z-test), one sample tests for means of small samples (t-test), Chi-square tests for goodness of fit. Analysis of variance.	7
5	NON-PARAMETRIC METHODS: Sign test for paired data. Rank sum test. Mann –Whitney U test and Kruskal Wallis H test. One sample run test, rank correlation. Kolmogorov-Smirnov –test.	6
6	REGRESSION and CORRELATION: Estimation of regression line by least square method, linear regressions, Multivariate regression ,Correlation analysis,	6

Text Books:

Sr. No.	Title	Author	Edition	Publisher
1	Introduction to probability and statistics for engineers and scientist	Sheldon M. Ross	3rd Edition	Elsevier
2	Statistics for Management	Richard I. Levin & David S. Rubin	7th Edition	Pearson Education
3	Probability and Statistics	Murray R. Spiegel, John J.Schiller, R AluSrinivasan	Third edition .	Mc Graw Hill education

Reference Book:

Sr. No.	Title	Author	Edition	Publisher
1	Practical Statistics for Data Scientists, 50 Essential Concepts.	Peter Bruce & Andrew Bruce		
2	An Introduction to Statistical Learning with Applications in R	Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani		

IV Semester

CSE2256– Lab: Introduction to Data Analysis

Sr. No.	List of Experiment
1.	Implement basic functionality of R
2.	Implement data import and export functionality in R
3.	Implement R functions to calculate basic statistics of data source
4.	Apply the visualization techniques in R to understand data
5.	Solve the problems using probability distributions in R
6.	Analyze the data using sampling technique
7.	Analyze the data to find out estimated value
8.	Analyze the data using hypothesis testing
9.	Implement integration of R and java using packages
10.	Case study on data analysis and visualization

IV Semester

CSE2257– Theory of Computation

Objective	Course Outcome
1. To understand the basic properties of formal languages and Finite Automata, regular expression and Regular Grammar. 2. To study of different types of grammars and the properties of Context Free Grammar 3. To understand the basic properties of CFL and Designing of Push Down Automata 4. To understand the basic properties of Turing machine and study of Recursive Language, undecidability, post Correspondence problem and Recursive enumerable language	1. Apply basic properties of formal languages and to design finite automata for regular expression and Regular Grammar. 2. Construct context free grammar for various languages. 3. Solve various problems of push down automata for context free language 4. Design Turing Machines for given any computational problem.

Unit No.	Contents	Max. Hrs.
1	Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Design of Finite State Machines, Acceptance of strings and languages, Non Deterministic Finite Automation, Deterministic Finite Automation, Equivalence between NFA and DFA, NFA with ε-transition, Minimization of FA.	8
2	Regular Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets, Regular grammars, Right linear and left linear regular grammars, inter-conversion between LLG & RLG, Equivalence between regular grammar and F.A., Inter-conversion between RE and RG.	7
3	Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal form, Greibach normal form.	7
4	Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Inter-conversion, Closure of properties of CFL, DPDA & NDPDA.	6
5	Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Church‟s hypothesis, Chomsky hierarchy of language, Linear bounded automata and context sensitive language, Universal Turing Machine	6
6	Un-decidability Problems related to Recursive enumerable language and Turing Machine, post correspondence problem. Recursive function Theory –Basis functions and operations on them. Bounded minimization preemptive μ recursive function unbounded minimization and recursive function	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Automata Theory, Languages, and computation	3rd Edition	Hopcroft J.E., Rajeev Motwani, Jeffrey D. Ullman	Pearson Education
2	Introduction to languages and the Theory of Computation	3rd Edition	John C.Martin	Mc Graw Hill

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to the Theory of Computation	2nd Edition	Michael Sipser	GALE CENGAGE Learning
2	Theory of Computation	1st Edition	Dr. O. G. Kakde	Laxmi Publication

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Bachelor of Technology

SoE & Syllabus 2021

5th Semester

(Department of Computer Science & Engineering

Computer Sciences & Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester														
1	5	HS	GE2312	Fundamentals of Economics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	CSE2301	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	CSE2302	Lab: Database Management Systems	**P**	0	0	2	2	1		60	40	
4	5	PC	CSE2303	Design & Analysis of Algorithms	**T**	4	0	0	4	4	30	20	50	3 Hours
5	5	PC	CSE2304	Lab: Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
6	5	PE		Professional Elective-I	**T**	3	0	0	3	3	30	20	50	3 Hours
7	5	PE		Lab: Professional Elective-I	**P**	0	0	2	2	1		60	40	
8	5	OE		Open Elective - I *	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5	OE		Open Elective - II *	**T**	3	0	0	3	3	30	20	50	3 Hours
10	**5/6**	**STR**	**CSE2310**	**Seminar**	**P**	**0**	**0**	**0**	**0**	**1**		100		
					TOTAL	**19**	**0**	**6**	**25**	**23**				

Professional Electives -I

1	5	PE-I	CSE2311	PE I: Business Intelligence
	5	PE-I	CSE2312	PE I: Lab: Business Intelligence
2	~~5~~	PE-I	CSE2313	PE I: Web Technologies
	5	PE-I	CSE2314	PE I: Lab: Web Technologies
3	5	PE-I	CSE2315	PE I: Introduction to Geographical Information System
	5	PE-I	CSE2316	PE I: Lab: Introduction to Geographical Information System
4	5	PE-I	CSE2317	PE I: Mobile Operating System
	5	PE-I	CSE2318	PE I: Lab: Mobile Operating System

Open Electives -I

1	5	OE-I	CSE2331	OE I: Database System Essentials
2	5	OE-I	CSE2332	OE I: Introduction to Image Processing
3	5	OE-I	CSE2333	OE I: Programming with Python

Open Electives -II

1	5	OE-II	CSE2341	OE II: Software Testing for Beginners
2	5	OE-II	CSE2342	OE II: Introduction to Web Technology
3	5	OE-II	CSE2343	OE II: Introduction to Cloud Computing

Audit Courses											
1	5	HS	AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE, IIoT, AIDS, CSD, AIML	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

V Semester

GE2312 Fundamentals of Economics

Objective	Course Outcome
1. Recognizes consumer's behaviour and pricing. 2. Extrapolates an operations in market with productions constrain. 3. Describes the national income accounting and public finance. 4. Interprets international trade and institutions.	Upon successful completion of the course, the student will be able to: 1. Discover the fundamental concept of Economics 2. Interpret the concept of micro -economics. 3. Generalize the ideas of macroeconomics. 4. Describe national and international trade

Unit No.	Contents	Max. Hrs.
1	**Introduction to Economics and Consumers' Behaviours:** Definitions, meaning and importance of economics Utility analysis: concept and measurement (cardinal and ordinal), Law of diminishing marginal utility, exceptions to law of diminishing marginal utility, law of equi-marginal utility, Indifference curve analysis: Meaning and properties of indifference curve, marginal rate of substitution, budget constraint, Complement and substitute goods, Consumer's equilibrium. Demand Analysis: Meaning and determinants of demand, law of demand, exception to law of demand, Elasticity of Demand-price, cross and income elasticity, measurement of elasticity of demand.	8
2	**Production and Costs:** Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Importance of Capital in production process. Entrepreneur and Innovations, Product and Process innovations, Concepts and types of costs: Fixed vs variable, total, average and marginal costs, Short run and long run cost curves. Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Depreciation: Meaning and various method of calculating depreciation	6
3	**Market structures - equilibrium output and price:** Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination - Degrees and conditions of discrimination.	7
4	**National income accounting:** Concepts of GDP and GNP, Estimation of GDP and GDP at factor and market prices, at constant and current prices, difference between GDP and NDP, GNP and NNP, per capita income as a measure of economic well-being, concepts of economic growth and development, Factors affecting economic growth and development. Capital formation and accumulation.	5
5	**Money, Banking and Public Finance** Money: definition, functions and role, Evolution of money, Banking-reserve ratios and credit creation by commercial banks, Functions of a central bank and instruments of credit control, Functions of money market. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation. Sources of public revenue and forms of government expenditure, Taxation: Cannons of taxation. Classification of taxes-Direct (Income tax, Wealth tax, Corporation tax, tax on capital, capital gains, etc) and Indirect Taxes (GST, Import duties), Revenue and capital expenditure.	7

6	**International Trade and Institutions:** Definitions of closed vs. open economy, small open economy, Concept of exchange rate- Fixed, flexible and managed, Role of Multilateral institutions, viz., IMF, World Bank, WTO (GATT) in promoting, Trade, growth and international financial transactions.	5

Text Books

SN	Title	Edition	Authors	Publisher
1	Modern Economics	13th Edition	H. L. Ahuja	S. Chand Publisher
2	Modern Economic Theory	3rd Edition	K. K. Devett	S. Chand Publisher

Reference Books

SN	Title	Edition	Authors	Publisher
1	Advance Economic Theory	17th Edition	H. L. Ahuja	S. Chand Publisher
2	International Trade	12th Edition	M. L. Zingan	Vindra Publication
3	Macro Economics	11th Edition	M. L. Zingan	Vindra Publication
4	Monitory Economics	1th Edition	M. L. Zingan	Himalaya Publisher
5	Economics of Development and Planning	12th Edition	S. K. Misra and V. K. Puri	Himalaya Publishing House
6	Economics		Samuelson	

V Semester

CSE2301– Database Management Systems

Objective	Course Outcome
1. To learn different database system concepts 2. To learn the designing of Entity Relationship Diagram. 3. To know relational data model, relational algebra & SQL Queries. 4. To understand relational database design. To know about data integrity issues	Upon successful completion of the course, the student will be able to: 1. Analyze & compare different levels of abstraction & data independence. 2 .Design Entity Relationship Diagram for any scenario. 3. Solve queries based on relational algebra & SQL. 4. Identify functional dependencies & normalize the database and apply ACID properties. 5. Analyze transaction management, various concurrency control protocols and crash recovery methods.

Unit No.	Contents	Max. Hrs.
1	**Introduction to Database Management System:** General File System and Database system Concepts and Architecture, Data Models, Schemas and Instances, Abstraction & Different Levels of Data Abstraction, Data Independence: Logical & Physical Independence.	5
2	**Entity-Relationship Model**: Entities and Entity Sets, Relationships and Relationship Sets, Attributes, Mapping Constraints, Keys, Entity Relationship Diagram, Reducing E-R Diagrams to Tables, Generalization, Aggregation, Design of an E-R Database Scheme	5
3	**SQL:** Data definition language (DDL), Data Manipulation Language (DML), Basic structure of SQL Queries, Set operations, Null Values, Nested subqueries, views, modification of database, transaction, Joins. **Advanced SQL:** SQL data types & schemas, Integrity Constraints, Domain Constraints, Assertions, triggers, Advanced SQL Features.	6
4	**Relational Data Model**: Structure of Relational Databases, **Relational Database Design**: Pitfalls in Relational Database Design, Functional Dependencies, Normalization using Functional Dependencies, Alternative Approaches to Database design. **Relational Algebra**: Structure of relational databases, Fundamental Relational-Algebra Operations, Additional relational algebra operations, extended relational algebra operations, modification of the databases	7
5	**Data Storage and Querying:** Storage and File Structure, Indexing and Hashing, Query Processing, query-evaluation. **Transaction Management**: ACID Properties, Implementation of ACID Properties, Database processes to support ACID Properties, Schedules, and Testing of Serializability.	7
6	**Concurrency Control**: Lock-based Protocols, Timestamp Based Protocols, Validation Techniques, Multiple Granularity, Multi version Timestamp Protocol, Transaction isolation levels, Read consistency. **Crash Recovery**: Failure Classification, Log Based Recovery, Buffer Management, Checkpoints, Shadow Paging.	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Database System Concepts	latest	Korth, Silberschatz, sudarshan	McGraw-Hill publication
2	Fundamentals of Database Systems	latest	Elmasri, Navathe & Gupta	Pearson Education.

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	SQL & PL / SQL for Oracle 11g Black Book Kindle Edition	3rd Edition	Dr. P.S. Deshpande	Dreamtech Press
2	Database Systems	3rd Edition	Connolly, Begg	Pearson Education
3	Database Systems	6th Edition	S. K. Singh,	Pearson Education

V Semester
CSE2302– Lab.: Database Management Systems

Sr. No.	List of Experiment
1	Creating a schema -To implement different basic Data Definition Language (DDL) & Data Manipulation Language(DML) Commands in SQL.
2	To design an ER Diagram.
3	Answer each of the following questions. The questions are based on the following relational schema: Emp(*eid:* integer, *ename:* string, *age:* integer, *salary:* real) Works(*eid:* integer, *did:* integer, *pcttime:* integer) Dept(*did:* integer, *dname:* string, *budget:* real, *managerid:* integer) a. Give an example of a foreign key constraint that involves the Dept relation. What are the options for enforcing this constraint when a user attempts to delete a Dept tuple? b. Write the SQL statements required to create the preceding relations, including appropriate versions of all primary and foreign key integrity constraints. c. Define the Dept relation in SQL so that every department is guaranteed to have a manager. d. Write an SQL statement to add John Doe as an employee with *eid* = 101, *age* = 32 and *salary* = 15, 000. e. Write an SQL statement to give every employee a 10 percent raise. f. Write an SQL statement to delete the Toy department.
4	Given a schema , apply BETWEEN…AND, NOT BETWEEN, IN, NOT IN, IS NULL, IS NOT NULL clause on created database.
5	Given a schema , implement aggregate function & grouping commands.
6	Given a schema , implement basic set operations in SQL
7	Write the following queries in SQL for the following schema. Suppliers(sid: integer, sname: string, address: string) Parts(pid: integer, pname: string, color: string) Catalog(sid: integer, pid: integer, cost: real) 1. Find the pnames of parts for which there is some supplier. 2. Find the snames of suppliers who supply every part. 3. Find the snames of suppliers who supply every red part.

	4. Find the pnames of parts supplied by Acme Widget Suppliers and by no one else. 5. Find the sids of suppliers who supply a red part and a green part. 6. Find the sids of suppliers who charge more for some part than the average cost of that part (averaged over all the suppliers who supply that part). 7. For each part, find the sname of the supplier who charges the most for that part. 8. Find the sids of suppliers who supply only red parts.
8	To create and manipulate various database object of table using views.
9	To implement Transaction Control Language (TCL) commands.
10	To display file database connectivity using JDBC.
11	Write a program in PL/SQL to check given number is even or odd

V Semester

CSE2303 - Design & Analysis of Algorithms

Objective	Course Outcome
1. To introduce basic algorithmic techniques, time requirements of an algorithm and mathematical techniques used in analysis of algorithms 2. Learn analysis of algorithms for a wide variety of foundational problems occurring in computer science applications with discussions on complexity and NP-completeness.	After completion of the course, student will be able to: **CO1 :** Remember the concepts of algorithms, **CO2 :** Understand time requirements of an algorithm and mathematical techniques used in analysis of algorithms. **CO3 :** Analyze the Complexities of different algorithms for a wide variety of foundational problems occurring in computer science applications. **CO4 :** Apply the knowledge of different algorithms with discussions on complexity. **CO5 :** Evaluate the knowledge of algorithms with Complexity and NP-completeness.

Unit No.	Contents	Max. Hrs.
1	Mathematical foundations, summation of arithmetic and geometric series, Σn, Σn2, bound summations using integration, Analysis of algorithms, analyzing control structures, worst case and average case analysis, Asymptotic notations, Analysis of sorting algorithms such as selection sort, insertion sort, bubble sort, heap sort, external Sorting, lower bound proof.	6
2	Recursive functions and recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions, elementary and advanced data structures with operations on them and their time complexity, Amortized analysis.	7
3	Divide and conquer basic strategy, binary search, quick sort, merge sort, Fast Fourier Transform etc. Greedy method –basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.	7
4	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem, Matrix Chain Multiplication, Longest Common Subsequent.	6
5	Basic Traversal and Search Techniques, breadth first search, connected components, Backtracking basic strategy, 8 – Queen‟s problem, graph colouring, Hamiltonian cycles etc.	6
6	NP-hard and NP-complete problems basic concepts, non-deterministic algorithms, NP-hard and NP- complete, Cook‟s Theorem, decision and optimization problems, polynomial reduction.	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Algorithm Design,	Latest edition	Klienberg and Tardos	Pearson
2	Computer Algorithms	Third	Horowitz, Sahani, Rajsekharan	Galgotia Publications Pvt. Ltd.
3	Introduction to Algorithms	Third	Thomas H. Cormen	Prentice Hall of India.

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Algorithms	Second	Brassard and Bratley	Prentice Hall

V Semester

CSE2304 – Lab.: Design & Analysis of Algorithms

Sr. No.	List of Experiment
1	To Compute and Analyze its time complexity of various sorting algorithm. • Bubble sort • Insertion sort • Selection Sort
2	To implement and compute time complexity of given problem using Divide and Conquer algorithm. • Merge sort • Quick sort • Binary Search
3	To implement and compute time complexity of Job sequencing problem using Greedy Method for different number of inputs.
4	To implement and compute time complexity of Knapsack Problem using Greedy Method for different number of inputs.
5	To implement and compute time complexity of Dijikstra Problem using Greedy programming for different number of inputs.
6	To implement the given problem using minimum cost spanning trees. • Kruskal Algorithm • Prim Algorithm
7	To implement and compute time complexity of All Pair Shortest Path using dynamic programming for different number of inputs.
8	To implement and compute time complexity of Travelling Salesman Problem using dynamic programming for different number of inputs.
9	To implement and compute time complexity of 8 Queens's problem using backtracking for different number of inputs.
10	To implement and compute time complexity of Graph coloring problem using backtracking for different number of inputs.

V Semester

CSE2311 – PE I: Business Intelligence

Objective	Course Outcome
Student will : 1. Understand the business relevance and technical basics of business intelligence (BI), knowledge management (KM), and decision support and describe how OLAP is different from OLTP. 2. Appreciate the use of SQL for BI 3. Understand principles of dimensional modeling. 4. Understand Business intelligence system architecture, its building blocks, life cycle of a typical BI project 5. Get acquainted to popular BI tool for getting insight into the business data.	After completion of the course Students will be able to : ➢ Assemble BI as a Process, identify its application in various domains and functional area, its roles and responsibilities. ➢ Identify functions of building blocks in N_tier BI ecosystem ➢ Identify different stages in Lifecycle of a BI project. ➢ Differentiate between traditional BI and self-service BI (PO1-2) 1. Apply SQL as a universal language for BI (PO2-3) 2. Model a business scenario; identify the metrics, indicators, various dimensions, and aggregation strategies and make recommendations to achieve the business goal (PO3-3) 4.Obtain hands on experience with some popular BI software for analysis, reporting, visualization of results (PO1-2, PO2-2,PO3-2,PO5-3)

Unit No.	Contents	Max. Hrs.
1	Introduction to Business Intelligence : What is business intelligence, why do we need BI, EIS,MIS,DSS& BI, information pyramid-data, information, Knowledge & intelligence. Basis For operational, tactical & strategic decision making , OLTP vs. OLAP, Requirement gathering in BI through business question BI in various domains and functional area	8
2	SQL the universal language for Business Intelligence :Introduction to RDBMS, Language for retrieving data from a database,various clauses in a SQL retrieving data from multiple tables- joins filtering, sorting & grouping datasets, Introduction to DDL & DML statements, various built- in functions in SQL,Use of sub- queries,data dictionary and dynamic SQL.	7
3	Principles of Dimensional modeling: Foundation for fact based decision making, star and snowflake schema, Pros& cons of the star/snowflake schema dimensional model, Slowly changing dimension tables, Fact-less fact strategy, Time dimension.	7

4	Business Intelligence system architecture: Need for enterprise class business intelligence infrastructure, The BI ecosystem, Building blocks of a n- tier BI system-servers & communication protocols ,The central repository-metadata, Information consumption user interfaces-desktop vs. web vs. Mobile. Open architecture, Scalability, performance in BI-in memory analytics.	6
5	BI Project Lifecycle :Typical BI project lifecycle, Requirements gathering & analysis-functional & non- functional requirements, reports and dashboards design- mock – up and storyboarding, Testing in a BI project, BI project deployment, Post production support, Applications of BI, BI best practices	6
6	Self-service Analytics : What is Self-service Analytics, What are the use cases of self-service analytics, Business Paradigm vs IT paradigm and the Paradigm Shift with self-service analytics, Challenges of Self-service Analytics. Introduction to MicroStrategy Desktop – Overview	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Data Warehousing ETL toolkit, Indian edition.	Latest	Ralph Kimball and Margy Ross	wiley
2	Fundamentals of Business Analytics	Latest	R.N.Prasad, Seema Acharya	wiley
3	Business Intelligence: The Savvy Manager's Guide	Latest	David Loshin	

Reference Books

SN	Title	Edition	Authors	Publisher
1	Data Warehousing in the real world A practical guide for building Decision Support System		Sam Anahory, Dennis Murray,	PEARSON

V Semester

CSE2312 – PE I: Lab: Business Intelligence

Sr. No.	Name of Practical
1	Exploring HR schema of Oracle, Implementation of queries based on range, relational operators, sorting, and concatenation.
2	Implementation of queries based on character matching, aggregate functions, set operations
3	Implementation of queries based on Joins (joining 2 or more tables), sub queries.
4	a. Design a multidimensional data cube for given data Using EXCEL b. Perform OLAP- slicing operation on it
5	Creation Of Dashboard Using EXCEL
6	Exploring Tableau OR/ MICROSTRATEGY ANALYTIC DESKTOP (MSTR) : Installation tool,Importing Data from file, Data Wrangling (Editing Data).
7	Visualization Of Data Using different visualizations in Tableau/ MSTR analytic desktop, Filtering data, and delivering Insights from data
8	Create reports and Dashboard with defined insights /requirements in Tableau/MSTR analytic desktop. (Sample Data to be provided)

V Semester

CSE2313 – PE I: Web Technologies

Objective	Course Outcome
1. To learn basic aspects of Web services, Server side scripting, Advanced CSS 2. To introduce with AJAX 3. To learn Basics of Advanced Client side programming 4. To learn JavaScript	On completion of this course, the student will be able to 1. Design Web pages using HTML. 2. Build an interactive website with CSS3 3. Develop basic programming skills using JavaScript 4. Use features of Client side programming

Unit No.	Contents	Max. Hrs.
1	**Web Essentials**: Clients, Servers, and Communication, Overview of Internet, Intranet, Basic Internet Protocols (HTTP, FTP, SMTP), WWW, HTTP: HTTP Request and Response message, Client Side Scripting, Server Side Scripting.	**6 Hours**
2	**Hyper Text Markup Language (HTML5):** Structure of an HTML Program, Basic HTML Tags (Headings, Paragraph, Division, Text formatting, Image element, Anchors), HTML Lists (Ordered Lists, Unordered Lists, Description Lists), HTML Links (Href Attribute, Target Attribute), HTML colors, Table handling in HTML, HTML Layout Elements (Semantic Elements), HTML Style Attribute, HTML class and id Attribute, HTML Forms, HTML Media(video, audio, YouTube).	**6 Hours**
3	**Cascading Style Sheets (CSS3):** Introduction to CSS3, Differences between CSS3 and earlier CSS specifications, Inserting CSS: Inline, Internal, External, CSS3 selectors, CSS3- Colors, Backgrounds, Borders, Text, Font, List, CSS3 Box Model, CSS3 Navigation Bar (Vertical, Horizontal), Media Queries, Basics of Responsive Web Designs, Introduction to Bootstrap.	**6 Hours**
4	**Client Side Scripting with JavaScript:** Introduction to JavaScript, Variables and Data Types, Operators and Expressions in JavaScript, Functions In JavaScript, Arrays, Loops and control statement, RegExp, Dialog Boxes, JavaScript Events. Event Handling and Form Validation, Error Handling, Handling Cookies, XML, JSON. Introduction to Web Frameworks- React JS, Angular JS.	**6 Hours**
5	**Advanced Client side programming**: WebSockets, Server-Sent Event (SSE), WebRTC, Web Graphics & Canvas, WebGL, WebWorkers, SVG. Libraries: Modernizr, Polyfills, Polymer.	**6 Hours**
6	Server Side Programming: Introduction to the server-side programming, Server-side web frameworks like Node JS/Express JS, Django. etc.	**6 Hours**

Text Books

SN	Title	Edition	Authors	Publisher
1	Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX	latest	-	Kogent Learning Solutions Inc.

Reference Books				
SN	Title	Edition	Authors	Publisher
1	HTML & CSS: The Complete Reference	Fifth Edition	Thomas A. Powell	The McGraw-Hill Companies, Inc.
2	Web Technologies	latest	Ivan Bayross	BPB Publication

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/106105084
2	https://www.youtube.com/watch?v=uUhOEj4z8Fo
3	https://www.w3schools.com/js/js_events.asp

V Semester

CSE2314 – PE I: Lab: Web Technologies

Course Objectives:

Student will:

1. To introduce with the internet technology
2. To study the basic of web page designing
3. To introduce the validations in the web page
4. To introduce the concepts of data storage using XML
5. To learn the advance technique for designing the interactive web page

Course Outcomes:

Upon successful completion of the course students will be able to

1. Understand various internet technologies
2. To design the web pages using some basic techniques
3. To design and implement the interactive web pages
4. To use the XML technology to store the data
5. To design and develop the interactive web pages using the advanced technique

Sr. No.	List of Experiment
1	Implement basic HTML Tags. Write a HTML code to illustrate the usage of the following - Ordered Lists - Unordered Lists - Description Lists
2	Write a HTML code to display data in tabular form (row* column) using HTML table tags
	Write a HTML code to create a home page having three links: About us, Services and Contact us create separate web pages for the three links.
3	Create web forms by using form tags in HTML. (Use any example)
4	Develop and demonstrate the usage of inline, internal and external style sheet using CSS3.
5	Create a single page responsive website using Bootstrap

6	Write JavaScript to validate the following fields of the Registration page. 1. First Name (Name should contains alphabets and the length should not be less than 6 characters). 2. Password (Password should not be less than 6 characters length). 3. E-mail id (should not contain any invalid andmust follow the standard pattern name@domain.com) 4. Mobile Number (Phone number should contain 10 digits only). 5. Last Name and Address (should not be Empty).
7	Create a simple script to download images using AJAX Or Develop and demonstrate the usage of jQuery
8	Introduction to XML program to demonstrate the use of External and Internal DTD
9	Create a web page which show the use of Canvas & SVG.
10	Develop a small web application using suitable web service framework and implement it.

V Semester

CSE2315 – PE I: Introduction to Geographical Information System

Objective	Course Outcomes
1) Get overview of fundamental concepts of GIS, applications and study. 2) Explore the Coordinate Systems, Map Projections metadata, spatial data, spatial analysis and new trends in GIS. 3) Comprehend the Making and sharing of maps.	**On completion of this course, the student will be able to:** 1) Demonstrate the fundamental concepts of GIS and relate the various GIS applications used by industries and government organization 2) Develop the apprehension of Coordinate Systems, Map Projections, metadata, spatial data, spatial analysis and new trends in GIS. 3) Design and share maps

Unit No.	Contents	Max. Hrs.
1	**Introduction to GIS:** Concepts of GIS, Applications currently used by Industry &Govt and their common usages. Fundamental concepts of GIS: GIS terminologies, various components of GIS software and types of GIS applications. The GIS Software Market, Role of GIS in smart cities.	6
2	**Fundamentals of Coordinate Systems and Map Projections**: History of Coordinate Systems, Geographic Coordinate Systems, Map Projections and Geo referencing.	7
3	**Fundamentals of Spatial Data:** Introduction to Spatial Data Formats, Creation of Vector data, Organization of Spatial Data and Displaying Spatial Data, metadata and spatial data standards.	7
4	**Making Sharing Maps:** Map Creation and Design, Sharing Maps as Services, Sharing Spatial Data and using shared Spatial Data.	6
5	**Fundamentals of Spatial Analysis:** Spatial Analysis, analyzing Vector and Raster data, overview of analysis tools, analyzing Spatial Relationships and sharing Analysis Results	7
6	**New trends in GIS:** GIS Trends Changing the World, Machine learning in GIS, Geospatial big data, Integration of GIS with different technologies, GIS with LiDar data.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	An Introduction to Geographical Information Systems	3rd t Edition(2006)	D. Ian Heywood, Sarah Cornelius & Steve Carver	Pearson Prentice Hall

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Getting to Know ArcGIS	4th Edition(2015)	Michael Law & Amy Collins	Esri Press
2	Mathematical Modeling in Geographical Information System global Positioning System and Digital Cartography	4th Edition(2006)	H. S. Shrama, D. R.Ram, Rama Prasad & P. R. Binda	Concept Publishing Company

V Semester

CSE2316 – PE I: Lab: Introduction to Geographical Information System

Sr. No.	Aim of Practical
1	To explore different proprietary GIS and Open GIS software.
2	To study the installation of GIS Desktop Software and explore various components of the GIS Desktop Software.
3	To explore various coordinate systems. Download any shape file and explore its coordinate system and change the existing coordinate system.
4	To create Geodatabase, layer files and shape files from the scratch.
5	To explore data formats using GIS Desktop Software and vector data points such as points, lines and polygon and create the map using simple vector data structure.
6	To create map in data view and layout view.
7	To install GIS Server, creating web services out of GIS maps or data, Sharing maps, using GIS web services.
8	Geoprocessing tools
9	Model builder
10	Project

V Semester

CSE2317 – PE I: Mobile Operating System

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Understand the basics of mobile programming. 2. Apply mobile programming concepts. 3. Design user interfaces. 4. Design mobile database. 5. Analyse inter – application communication.

Unit No.	Contents	Max. Hrs.
1	**Introduction to Mobile Programming** Mobility Technology Trends, Mobile Ecosystem Overview, Mobile Devices Overview, Mobile Development, Methodology, Wireless Networks Overview, Proximity Technologies.	5
2	**Introduction to Android** Android Overview, Basic building blocks, Introduction to Activities/Fragments, Introduction to Services, broadcast receivers, content providers, Android Application Structure, Source Files, Resources, Assets, Manifest, Basic IDE Operation (Android Studio), Project Creation and Handling (App Creation through Wizard), Running App on AVD and Device, DDMS and Debugging, Layout Overview, Linear Layout, Relative Layout, Frame Layout, Widgets (UI Controls) Overview, Text View, Image View, button.	6
3	**User Interface Designing** Notifications, Toast, Dialog, Listview and Adapter, View Re-usability, Spinner, Complex View, Android Component overview, Intent Resolution, Activity Stack, Launch Modes , Activity Flags, Service Overview, Service Lifecycle, Service Usage and Applicability, Message Binder.	6
4	**Data Management** Data Storage Overview, Persistant v/s Local, Shared Preferences, Internal Storage, SQLite Data Base, Thread, process overview, Async Task, Loaders, Handlers, Intent and Intent Filters, Broadcast receiver Overview, Manifest Registration vs Component Registration, Unregistration, SMS, Boot, Network etc., Action Bar and Context Menu.	6
5	**Inter - Application Communication** Inter app communication requirement overview, Intents Based, Gallery, Camera, SMS App, Contacts, Content provider Overview ,Need and Usage, Content Provider structure, URI Permissions, Views, triggers, Network communication basics, Connecting to server/ request creation, Response Formats XML/JSON, Rest / Web	6

	Services.	
6	**Advanced User Interface Designing** Style and Themes, View and layout animation, Localization, Orientation and Config Change Handling, Handling multiple resolution devices, Device and Tablet consideration, Support Library, Application Signing, Application Distribution, Application Publishing, Google Play, Query solving topics, Recycling view adapter, SQLite DB, Drawer, Tab Layout (view Pager 2), http request using retrofit, Navigation Drawer, Android Application Architecture and Unit Testing, Introduction to Jetpack, Introduction to Daggers, Introduction to AndroidX	7

Reference Books

SN	Title	Edition	Authors	Publisher
1	Programming the Mobile Web	2nd ed., 2013	Maximiliano Firtman	O'Reilly Media, Inc.

Text Books

SN	Title	Edition	Authors	Publisher
1	Mobile Design and Development	2009	Brian Fling	O'Reilly Media, Inc
2	Android Programming: The Big Nerd Ranch Guide	2nd edition, 2015	Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano	Big Nerd Ranch LLC

V Semester

CSE2318 PE I: Mobile Operating System Lab

Sr. No.	Experiments based on
1	Study of Mobile devices & their history.
2	Study of Mobile Apps Architecture.
3	Installation of Android Studio.
4	Modification to AndroidManifest File.
5	Develop an app making use of Android layout.
6	Develop an app based on Android widgets.
7	Design & Develop an app making use of Event Handling.
8	Develop an app to demonstrate fragment manager.
9	Design & Develop an app making use of mobile database.
10	Design & Develop an app based on inter application communication.

V Semester

CSE2331 – OE I: Database System Essentials

Objective	Course Outcome
To understand basic database concepts by students whose basic degree is not in Computer or IT.	Upon successful completion of the course the students will be able to 1. Understand the basics concepts of Database System and its modelling, compare SQL and NoSQL databases. 2. Solve queries based on SQL and procedures using PL-SQL, & Analyse data dependencies & normalization. 3. Understand Query Processing and evaluate queries. 4. Understand ACID Properties and database system Architecture.

Unit No.	Contents	Max. Hrs.
Unit:1	**Database system Essentials**: Purpose of Database systems, Example of Database Applications, Basic Terminologies, Data Models, Entity–Relationship Model, Relational Model.	6 Hours
Unit:2	**Relational Databases:** Introduction, SQL, DDL, DML, DCL, Database Integrity and Security, Relational–Database Design, Object–Oriented Databases, Object–Relational Databases, database constraints, functional dependencies and normalization.	7 Hours
Unit:3	**Data Storage and Querying:** Storage and File Structure, Indexing and Hashing, Data Retrieval, Query Processing, data-access techniques, query-evaluation.	6 Hours
Unit:4	**Transaction Management**: Introduction, transaction atomicity, consistency, isolation, and durability, concurrency control, serializability, locking, time stamping. Deadlock issues.	6 Hours
Unit:5	**Database System Architecture**: Centralized systems, client–server systems, parallel and distributed architectures, and network types,	6 Hours
Unit :6	**PL-SQL and No SQL:** Introduction to Pl-SQL, Block Structure: Variables, Decision Structures & Loops, Basic Pl-SQL programming. Overview of NoSQL Databases, SQL Vs NO SQL, Types of NoSQL Database	5 Hours

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Database System Concepts	7th Edition	Silberschatz–Korth–Sudarshan	McGraw–Hill, 2019

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Database Systems	5th Edition	Elmasri, Navathe & Gupta	Pearson Education
2	Database Systems	5th Edition	S. K. Singh	Pearson Education

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs04/preview
2	https://onlinecourses.nptel.ac.in/noc22_cs80/preview

V Semester

CSE2332 – OE I: Introduction to Image Processing

Objective	Course Outcome
1. Overview the Fundamental concepts of Digital Image Processing 2. Explore image enhancement techniques in spatial domain and frequency domain 3. Understand the fundamental concept of image compression 4. To Study various similarity based, and dissimilarity-based image segmentation approaches. 5. Understand the basic concepts of image representation and description.	Upon successful completion of the course the students will be able to CO1: Understand basic principles of image processing. CO2: Analyze images using processing algorithms/Techniques. CO3: Apply the concepts to implements basic image processing algorithms/operations.

Unit No.	Contents	Max. Hrs.
Unit:1	Fundamentals of Image Processing: Digital Image Fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.	6 Hours
Unit:2	Image Transformations: Image Enhancement in the Spatial Domain: Basic Grey Level Transformations, Histogram Processing, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	7 Hours
Unit:3	Image Processing: Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation	6 Hours
Unit:4	Image Segmentation :Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds	6 Hours
Unit:5	Image Compression: Image Compression: Fundamentals, Some Basic Compression Methods -Run Length Coding, Huffman Coding, Arithmetic Coding, Bit Plane Coding, Block Truncation Coding. JPEG Compression.	6 Hours
Unit :6	Morphological Image Processing: Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, Hit or Miss Transformation, Some Basic Morphological Algorithms, Grey Scale Morphology.	6 Hours

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Digital Image Processing, (DIP/3e)		Gonzalez and Woods	Prentice Hall - 2008

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Digital Image Processing		Kenneth R Castleman	Pearson Education
2	Fundamentals of Digital image Processing		Anil Jain.K	Prentice Hall of India
3	Digital Image Processing		S Jayaraman	Mc Graw Hill India 2017.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Science%20and%20Engineering/
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs04/preview
2	https://onlinecourses.nptel.ac.in/noc22_cs80/preview

V Semester

CSE2333 – OE I: Programming with Python

CSE 2333	Programming with Python			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes
Upon successful completion of the course the students will be able to : 1. Understand the basic data types, built in data structures, control statements and loops and write simple programs in Python. 2. Understand and apply the concepts of functions, modules and packages and write programs using them. 3. Design and develop classes in Python. 4. Solve real world problems and develop applications using Python.

Unit No.	Contents	Max. Hrs.
Unit:1	**Introduction to Python**: Build-in Data types & variables, arithmetic operators, assignment statement, print & input function, relational and logical operators, if, if – else & nested if- else statements, writing simple programs.	6 Hours
Unit:2	**Data Structures:** Built in data structures: Lists, Dictionaries, Tuples, Sets, and Arrays,mutability. Programs based on the built-in data structures	6 Hours
Unit:3	**Looping: Loop statements:** For, while, continue and break statements, list comprehension. Bitwise operators, Real world problem solving	6 Hours
Unit:4	**Functions:** Library functions in Python standard library, user defined Functions, returning values, local & global variables, global statement, doc strings for functions, developing useful functions, Modules and Packages, using import statement	6 Hours
Unit:5	**Introduction to Object oriented programming in Python:** Features of object-oriented programming, Python Object and Classes: defining classes, member variables, doc strings for classes, Private members, Operator Overloading, inheritance, and polymorphism	6 Hours
Unit:6	**Application Development:** Data visualization, basic file handling, Exception handling, developing applications in Python	6 Hours

Text Books

SN	Title	Edition	Authors	Publisher
1	Learn Python Programming	Third Edition	Fabrizio Romano, Heinrich Kruger	PACKT Publishing

		Jan 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Computation and Programming Using Python	Second Edition	John V. Guttag	PHI EEE (MIT Press)

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc20_cs70/preview
2	https://onlinecourses.nptel.ac.in/noc20_cs83/preview

V Semester

CSE2341 – OE II: Software Testing for Beginners

Objective	Course Outcome
1. Understand Software testing fundamentals / principles. 2. Learn systematic approach to software testing using strategies. 3. Explore Methods and tools of testing software.	Upon successful completion of this course, the student will be able to: 1. Formulate problem by following Software testing life cycle. 2. Design Manual Test cases for Software Project. 3. Demonstrate utilization of testing automation though testing tool.

Unit No.	Contents	Max. Hrs.
1	**Software Testing Basics:** Basic concepts of Testing: Need of Testing, Basic concepts-errors, faults, defects, failures, objective of testing, central issue in testing, Testing activities, V-Model, Sources of information for test cases, Monitoring and Measuring Test Execution, Test tools and Automation, Limitation of Testing.	6
2	**Unit Testing:** Unit Testing: Concepts of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Tools for Unit Testing.	6
3	**Control Flow Testing:** Control Flow Testing: Outline of Control Flow Testing, Control Flow Graphs, Path in Control Flow Graph, Path selection criteria, All path coverage criteria, Statement coverage, Path coverage.	7
4	**Integration Testing:** Data Flow and System Integration Testing: Introduction Data flow testing, Data flow graph, Data flow testing criteria, Fundamentals of System Integration: Types of interfaces and interface errors, System integration testing, Software and Hardware integration.	7
5	**System Testing:** System Testing: Taxonomy of system test, Basic Test, Functionality test, Robustness test, Performance test, Scalability test, Stress test, Load and Stability test, Reliability test, Regression test, Documentation Test.	6
6	**Test Cases:** Test Design: Test cases, Necessity of test case documentation, Test case design methods, Functional specification-based test case design, Use case bases, application based test case design, level of test execution.	6

Text Books				
S.No	**Title**	**Edition**	**Authors**	**Publisher**
1	Software Testing and Quality Assurance		Kshirsagar Naik and PriyadarshiniTripathi	Wiley Publication
2	Software Testing Principles, Techniques and Tools		M.G. Limaye	McGraw Hills

Reference Books				
S.No	**Title**	**Edition**	**Authors**	**Publisher**
1	Foundations of Software Testing		Aditya P. Mathur	Pearson Education
2	Software Testing Tools		Dr. K. V. K. K. Prasad	Dream Tech

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs13/preview
2	https://onlinecourses.nptel.ac.in/noc19_cs71/preview

V Semester

CSE2342 – OE II: Introduction to Web Technology

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Design Web pages using HTML5 2. Build an interactive website with CSS3 3. Develop basic programming skills using JavaScript 4. Create XML documents and Schemas.

Unit No.	Contents	Max. Hrs.
Unit:1	**Introduction to internet:** Overview of Internet, Intranet, WWW, Internet Protocols (HTTP, FTP, SMTP), Email, broadband.	6 Hours
Unit:2	**Introduction to HTML5:** Web server, Web Client/Browser, Structure of an HTML Program, Basic HTML Tags(Headings, Paragraph, Division, Text formatting, Image, Anchors), HTML Lists (Ordered Lists, Unordered Lists, Description Lists), HTML Attributes, HTML Links (Href Attribute, Target Attribute).	6 Hours
Unit:3	**Table handling in HTML and Creating Forms:** Table handling in HTML: width and border attribute, CELLPADDING attribute, CELLSPACING attribute, COLSPAN and ROWSPAN attributes, background color attribute, HTML Forms: Elements to Capturing Form Data, Properties of Form Elements, HTML Layout Elements(Semantic Elements), HTML style attribute, HTML class and id attribute.	6 Hours
Unit:4	**Cascading Style Sheets (CSS3):** Introduction to CSS, Differences between CSS3 and earlier CSS specifications, CSS Syntax, CSS selectors, Inserting CSS: Inline, Internal, External, CSS properties: Background, Text, Font, Border, Margin, Padding, List, Dimension, and Classification.	6 Hours
Unit:5	**Java Script:** Introduction to Java Script, Functions of Javascript, Variables and Data Types, Operators, Loops and control statement: if Statement, if...else Statement, else if Statement, JavaScript Switch Statement, JavaScript Functions, JavaScript Loops: for loop, while loop, do...while loop, Dialog Boxes, JavaScript Events.	6 Hours
Unit :6	**Introduction to XML:** What is XML?, Features of XML, XML Syntax and Structure Rules(Start tags, End tags, Empty elements, XML tag attributes),XML Document Type Declaration(DTD, Internal DTD's, External DTD's.	6 Hours

Text Books				
S No	**Title**	**Edition**	**Authors**	**Publisher**
1	Web Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX			Kogent Learning Solutions Inc.

Reference Books				
S No	**Title**	**Edition**	**Authors**	**Publisher**
1	HTML & CSS: The Complete Reference	Fifth Edition	Thomas A. Powell	The McGraw-Hill Companies, Inc
2	Web Technologies		Ivan Bayross	BPB Publication

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/106105084
2	https://www.youtube.com/watch?v=uUhOEj4z8Fo
3	https://www.youtube.com/watch?v=mU6anWqZJcc

V Semester

CSE2343 – OE II: Introduction to Cloud Computing

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Understand Cloud Computing Models. 2. Apply Cloud Concepts &Technologies. 3. Analyse Cloud Services & Platforms 4. Use MapReduce to process Big Data on Apache Hadoop.

Unit No.	Contents	Max. Hrs.
Unit:1	**Introduction to Cloud Computing:** Definition of Cloud Computing, Characteristics of Cloud Computing, Cloud Models (Service & Deployment), Cloud Services Examples (IaaS, PaaS, SaaS), Cloud-based Services and Applications (Cloud computing for Healthcare, Manufacturing Industry and Education)	6 Hours
Unit:2	**Cloud Concepts &Technologies:** Virtualization, Load balancing, Scalability & Elasticity, Monitoring, Identity & Access Management, Service Level Agreements	6 Hours
Unit:3	**Cloud Services & Platforms:** Compute Services (Amazon Elastic Compute Cloud, Google Compute Engine, Windows Azure Virtual Machines), Storage Services (Amazon Simple Storage services, Google Cloud Storage, Windows Azure Storage), Database Services (Amazon Relational Data Store, Google Cloud SQL, Windows Azure SQL Database), Application Services (Application Runtimes & Frameworks) Identity & Access Management Services (Amazon Identity & Access Management, Windows Azure Active Directory).	6 Hours
Unit:4	**Hadoop & MapReduce:** Apache Hadoop, Hadoop MapReduce Job Execution, NameNode, Secondary NameNode, JobTracker, TaskTracker, DataNode	6 Hours
Unit:5	**Cloud Application Design:** Design Considerations for Cloud Applications, Scalability, Reliability & Availability, Security, IaaS, SaaS Services for Cloud Applications.	6 Hours
Unit :6	**Cloud Security:** Introduction, CSA Cloud Security Architecture, Authentication, Single Sign On (SSO), Authorization.	6 Hours

Text Books				
S.No	**Title**	**Edition**	**Authors**	**Publisher**
1	CLOUD COMPUTING A Hands -on Approach		Arshdeep Bahga & Vijay Madisetti	Wiley Publication

Reference Books				
S.No	**Title**	**Edition**	**Authors**	**Publisher**
1	CLOUD COMPUTING	**18th edition**	Michael Miller	PEARSON PUBLICATION
2	Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance		Tim Mather, Subra Kumaraswamy, and Shahed Latif	O'Reilly
3	Cloud Computing Bible		Barrie Sosinsky	John Wiley & Sons

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2	https://www.simplilearn.com/

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

6th Semester

(Department of Computer Science & Engineering

Computer Sciences & Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester														
1	6	HS	GE2311	Fundamentals of Management	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	CSE2351	Computer Networks	**T**	3	0	0	3	3	30	20	50	3 Hours
3	6	PC	CSE2352	Lab: Computer Networks	**P**	0	0	2	2	1		60	40	
4	6	PC	CSE2353	Compilers	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PC	CSE2354	Lab: Compilers	**P**	0	0	2	2	1		60	40	
6	6	PC	CSE2355	Software Engineering	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PC	CSE2356	Lab: Software Engineering	**P**	0	0	2	2	1		60	40	
8	6	PE		Professional Elective-II	**T**	3	0	0	3	3	30	20	50	3 Hours
9	6	PE		Lab: Professional Elective-II	**P**	0	0	2	2	1		60	40	
10	6	OE		Open Elective - III **	**T**	3	0	0	3	3	30	20	50	3 Hours
11	6	OE		Open Elective - IV **	**T**	3	0	0	3	3	30	20	50	3 Hours
				TOTAL		**21**	**0**	**8**	**29**	**25**				

Professional Electives -II

1	6	PE-II	CSE2361	PE II: Digital Image Processing
	6	PE-II	CSE2362	PE II: Lab:Digital Image Processing
2	6	PE-II	CSE2363	PE II: Internet of Things
	6	PE-II	CSE2364	PE II: Lab: Internet of Things
3	6	PE-II	CSE2365	PE II: Neural Network and applications
	6	PE-II	CSE2366	PE II: Lab Neural Network and applications

Open Electives -III

1	6	OE-III	CSE2371	OE III: Database System Essentials
2	6	OE-III	CSE2372	OE III: Introduction to Image Processing
3	6	OE-III	CSE2373	OE III: Programming with Python

Open Electives -IV

1	6	OE-IV	CSE2381	OE IV: Software Testing for Beginners
2	6	OE-IV	CSE2382	OE IV: Introduction to Cloud Computing
3	6	OE-IV	CSE2383	OE IV: Introduction to Web Technology

Audit Courses											
1	6	HS	AU2130	YCCE Communication Aptitude Preparation (YCAP6.3) for CT, IT, CSE	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

VI Semester
GE2311 - Fundamentals of Management

Objective	Outcome
1. To introduce the fundamentals and legal provision of Management 2. To introduce the Human Resource and Financial practice of organization 3. To Introduce the Project Management 4. To provide knowledge of Marketing Activities of Management	Upon successful completion of the course, the student will be able to: 1. Explain the Legal provision and Functions of Management. 2. Analyze the role of Human Resource and Financial Management in the organization. 3. Analyze the project life cycles. 4. Identify tools and techniques for the marketing of goods and services.

Unit No.	Contents	Max Hrs.
1	**Evolution of Management Thought**: Scientific and Administrative Theory of Management Definition and Concept of Management, Functions of Management: Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership	6
2	**Legal Aspects of Management:** The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company	6
3	**Human Resource Management**: Meaning and Scope, Principles of HRD, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Grievance Redressal Procedure.	7
4	**Project Management:** Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Tools and Techniques of Project Management, Network techniques - Introduction and Use of CPM & PERT for planning, SWOT Analysis, Project Risk Analysis, Project Control.	7
5	**Marketing Management**: Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting	6
6	**Financial Management :**Definition & Functions of Finance department, Sources of finance, Types of capital, Profit maximization vs. Wealth Maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet	6

Text and Reference Books

SN	Title	Edition	Authors	Publisher
1	Principles of Management		Harold Koontz Ramchandra	Tata McGrow hills
2	Marketing Management: Planning, Implementation and Control	3rd Edition	Ramaswamy V.S. and Namakumari S	macmillan publishers
3	Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law			

4	Human Resource Management - Text and Cases	3rd Edition	Dr. V.S.P.Rao	Excel Books
5	A Text book of Human Resource Management	latest	C.B.Mamoria and S.V.Gankar	Himalaya Publishing House
6	Project Management Handbook	1st Edition	Lock, Gower	Routledge
7	Marketing Management	latest	Rajan Saxena	Tata McGraw Hill
8	Foundations of Financial Markets and Institutions	3rd Edition	Fabozzi	Prentice hall
9	Fundamentals of Financial Instruments	latest	Parameswaran	Wiley India
10	Financial Institutions and Markets	3rd Edition	Bhole L M	Tata McGraw-Hill
11	Financial Services	latest	Khan M Y	Tata Mc Graw Hill

VI Semester
CSE2351 – Computer Networks

Objective	Course Outcome
1. Understand the importance of layering architecture and cla different types of networks. 2. Study of different protocols at various layers. 3. Study of modern networking tools.	1. Identify appropriate design issues and explain network reference model. 2. Select appropriate protocol at various layers for the given application. 3. Solve problems in the networking domain. 4. Analyze the performance of network using different tools 5. Design computer networks and sub-networks

Unit No.	Contents	Max. Hrs.
1	Introduction to computer networks and Internet, The uses of computer networks, LAN's, MAN's, WAN's, Heterogeneous Networks Network Topologies, Physical Mediums, Concept of Network Protocols, design issues for layers. Layered Architecture: The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference models, Various Losses in the Internet, Brief History of Computer Network.	5
2	Application Layer: Basics of Socket Programming, Transport Layer Programming Interface(TCP, UDP) , Protocols: HTTP (Overview, Persistent and Non-Persistent, Message Format, Cookies, Cachess) , SMTP (Overview, Message Formats) , IMAP, POP, DNS; FTP; Telnet, SSH; Peer-to-Peer Applications, BitTorrent Protocol; Conte Distribution Networks;	7
3	Transport Layer: Relationship Between Transport and Network Layer, TCP and UDP; Multiplexing and Demultiplexing; Principles of Reliable Data Transfer; Go-Back-N and Selective Repeat; TCP: Segment Structure, Round Trip Time Estimation, Reliable Data Transfer, State Transitions, Flow Control, Congestion Control, UDP: Segment Structure	7
4	Network Layer, Subnets: Concept of IP Address, Netmask, Subnet; CIDR; Design of a LAN and WAN,r, Routers, Functions of a Router; Switching; Queueing: Causes, Delays; IPV4: Datagram Format, Fragmentation; Network Address Translation; IPv6 Introduction; Multicasting, , Routing algorithms: Link State, Distance Vector Routing; OSPF, BGP, RIP; Routing Policies	7
5	Link Layer: Review of fundamentals of link layer protocols; Error-Detection and -Correction Techniques Ethernet Switches, LANs, LinkLayer Switches, VLANs, Complete tracking of traversal of a packet over internet between two application, MAC	5
6	Transmission Impairments, Transmission Media: Guided, unguided, Architecture of the Internet, Wireless LANs: IEEE 802.11, IEEE 802., The Public Switched Telephone Network, Switching: circuit, packet and message switching, Modems..	5

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Computer Networking: A Top-Down Approach	Latest Edition/6th	Kurose and Ross	Pearson Publication
2	Computer Networks	Latest Edition	Behrouz A. Forouzan	McGraw-Hill Publication
3	Computer Networks	Latest Edition	A.S. Tanenbaum	Pearson Publication

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Computer Networks A Systems Approach	ISBN: 9780123850591	Larry Peterson Bruce Davie	Elsevier
2	Data and computer Communication	ISBN-81- 297-0206-1	William Stallings	Pearson Education

VI Semester
CSE2352 – Lab. Computer Networks

Sr. No.	List of Experiment
1	Study of Network Devices and Network cables.
2	Implement Network Utility Commands to observe the network details.
3	Configure TCP/IP to configure Internet on your computer.
4	Configure network using Cisco Packet Tracer software and show packet transmission from source to destination.
5	Configure network using Static routing protocol in Cisco Packet Tracer
6	Use traffic monitoring tool Wire shark to observe network traffic with packet details.
7	To implement Routing algorithm using Cisco Packet Tracer
8	Use TCP dump utility to capture and analyse network traffic
9	To implement Hamming Code using C and C++.
10	Advanced Practical: Study of NSG tool.

VI Semester
CSE2353 – Compilers

Objective	Course Outcome
1. To study the structure of Compiler and FLEX tool for generating lexical analyzer 2. To explore top down, Bottom up parsing approaches and YACC tool for generating syntax analyzer 3. To understand Syntax Directed Translation Scheme. 4. To introduce Symbol Table Management and Error Detection and Recovery with respect to all phases of compilation. 5. To understand Code optimization and Code generation techniques.	Upon successful completion of the course, the student will be able to: 1. Understand basic concepts of compiler design, Lexical analysis process and apply the knowledge of LEX/Flex tool. 2. Explain the role of a syntax analyzer and distinguish between different types of parsers, design and implement a parser using a YACC tool. 3. Apply the knowledge of Syntax directed translation to create intermediate code generation 4. Demonstrate the use of a symbol table throughout compilation. 5. Apply various code optimizing transformations and code generation techniques.

Unit No.	Contents	Max Hrs.
1	Introduction to Compilation Process, Compilers & Translators, Phase structure of Compiler, Design of Lexical Analysis.	6
2	Specifying Syntactic Structure of Programming Language using Context Free Grammars, The role of Parser, Top-down Parsing, Bottom Up Parsing, Predictive Parsers, Recursive Decent Parser.	7
3	Construction of efficient LR Parsers (SLR, CLR & LALR), Canonical Collection of set of items and construction of Parsing table, Implementation of LR Parsing table.	7
4	Syntax Directed Translation: Intermediate Code, Postfix notation, Parse tree and Syntax Trees, Three address codes, quadruples, triples, Translation of Arithmetic Expression, Boolean expressions, Control Statements. Array references, Procedure Calls, Declarations, Case Statements, Use of Compiler writing tools (Lex/ Flex, Yacc / Biason).	7
5	Symbol Tables: Contents, Representing scope information. Error detection and Recovery: Error handling, Lexical-phase, Syntactic phase and semantic phase.	6
6	Introduction to Code Optimization, The principle sources of optimization, Loop optimization, The DAG representation, Introductory Data Flow analysis, Introduction to Code Generation: Object programs, Problems in Code Generation, Register allocation and assignment, Code generation from DAG, Peephole optimization.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Compilers Principles, Techniques & Tools	2nd Edition	Alfred V. Aho, Jeffrey D. Ullman & Ravi Sethi	Pearson Education
2	Principles of Compiler Design	Latest	Alfred V. Aho, Jeffrey D. Ullman	Narosa Publishing House

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Compiler Design	4th Edition	Dr. O.G. Kakde	Laxmi Publication
2	Introduction to Compiling Techniques: First Course Using ANSI C, Lex and Yacc	Latest	J. P. Bennett	McGraw-Hill Publication

VI Semester
CSE2354 – Lab.: Compilers

Sr. No.	List of Experiment
1	Implement a Lexical Analyzer using FLEX and develop: A. Program For converting all small case letters to UPPER case letters and Vice-Versa. B. Program to count the words, spaces, and lines in a given input file.
2	Study the LEX/Flex and YACC/Bison tool and Develop: A. LEX program to eliminate comment lines (Single and Multiple) in a text(C program) file and copy the resulting program into a separate file. B. YACC program to recognize valid identifier, operators and keywords in the given text (C program) file.
3	A. Develop a LEX program to recognize valid arithmetic expression. Identifiers in the expression could be only integers and operators could be + and *. Count the identifiers & operators present and print them separately. B. Develop a YACC program to evaluate arithmetic expression involving operators: +, -, *, and /.
4	Develop, Implement and execute a program using YACC tool to recognize all strings ending with b preceded by n a's using the grammar a n b (note: input n value), also create DFA of given grammar using JFLAP
5	Develop a program to find FIRST and FOLLOW of all variables. Write a suitable data structure to store a context fee grammar. Prerequisite is to eliminate left recursion from the grammar before storing
6	Design and Simulate Predictive / LL (1) Parsing Table using JFLAP for the grammar rules: A→ aBa, B→bB .
7	Design and Simulate SLR(1) parsing using JFLAP for the grammar rules: E→ E+T | T, T→ T*F | F, F → (E) | id and parse the sentence: id + id * id.
8	Develop a program for intermediate code generator to generate three address code using LEX & YACC.

VI Semester
CSE2355 – Software Engineering

Objective	Course Outcome
1. Study software engineering best practices and different strategies applicable for software development, software requirement and its design activity. 2. Explore the various testing types and it strategies. 3. Understand configuration management, version control and change control process of Software development. 4. Understand project management, planning, scheduling, risk management, project and process metrics. 5. Get an overview of open source Software Engineering tool viz. Subversion and understand some concepts such as Re-engineering and Reverse engineering.	**Upon successful completion of the course, the student will be able to:** 1. Choose appropriate software engineering process model, requirement engineering principles and software designing fundamentals for a given project. (CO1) 2. Select appropriate testing strategy and apply testing principles for testing a given application. (CO2) 3. Apply basics of software configuration management, version control and change control in software development. (CO3) 4. Evaluate cost estimation, effort and severity of software risk for given application. (CO4) 5. Perform basic operations on Sub-version for software version control. (CO5)

Unit No.	Contents	Max. Hrs.
1	Introduction to Software Engineering, A Generic View of process, Process models: Water fall Model, RAD Model, Prototyping Model, Component Development Model, Agile Model, Requirement Engineering: Requirement Engineering Task Initialization Eliciting Requirement, Developing Use Case, Analysis Model, Negotiation, Validation	6
2	Building the Analysis mode: Requirement Analysis, Analysis Modeling Approaches, Data Modeling Concept, Object Oriented Analysis, Types of Modeling, Design Engineering: Design Concept, Design Model.	7
3	Testing Strategies : Strategic Approach, Strategic issues, Strategies for conventional Software, Strategies for Object Oriented Software, Validation Testing, Testing Tactics: White-Box Testing, Basis Path testing: Flow Graph Notation, Independent Program Paths, Control Structure Testing, Black Box Testing, Introduction to object oriented testing.	7
4	Configuration Management: Base lines, Software Configuration items, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting, SCM Standards.	5
5	Project Management, Metrics for Process and Projects, Project Estimation, Risk Management: Reactive vs. Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection.	7
6	Advanced Topics in Software Engineering: Re engineering Computer aided software engineering, Open source SE tools introduction, Example-Subversion: Overview, Typical subversion usage and work flow.	5

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Software Engineering–A Practitioner's Approach	6th	Roger S. Pressman	McGraw Hill
2	Software Engineering,	9th	Ian Sommerville,	Pearson

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Object Oriented Software Engineering	6th	Leth Bridge	TATA McGraw Hill

VI Semester
CSE2356 – Lab.: Software Engineering

Sr. No.	List of Experiment
1	Introduction to Software Engineering fundamentals, UML and RATIONAL ROSE Interface.
2	To study and create Software Requirement Specification document for given case study.
3	To study and draw UML Use Case diagram for the given case study.
4	To study and draw UML Class diagram for given Case Study.
5	To study and draw UML Activity diagram for given Case Study.
6	To study and draw UML Sequence Diagram for given Case Study.
7	To study and draw State Diagram for given Case Study.
8	Write a Program to find out the Estimation (cost and effort) by using COCOMO model.
9	To Perform Manual and Automated testing using CASE tool for given Case Study.
10	To Study and execute Version Control using Subversion

VI Semester

CSE2361 – PE II: Digital Image Processing

Objective	Course Outcome
1. Overview the Fundamental concepts of Digital Image Processing 2. Explore image enhancement techniques in spatial domain and frequency domain 3. Understand the fundamental concept of image compression 4. To Study various similarity based, and dissimilarity-based image segmentation approaches. 5. Understand the basic concepts of image representation and description.	1. Describe Basic relationships between pixels. 2. Compare various image enhancement techniques in spatial domain and frequency domain. 3. Illustrate different image compression techniques to understand the advantage of image compression 4. Demonstrate the applications of similarity based and dissimilarity-based approaches for image segmentation. 5. Interpret various representation techniques

Unit No.	Contents	Max. Hrs.	CO
1	**Introduction:** Fundamental Steps in Image Processing, Elements of DIP systems, Elements of Visual Perception, Fundamentals of Image processing, A Simple Image Model, Sampling and Quantization, Some Basic Relationships between Pixels.	5	CO1
2	**Image Enhancement in the Spatial Domain:** Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	6	CO2
3	**Transforms:** Introduction to the Fourier Transform, Discrete Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, **Image Enhancement in the frequency Domain:** Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering.	7	CO2
4	**Image Compression:** Fundamentals of Image compression, coding redundancy, spatial and temporal redundancy, Measuring Image Information, Fidelity criteria, Image compression models, Basic compression methods, Huffman coding, arithmetic coding, LZW coding, run length coding.	5	CO3
5	**Image Segmentation**: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.	6	CO4
6	**Image Representation:** Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Regional Descriptors, Topological Descriptors. Introduction to color image processing: RGB and HSI color models.	5	CO5

Text books:				
1	Digital Image Processing	3rd edition 2007	Rafael C. Gonzalez and Richard E. Woods	Prentice Hall
2	Digital Image Processing	2009	S Jayaraman	Tata McGraw Hill
Reference books:				
1	Fundamentals of Digital Image Processing	1988	A K Jain	Prentice Hall, 1988
2	Image Processing Principles & Applications	2005	Tinku Acharya & Ajoy K. Ray	Willey Inter-Science

VI Semester
CSE2362 – PE II: Lab: Digital Image Processing

Sr. No.	List of Experiment
1	1. Write a program in MATLAB for following Point processing techniques in spatial domain a. Negation of an image b. Thresholding of an image c. Contrast Stretching of an image
2	. Write a Program in MATLAB to Create a Histogram of a given Image OR *https://cse19-iiith.vlabs.ac.in/objective.php?exp=histo*
3	Write a program in MATLAB to perform following smoothing operations on an image a. Average filter b. Ordered Statistics filter
4	. Write a program in MATLAB to sharp an image using Laplacian mask.
5	. Write a program in MATLAB to segment an image using multilevel thresholding OR *https://cse19-iiith.vlabs.ac.in/objective.php?exp=segment*
6	. Write a program in MATLAB to apply split and merge algorithm on a given image.
7	Write a program in MATLAB to find the code chain of a given image.
8	Write a program in MATLAB to find Euler number of image a given image.
9	Write a program using OpenCV tool to detect the object present in an image.
10	Write a program using OpenCV tool to detect and track the object present in video.

VI Semester
CSE2363 – PE II: Internet of Things

Objective	Course Outcome
1. Get acquainted with various IOT environments. 2. Study IOT architecture and its enabling technologies. 3. Acquire hands on laboratory experience, utilizing IOT kit.	1. Develop various IOT environments 2. Demonstrate IOT architecture and its enabling technologies 3. Analyze IOT environments using various communication technologies 4. Apply various IOT enabling technologies for creation of IOT environments

Unit No.	Contents	Max. Hrs.
1	**Introduction :** Concepts behind the Internet of Things, Characteristics of IoT, IoT enabling technologies, IoT Communication Model, IoT architecture, Applications of IoT, Transducers, Sensors, Sensor classes, Sensor types, Actuators and its types.	6
2	**IOT Protocols**: Application layer: MQTT, COAP, XMPP, AMQP, Network Layer: IPv4, IPv6, 6LoWPAN, IoT Communication protocols: IEEE802.15.4, ZigBee, Wireless HART, Zwave, Bluetooth, NFC, RFID.	7
3	**Wireless Sensor networks**: Components of sensor nodes, Node Behavior in WSNs, Applications, WSN Coverage, OGDC algorithm, Stationary and Mobile Wireless Sensor Networks.	6
4	**Cloud Computing:** Recent Trends in Computing, Characteristics, Components of Cloud Computing, Service Models, Deployment Models, Service Management, Cloud Security, IoT Data analytics, Case studies, Middleware for IoT	6
5	**Machine to Machine Communication**: Node types, IP and Non IP based M2M network Interoperability in Internet of Things: Current Challenges in IoT, Interoperability, Types of Interoperability	6
6	**Software-Defined Networking**: Current Network to SDN, SDN Architecture, Challenges, OpenFlow Protocol, APIs in SDN, Controller Placement, Recent Advances of SDN in IoT, Industrial internet of things, Case studies	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Internet of Things: A Hands-On Approach	Latest	Arsheep Bahga, Vijay Madisetti	Universities Press

Reference Books

SN	Title	Edition	Authors	Publisher
1	Introduction to IOT	Latest	S.Misra , A. Mukherjee, A.Roy	Cambridge university press

VI Semester
CSE2364 – PE II: Lab: Internet of Things

Sr. No.	List of Experiment
1	To study IoT Kit
2	Design a sketch for running of LED's
3	Design a sketch to monitor state of switch by establishing serial communication between Arduino and computer
4	Design a sketch to read analog value of potentiometer by establishing serial communication between arduino and computer
5	Design a sketch for blinking LED's without using delay
6	Design a sketch to develop switch based binary LED counter. Also observe output on serial monitor
7	Design a sketch to create a simple digital clock using LCD display
8	Design a sketch to make use of EEPROM to control devices(LED)
9	To log data of temperature sensor over internet and monitor it from anywhere in the world
10	Use of ESP-32

VI Semester

CSE2365 – PE II: Neural Network and Applications

Course Outcome
Upon successful completion of the course the students will be able to CO 1: understand the basic concepts, underlying mathematics, and differences between Networks CO 2: Apply popular neural network algorithms for solving classification and regression problems CO 3: Identify and Analyse various ways of selecting suitable model parameters for different neural network algorithms. CO 4: Design multi-layer feed-forward neural networks and CNNs using deep learning concepts

Unit No.	Contents	Max. Hrs.
1	**Introduction to Biological and Artificial Neural Networks:** Biological Neurons, General Artificial Neuron Model, MP Neuron, Perceptrons, Neural Network learning Rules, types of neural networks, feedforward vs recurrent neural networks	6
2	**Perceptrons and Machine Learning Basics:** Single Discrete Perceptron algorithm, linear machine and minimum distance classification, gradient descent and Single Continuous Perceptron algorithm Machine learning basics: supervised vs unsupervised learning, various Machine learning tasks like classification, regression, machine Translation, Anomaly detection, etc. Capacity, Overfitting and Underfitting, bias and variance.	6
3	**Multilayer Perceptrons and Backpropagation Algorithm:** Multilayer Perceptrons (MLPs), Representation Power of MLPs, Feed forward Neural Networks, Backpropagation, algorithm, Momentum Based Gradient Descent (GD), Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Applications of MLPs for classification and regression,Performance measures.	6
4	**Regularization:** L1, L2 Regularization, Early stopping, Dataset augmentation, Parameter sharing and tying, Injecting noise at input, any other recent topics.	5
5	**Introduction to Deep Networks:** History of deep learning, Types of deep networks, Introduction to Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Transfer learning using CNNs, comparison of shallow and deep networks.	6
6	**Autoencoders:** Auto encoders, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Contractive auto encoders.	5

Text Books

SN	Title	Edition	Authors	Publisher
1	Deep Learning	Latest	Ian Goodfellow, Yoshua Bengio, Aaron Courville	MIT Press
2	Introduction to artificial neural systems	Latest	Jacek M. Zurada	-

		Jan 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Deep learning with python	Latest	Francois Chollet	Manning
2	Pattern Recognition and Machine Learning	Latest	Christopher Bishop	Springer
3	Neural Networks: A Systematic Introduction	Latest	Raul Rojas	Springer
4	Deep Learning	First	Amit Das, Saptarshi Goswami, Prabir Mitra, Amlan Chakrabarti	Pearson

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1	Deep Learning – Prof. Mitesh Khapra (IIT Ropar), Swayam Course https://onlinecourses.nptel.ac.in/noc22_cs124/preview
2	Neural Networks and Deep Learning, Andrew Ng https://www.coursera.org/learn/neural-networks-deep-learning#syllabus

VI Semester

CSE2366 – PE II: LAB: Neural Network and Applications

Practicals based on above subject

VI Semester

CSE2371 – OE III: Database System Essentials

Objective	Course Outcome
To understand basic database concepts by students whose basic degree is not in Computer or IT.	Upon successful completion of the course the students will be able to 1. Understand the basics concepts of Database System and its modelling, compare SQL and NoSQL databases. 2. Solve queries based on SQL and procedures using PL-SQL, & Analyse data dependencies & normalization. 3. Understand Query Processing and evaluate queries. 4. Understand ACID Properties and database system Architecture.

Unit No.	Contents	Max. Hrs.
Unit:1	**Database System Essentials**: Purpose of Database systems, Example of Database Applications, Basic Terminologies, Data Models, Entity–Relationship Model, Relational Model.	6 Hours
Unit:2	**Relational Databases:** Introduction, SQL, DDL, DML, DCL, Database Integrity and Security, Relational–Database Design, Object–Oriented Databases, Object–Relational Databases, database constraints, functional dependencies and normalization.	7 Hours
Unit:3	**Data Storage and Querying:** Storage and File Structure, Indexing and Hashing, Data Retrieval, Query Processing, data-access techniques, query-evaluation.	6 Hours
Unit:4	**Transaction Management**: Introduction, transaction atomicity, consistency, isolation, and durability, concurrency control, serializability, locking, time stamping. Deadlock issues.	6 Hours
Unit:5	**Database System Architecture**: Centralized systems, client–server systems, parallel and distributed architectures, and network types,	6 Hours
Unit :6	**PL-SQL and No SQL:** Introduction to Pl-SQL, Block Structure: Variables, Decision Structures & Loops, Basic Pl-SQL programming. Overview of NoSQL Databases, SQL Vs NO SQL, Types of NoSQL Database	6 Hours

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Database System Concepts	7th Edition	Silberschatz–Korth–Sudarshan	McGraw–Hill, 2019

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Database Systems	5th Edition	Elmasri, Navathe & Gupta	Pearson Education
2	Database Systems	5th Edition	S. K. Singh	Pearson Education

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs04/preview
2	https://onlinecourses.nptel.ac.in/noc22_cs80/preview

VI Semester

CSE2372 – OE III: Introduction to Image Processing

Objective	Course Outcome
1. Overview the Fundamental concepts of Digital Image Processing 2. Explore image enhancement techniques in spatial domain and frequency domain 3. Understand the fundamental concept of image compression 4. To Study various similarity based, and dissimilarity-based image segmentation approaches. 5. Understand the basic concepts of image representation and description.	Upon successful completion of the course the students will be able to CO1: Understand basic principles of image processing. CO2: Analyze images using processing algorithms/Techniques. CO3: Apply the concepts to implements basic image processing algorithms/operations.

Unit No.	Contents	Max. Hrs.
Unit:1	Fundamentals of Image Processing: Digital Image Fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.	6 Hours
Unit:2	Image Transformations: Image Enhancement in the Spatial Domain: Basic Grey Level Transformations, Histogram Processing, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	7 Hours
Unit:3	Image Processing: Color Image Processing: Color Fundamentals, Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation	6 Hours
Unit:4	Image Segmentation :Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds	6 Hours
Unit:5	Image Compression: Image Compression: Fundamentals, Some Basic Compression Methods - Run Length Coding, Huffman Coding, Arithmetic Coding, Bit Plane Coding, Block Truncation Coding. JPEG Compression.	6 Hours
Unit :6	Morphological Image Processing: Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, Hit or Miss Transformation, Some Basic Morphological Algorithms, Grey Scale Morphology.	6 Hours

Text Books

SN	Title	Edition	Authors	Publisher
1	Digital Image Processing, (DIP/3e)	3rd edition	Gonzalez and Woods	Prentice Hall - 2008

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Digital Image Processing	latest	Kenneth R Castleman	Pearson Education
2	Fundamentals of Digital image Processing	latest	Anil Jain.K	Prentice Hall of India

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Science%20and%20Engineering/
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs04/preview
2	https://onlinecourses.nptel.ac.in/noc22_cs80/preview

VI Semester

CSE2373 – OE III: Programming with Python

Course Outcome
Upon successful completion of the course the students will be able to : 1. Understand the basic data types, built in data structures, control statements and loops and write simple programs in Python. 2. Apply the concepts of functions modules and packages and write programs using them. 3. Design and develop classes in Python. 4. Solve real world problems and develop interesting applications using Python.

Unit No.	Contents	Max. Hrs.
Unit:1	**Introduction to Python**: Build-in Data types & variables, arithmetic operators, assignment statement, print & input function, relational and logical operators, if, if – else & nested if- else statements, writing simple programs.	7 Hours
Unit:2	**Data Structures:** Built in data structures: Lists, Dictionaries, Tuples, Sets, and Arrays. Programs based on the built in data structures	6 Hours
Unit:3	**Looping: Loop statements:** For, while, continue and break statements, list comprehension. Bitwise operators, Real world problem solving based on loops.	6 Hours
Unit:4	**Functions:** Library functions in Python standard library, user defined Functions, returning values, local & global variables , global statement, doc strings for functions, developing useful functions, Modules and Packages, import statement.	6 Hours
Unit:5	**Introduction to Object oriented programming in Python:** Features of object oriented programming, Python Object and Classes: defining classes, member variables, doc strings for classes, Private members, Operator Overloading, inheritance and polymorphism.	7 Hours
Unit :6	**Application Development:** Developing applications using libraries and packages, File handling, Exception handling, developing applications using Python	5 Hours

Text Books

SN	Title	Edition	Authors	Publisher
1	Learn Python Programming	Third Edition	Fabrizio Romano, Heinrich Kruger	PACKT Publishing

Reference Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Computation and Programming Using Python	Second Edition	John V. Guttag	PHI EEE (MIT Press)

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc20_cs70/preview
2	https://onlinecourses.nptel.ac.in/noc20_cs83/preview

VI Semester

CSE2381 – OE IV: Software Testing for Beginners

Objective	Course Outcome
1. Understand Software testing fundamentals / principles. 2. Learn systematic approach to software testing using strategies. 3. Explore Methods and tools of testing software.	Upon successful completion of this course, the student will be able to: 1. Formulate problem by following Software testing life cycle. 2. Design Manual Test cases for Software Project. 3. Demonstrate utilization of testing automation though testing tool.

Unit No.	Contents	Max. Hrs.
1	**Software Testing Basics:** Basic concepts of Testing: Need of Testing, Basic concepts-errors, faults, defects, failures, objective of testing, central issue in testing, Testing activities, V-Model, Sources of information for test cases, Monitoring and Measuring Test Execution, Test tools and Automation, Limitation of Testing.	6
2	**Unit Testing:** Unit Testing: Concepts of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Tools for Unit Testing.	6
3	**Control Flow Testing:** Control Flow Testing: Outline of Control Flow Testing, Control Flow Graphs, Path in Control Flow Graph, Path selection criteria, All path coverage criteria, Statement coverage, Path coverage.	7
4	**Integration Testing:** Data Flow and System Integration Testing: Introduction Data flow testing, Data flow graph, Data flow testing criteria, Fundamentals of System Integration: Types of interfaces and interface errors, System integration testing, Software and Hardware integration.	7
5	**System Testing:** System Testing: Taxonomy of system test, Basic Test, Functionality test, Robustness test, Performance test, Scalability test, Stress test, Load and Stability test, Reliability test, Regression test, Documentation Test.	6
6	**Test Cases:** Test Design: Test cases, Necessity of test case documentation, Test case design methods, Functional specification-based test case design, Use case bases, application based test case design, level of test execution.	6

Text Books				
S.No	**Title**	**Edition**	**Authors**	**Publisher**
1	Software Testing and Quality Assurance		Kshirsagar Naik and PriyadarshiniTripathi	Wiley Publication
2	Software Testing Principles, Techniques and Tools		M.G. Limaye	McGraw Hills

Reference Books				
S.No	**Title**	**Edition**	**Authors**	**Publisher**
1	Foundations of Software Testing		Aditya P. Mathur	Pearson Education
2	Software Testing Tools		Dr. K. V. K. K. Prasad	Dream Tech

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs13/preview
2	https://onlinecourses.nptel.ac.in/noc19_cs71/preview

VI Semester

CSE2382 – OE IV: Introduction to Cloud Computing

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Understand Cloud Computing Models. 2. Apply Cloud Concepts &Technologies. 3. Analyse Cloud Services & Platforms 4. Use MapReduce to process Big Data on Apache Hadoop.

Unit No.	Contents	Max. Hrs.
Unit:1	**Introduction to Cloud Computing:** Definition of Cloud Computing, Characteristics of Cloud Computing, Cloud Models (Service & Deployment), Cloud Services Examples (IaaS, PaaS, SaaS), Cloud-based Services and Applications (Cloud computing for Healthcare, Manufacturing Industry and Education).	6 Hours
Unit:2	**Cloud Concepts &Technologies:** Virtualization, Load balancing, Scalability & Elasticity, Monitoring, Identity & Access Management, Service Level Agreements	6 Hours
Unit:3	**Cloud Services & Platforms:** Compute Services (Amazon Elastic Compute Cloud, Google Compute Engine, Windows Azure Virtual Machines), Storage Services (Amazon Simple Storage services, Google Cloud Storage, Windows Azure Storage), Database Services (Amazon Relational Data Store, Google Cloud SQL, Windows Azure SQL Database), Application Services (Application Runtimes & Frameworks) Identity & Access Management Services (Amazon Identity & Access Management, Windows Azure Active Directory), Open Source Private Cloud Software (CloudStack, Eucalyptus, OpenStack).	6 Hours
Unit:4	**Hadoop & MapReduce:** Apache Hadoop, Hadoop MapReduce Job Execution, NameNode, Secondary NameNode, JobTracker, TaskTracker, DataNode, MapReduce Job Execution Workflow, Hadoop Schedulers, Hadoop Cluster Setup.	6 Hours
Unit:5	**Cloud Application Design:** Design Considerations for Cloud Applications, Scalability, Reliability & Availability, Security, IaaS, SaaS Services for Cloud Applications.	6 Hours
Unit :6	**Cloud Security:** Introduction, CSA Cloud Security Architecture, Authentication, Single Sign On (SSO), Authorization.	6 Hours

Text Books				
S.No	**Title**	**Edition**	**Authors**	**Publisher**
1	CLOUD COMPUTING A Hands -on Approach	Latest	Arshdeep Bahga & Vijay Madisetti	Wiley Publication

Reference Books				
S.No	**Title**	**Edition**	**Authors**	**Publisher**
1	CLOUD COMPUTING	**18th edition**	Michael Miller	PEARSON PUBLICATION
2	Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance		Tim Mather, Subra Kumaraswamy, and Shahed Latif	O'Reilly
3	Cloud Computing Bible	Latest	Barrie Sosinsky	John Wiley & Sons

MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2	https://www.simplilearn.com/

VI Semester
CSE2383 – OE IV: Introduction to Web Technology

Course Outcomes:
Upon successful completion of the course the students will be able to 1. Design Web pages using HTML5 2. Build an interactive website with CSS3 3. Develop basic programming skills using JavaScript 4. Create XML documents and Schemas.

Unit No.	Contents	Max. Hrs.
Unit:1	**Introduction to internet:** Overview of Internet, Intranet, WWW, Internet Protocols (HTTP, FTP, SMTP), Email, broadband.	6 Hours
Unit:2	**Introduction to HTML5:** Web server, Web Client/Browser, Structure of an HTML Program, Basic HTML Tags(Headings, Paragraph, Division, Text formatting, Image, Anchors), HTML Lists (Ordered Lists, Unordered Lists, Description Lists), HTML Attributes, HTML Links (Href Attribute, Target Attribute).	6 Hours
Unit:3	**Table handling in HTML and Creating Forms:** Table handling in HTML: width and border attribute, CELLPADDING attribute, CELLSPACING attribute, COLSPAN and ROWSPAN attributes, background color attribute, HTML Forms: Elements to Capturing Form Data, Properties of Form Elements, HTML Layout Elements(Semantic Elements), HTML style attribute, HTML class and id attribute.	6 Hours
Unit:4	**Cascading Style Sheets (CSS3):** Introduction to CSS, Differences between CSS3 and earlier CSS specifications, CSS Syntax, CSS selectors, Inserting CSS: Inline, Internal, External, CSS properties: Background, Text, Font, Border, Margin, Padding, List, Dimension, and Classification.	6 Hours
Unit:5	**Java Script:** Introduction to Java Script, Functions of Javascript, Variables and Data Types, Operators, Loops and control statement: if Statement, if...else Statement, else if Statement, JavaScript Switch Statement, JavaScript Functions, JavaScript Loops: for loop, while loop, do...while loop, Dialog Boxes, JavaScript Events.	6 Hours
Unit :6	**Introduction to XML:** What is XML?, Features of XML, XML Syntax and Structure Rules(Start tags, End tags, Empty elements, XML tag attributes),XML Document Type Declaration(DTD, Internal DTD's, External DTD's.	6 Hours

Text Books

S No	Title	Edition	Authors	Publisher
1	eb Technologies Black Book: HTML, JavaScript, PHP, Java, JSP, XML and AJAX			Kogent Learning Solutions Inc.

Reference Books				
S No	**Title**	**Edition**	**Authors**	**Publisher**
1	HTML & CSS: The Complete Reference	Fifth Edition	Thomas A. Powell	The McGraw-Hill Companies, Inc
2	Web Technologies		Ivan Bayross	BPB Publication

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/106105084
2	https://www.youtube.com/watch?v=uUhOEj4z8Fo
3	https://www.youtube.com/watch?v=mU6anWqZJcc

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University) **(Accredited 'A++' Grade by NAAC with a score of 3.6)**

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

7th Semester

(Department of Computer Science & Engineering

Computer Sciences & Engineering

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester														
1	7	PC	CSE2401	Artificial Intelligence	T	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	CSE2402	Lab: Artificial Intelligence	P	0	0	2	2	1		60	40	
3	7	PC	CSE2403	Cryptography and Network Security	T	3	0	0	3	3	30	20	50	3 Hours
4	7	PE		Professional Elective-III	T	3	0	0	3	3	30	20	50	3 Hours
5	7	PE		Professional Elective-IV	T	3	0	0	3	3	30	20	50	3 Hours
6	7	PE		Lab:Professional Elective-IV	P	0	0	2	2	1		60	40	
7	7	PE		Professional Elective-V	T	3	0	0	3	3	30	20	50	3 Hours
8	7	STR	CSE2409	Mini Project	P	0	0	4	4	2		100		
9	7	STR	CSE2410	CRT	P	0	0	0	0	2		100		
					TOTAL	**15**	**0**	**8**	**23**	**21**				

Professional Electives -III

1	7	PE-III	CSE2411	PE III:Software Project Management
2	7	PE-III	CSE2412	PE III: Adhoc Wireless Network
3	7	PE-III	CSE2413	PE III: Information Retrival System
4	7	PE-III	CSE2414	PE III: Natural Language Processing
5	7	PE-III	CSE2415	PE III: Blockchain Technology

Professional Electives -IV

1	7	PE-IV	CSE2421	PE IV: Cyber Forensic
	7	PE-IV	CSE2422	PE IV: Lab: Cyber Forensic
2	7	PE-IV	CSE2423	PE IV: Machine Learning Techniques
	7	PE-IV	CSE2424	PE IV: Lab: Machine Learning Techniques
3	7	PE-IV	CSE2425	PE IV: Parallel Programming
	7	PE-IV	CSE2426	PE IV: Lab Parallel Programming
4	7	PE-IV	CSE2427	PE IV : Data Mining & Data Warehousing
	7	PE-IV	CSE2428	PE IV : Lab. Data Mining & Data Warehousing
5	7	PE-IV	CSE2429	PE IV : Java FullStack
	7	PE-IV	CSE2430	PE IV : Lab. Java FullStack
6	7	PE-IV	CSE2431	PE IV : Dot Net FullStack
	7	PE-IV	CSE2432	PE IV : Lab. Dot Net FullStack

Professional Electives -V

1	7	PE-V	CSE2441	PE V: Cloud Computing
2	7	PE-V	CSE2442	PE V: Distributed System
3	7	PE-V	CSE2443	PE V: Human Computer Interaction
4	7	PE-V	CSE2444	PE V: Real Time System
5	7	PE-V	CSE2445	PE V: Big Data Analytics

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	Dean (Acad. Matters)	Date of Release	Version

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No.
CSE-202.1

B.TECH SCHEME OF EXAMINATION 2020-21

(Scheme of Examination w.e.f. 2022-23 onward)

Computer Science & Engineering

SN	Sem	Type	Course Code	Course Name	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
						L	T	P	Hrs		MSEs*	TA**	ESE	
Eigth Semester														
1	8	STR	CSE2451	Major Project	P	0	0	12	12	9		60	40	
2	8	STR	CSE2452	Extra Curricular Activity Evaluation	P	0	0	0	0	1		100		
				TOTAL		**0**	**0**	**12**	**12**	**10**				
				GRAND TOTAL		**83**	**0**	**46**	**129**	**160**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.01**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Semester VII

CSE2401	Artificial Intelligence			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA		Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Understand and apply suitable Intelligent agents for various AI applications
2. Build smart system using different informed search / uninformed search or heuristic approaches
3. Solve various constraint satisfaction problem and game playing techniques.
4. Implement ideas underlying modern logical inference systems to solve AI problems.
5. To understand the knowledge representation and under uncertainty.

Unit:1	Introduction to AI	6 Hours

Introduction to Artificial Intelligence, History of Artificial Intelligence, Strong AI Weak AI, Task domain of AI, Intelligent Agents, Agents and Environments, Good Behavior: Concept of Rationality, Nature of Environments, Structure of Agents.

Unit:2	Search Techniques	7 Hours

Solving Problems by Searching, Problem-Solving Agents, Example Problems, Search Algorithms, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions, Search in Complex Environments, Local Search and Optimization Problems.

Unit:3	Adversarial Search	7 Hours

Game Theory, Optimal Decisions in Games, The Mini-Max algorithm, Alpha–Beta Pruning, Partially Observable Games, Limitations of Game Search Algorithms, Constraint Satisfaction Problems (CSP), Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs.

Unit:4	Knowledge Representation	6 Hours

Knowledge Based Agents, Logic, Propositional Logic: Inference, Equivalence, Validity and Satisfiability, Resolution, Forward and Backward Chaining, First Order Logic: Models for first order logic, Symbols and Interpretations, complex sentences, Quantifiers, Inference in FOL, Unification, Forward Chaining, Backward Chaining, Resolution.

Unit:5	Planning	6 Hours

Planning, Language of planning problems, Algorithm for planning as state-space search, Planning graph, Planning and acting in the real world-Time, Schedules and Resources, Hierarchical planning, Planning and

acting in Nondeterministic Domains.		
Unit :6	**Uncertainty**	**7 Hours**
Uncertainty, Handing uncertain knowledge, rational decisions, basics of probability, axioms of probability, inference using full joint distributions, independence, Baye's Rule and conditional independence, Bayesian networks, Semantics of Bayesian networks, Exact inference in Bayesian Networks.		
Total Lecture Hours		**39 Hours**

Textbooks	
1	Artificial Intelligence A Modern Approach, Stuart Russell,Peter Norvig, Pearson
2	Artificial Intelligence, Third edition, by E. Richand K. Knight and S. Nair, McGraw Hill
Reference Books	
1	Introduction to Artificial Intelligence and Expert System, D. W. Patterson, PHI
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_ge20/preview
2	https://onlinecourses.nptel.ac.in/noc22_cs67/preview

Semester VII

CSE2402	LAB – Artificial Intelligence		L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME						
MSPA – I	MSPA –II	MSPA – III	MSPA – IV	ESE	TOTAL	ESE DURATION
15	15	15	15	40	100	--

Sr. No.	Experiments based on
1	To implement 8-puzzle problem using uniformed searching technique: Depth First Search
2	To implement Missionaries and cannibal Problem using uniformed searching technique: Breath First Search
3	To implement Heuristic (Steepest Ascent) Search for Tic-Tac-Toe game problem.
4	To implement Min-Max Algorithm for game solving.
5	To implement Best First Search for Travelling Salesman Problem.
6	To implement A* Algorithm for Travelling Salesman Problem and compare it with Best First Search.
7	To implement 8 Queens Problem.
8	To implement Resolution theorem (Negation).
9	To implement Naïve Bayes Classifiers.
10	To implement and demonstrate Bayesian network using pgmpy.

Semester VII

CSE2403	Cryptography and Network Security			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Understand the security threats aimed at computer network and describe various security mechanisms and services to counter them.
2. Study cryptographic mathematics to solve network security problems.
3. Study of various cryptographic algorithms
4. Understand different security protocols at various layers of network model

Unit:1	Introduction to cryptography	6 Hours

Introduction: Security goals, cryptographic attacks, Services and mechanism, techniques. Mathematics of cryptography: Integer arithmetic, modular arithmetic, matrices, linear congruence. Mathematics of symmetric key cryptography: Algebraic structure, GF(2^n) Fields.

Unit:2	Ciphers	6 Hours

Traditional symmetric key ciphers: Introduction, substitution ciphers, Transposition ciphers, stream and block ciphers. Introduction to modern symmetric-key ciphers: Modern block ciphers, modern stream ciphers.

Unit:3	Encipherment	7 Hours

DES, AES, Encipherment using modern symmetric key ciphers: Use of modern block ciphers, use of stream ciphers: RC4. Mathematics of asymmetric key cryptography: Primes, primality testing, factorization, Chinese remainder theorem, Quadratic congruence, Exponentiation and logarithms. Asymmetric key cryptography: RSA, ElGamal, Diffie Helman- key Exchange.

Unit:4	Integrity and Authentication	7 Hours

Message integrity and authentication: Message integrity, Random oracle model, message authentication. Cryptographic hash functions: Introduction, Description of MD hash family, Whirlpool, SHA-512. Digital signature: Comparison, process, services, attacks on digital signature, Digital signature schemes. Entity authentication: Introduction, passwords, Challenge-Response, Zero knowledge, Biometric. Key management: Symmetric key distribution, Kerberos, symmetric key agreement, Public key distribution.

Unit:5	Security	7 Hours

Security at application layer : E-mail, PGP, S/MIME. Security at transport layer: SSL architecture, four protocols, SSL message formats, Transport layer security. Security at network layer IPSec : Two modes, two security protocols, security association, security policy, Internet key exchange, ISAKMP

Unit :6	Trusted Systems	6 Hours
System security: Description of the system, Users, Trust and trusted systems, Buffer overflow and malicious software, malicious programs, worms, viruses, Intrusion detection systems, Firewalls: Definitions, construction and working principles		
Total Lecture Hours		**39 Hours**

Textbooks	
1	Cryptography and Network Security, by Behrouz A.Forouzan, and Debdeep Mukhopadhyay, McGraw-Hill Publication.,2nd Edition.
Reference Books	
1	Cryptography and Network Security by Atul Kahate, fourth edition, McGraw-Hill Publication.
2	Cryptography And Network Security Principles And Practice ,Fifth Edition, WILLIAM STALLINGS
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/e-copies%20of%20books/7.Information%20Technology/39.Guide%20to%20computer%20network%20security.pdf
2	http://103.152.199.179/YCCE/e-copies%20of%20books/7.Information%20Technology/11.2010_Book_UnderstandingCryptography.pdf
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs16/preview
2	https://onlinecourses.nptel.ac.in/noc22_cs03/preview

Semester VII

CSE2411 - PE III	Software Project Management			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. To understand basic concepts about project, project management and project planning.
2. To assess given requirements and perform cost benefit analysis.
3. To create a project schedule using some network planning model for given requirements.
4. To identify and create a risk management plan for given requirements.
5. To perform earned value analysis for given requirements and current completion state of project.
6. To form teams for any given exercise, work as a team and understand leadership qualities.

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Unit:1	Introduction	8 Hours

Introduction to Software Project Management: Project Definition, Contract Management, Activities Covered By Software Project Management, Overview of Project Planning, Stepwise Project Planning.

Unit:2	Evaluation & Assessment	7 Hours

Project Evaluation: Strategic Assessment, Technical Assessment, Cost Benefit Analysis, Cash Flow Forecasting, Cost Benefit Evaluation Techniques, Risk Evaluation.

Unit:3	Planning	7 Hours

Activity Planning: Objectives, Project Schedule, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass, Backward Pass, Activity Float, Shortening Project Duration, Activity on Arrow Networks.

Unit:4	Risk Management	6 Hours

Risk Management: Risk Management, Nature Of Risk, Types Of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning And Control.

Unit:5	Monitoring	6 Hours

Monitoring and Control: Creating Framework , Collecting The Data , Visualizing Progress, Cost Monitoring, Earned Value, Prioritizing Monitoring, Getting Project Back To Target, Change Control, Managing Contracts, Introduction, Types Of Contract, Stages In Contract Placement, Typical Terms of A Contract, Contract Management, Acceptance.

Unit :6	Decision Making	6 Hours
Managing People and Organizing Teams: Introduction, Understanding Behavior, Organizational Behaviour: A Background, Selecting The Right Person For The Job, Instruction In The Best Methods , Motivation, The Oldman – Hackman Job Characteristics Model, Working In Groups– Becoming A Team, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety.		
Total Lecture Hours		**38 Hours**

Textbooks	
1	Software Project Management, Third Edition, Bob Hughes, Mikecotterell, Tata McGraw Hill.
2	Software Project Management, Royce, Pearson Education
Reference Books	
1	Software Project Manangement in Practive, Jalote, Pearson Education
2	Managing Global Projects, Ramesh, Gopalaswamy, Tata McGraw Hill.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Science%20and%20Engineering/
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc22_cs107/preview
2	https://nptel.ac.in/courses/112102106

Semester VII

CSE2412 - PE III	Adhoc Wireless Network			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Identify the characteristics and features of Adhoc Networks.
2. Understand the concepts & be able to design MAC protocols for Ad Hoc networks
3. Implement protocols / Carry out simulation of routing protocols of Adhoc Networks
4. Interpret the flow control in transport layer of Ad Hoc Networks
5. Analyze security principles for routing of Ad Hoc Networks

Unit:1	Introduction	7 Hours

INTRODUCTION: Introduction to ad-hoc networks – definition, characteristics features, applications. Characteristics of wireless channel, ad-hoc mobility models: indoor and outdoor models.

Unit:2	MAC Protocols	7 Hours

MAC Protocols: Design issues, goals and classification. Contention based protocols – with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

Unit:3	Routing	7 Hours

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, energy aware routing algorithm, hierarchical routing, QoS aware routing.

Unit:4	Transport Layer	6 Hours

Transport Layer: Issues in designing – Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

Unit:5	Cross layer Design	6 Hours

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of adhoc with Mobile IP networks.

Unit :6	Security	6 Hours

Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in

security provisioning, Leadership.	
Total Lecture Hours	**39 Hours**
Textbooks	
1	Ad Hoc Wireless Networks: Architectures and Protocols, 2004, C. Siva Ram Murthy and B. S. Manoj, Prentice Hall
2	Ad hoc Networking, 2000, Charles E. Perkins, Addison – Wesley.
Reference Books	
1	Protocols and Architectures for Wireless Sensor Networks, H. Karl and A. Willig. John, Wiley & Sons
2	Wireless Sensor Networks: Technology, Protocols, and Applications, K. Sohraby, D. Minoli, and T. Znati. John, Wiley & Sons
3	Wireless Sensor Networks, C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Springer Verlag
4	Wireless Sensor Networks: Architectures and Protocols, E. H. Callaway, Jr. AUERBACH
5	Networking Wireless Sensors, B. Krishnamachari, Cambridge University Press
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1	https://archive.nptel.ac.in/courses/106/105/106105160/
2	https://onlinecourses-archive.nptel.ac.in/noc18_cs09/preview

Semester VII

CSE2413 - PE III	Information Retrieval System			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Understand different Information retrieval models.
2. Know about evaluation methods of the information retrieval model.
3. 3. Know the challenges associated with each topic

Unit:1	Introduction to Information retrieval	7 Hours

Introduction to Information retrieval: Information retrieval process, Indexing, Information retrieval model, Boolean retrieval model Dictionary and Postings: Tokenization, Stop words, Stemming, Inverted, index, Skip pointers, Phrase queries

Unit:2	Tolerant Retrieval	7 Hours

Tolerant Retrieval : Wild card queries, Permuterm index, Bigram index, Spelling correction, Edit distance, Jaccard coefficient, Soundex

Term Weighting and Vector Space Model: Wild card queries, Permuterm index, Bigram index, Spelling correction, Edit distance, Jaccard coefficient, Soundex.

Unit:3	Evaluation	7 Hours

Evaluation: Precision, Recall, F-measure, E-measure, Normalized recall, Evaluation problems

Latent Semantic Indexing: Eigen vectors, Singular value decomposition, Low rank approximation, Problems with Lexical Semantics.

Unit:4	Query Expansion	6 Hours

Query Expansion : Relevance feedback, Rocchio algorithm, Probabilistic relevance feedback, Query Expansion and its types, Query drift

Probabilistic Information Retrieval: Probabilistic relevance feedback, Probability ranking principle, Binary Independence Model, Bayesian network for text retrieval

Unit:5	XML Indexing and Search	6 Hours

XML Indexing and Search: Data vs. Text-centric XML, Text-Centric XML retrieval, Structural terms.

Unit :6	Web Information Retrieval	6 Hours

Web Information Retrieval Hypertext, web crawling, search engines, ranking, link analysis, PageRank, HITS.	
Total Lecture Hours	**39 Hours**
Textbooks	
1	Introduction to Information Retrieval , Christopher D. Manning, Raghavan and Schutze, Cambridge University Press,2008
Reference Books	
1	Natural Language Processing And Information Retrieval, Tanveer Siddiqui and U. S. Tiwary, Oxford Higher Education,2008
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1	https://cse.iitkgp.ac.in/~pabitra/course/ir06/ir06.html
2	https://cse.iitk.ac.in/pages/CS657.html

Semester VII

CSE2414 - PE III	Natural Language Processing			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Model linguistic phenomena with formal grammars.
2. Design, implement and test algorithms for NLP problems
3. Apply NLP techniques to design real world NLP applications

Unit:1	Introduction to NLP	5 Hours

Introduction, History of NLP, Generic NLP system, levels of NLP , Knowledge in language processing , Ambiguity in Natural language, stages in NLP, challenges of NLP, Applications of NLP.

Unit:2	Morphology	7 Hours

Morphology fundamentals, Morphological Diversity of Indian Languages, Morphology Paradigms, Shallow Parsing, Named Entities, Maximum Entropy Models, Random Fields. Word Level Analysis, Morphology analysis –survey of English and Indian language Morphology, Inflectional morphology & Derivational morphology, Lemmatization, Regular expression, finite automata, finite state transducers (FST) ,Morphological parsing with FST , Lexicon free FST Porter stemmer. N –Grams- N-gram language model, N-gram for spelling correction.

Unit:3	Parsing	7 Hours

Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents, Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.

Unit:4	Semantic & Lexical Analysis	7 Hours

Meaning : Lexical Knowledge Networks, Wordnet Theory, Indian Language Wordnets and Multilingual Dictionaries, Semantic Roles, Word Sense Disambiguation, WSD and Multilinguality
Semantic Analysis: Lexical Semantics, Attachment for fragment of English- sentences, noun phrases, Verb phrases, prepositional phrases, Relations among lexemes & their senses –Homonymy, Polysemy, Synonymy, Hyponymy, Robust Word Sense Disambiguation (WSD), Dictionary based approach.

Unit:5	Pragmatics Discourse	7 Hours

Pragmatics Discourse, Co-references, reference resolution, reference phenomenon, syntactic & semantic

constraints on co reference.		
Unit :6	**NLP Applications**	**7 Hours**
Natural language Processing applications (preferably for Indian regional languages) : Sentiment Analysis, Text Entailment, Robust and Scalable Machine Translation, Question Answering in Multilingual Setting, Cross Lingual Information Retrieval (CLIR).		
Total Lecture Hours		**40 Hours**

Textbooks	
1	Jurafsky, Daniel, and James H. Martin, Speech and Language Processing:An Introduction to Natural Language Processing, Speech Recognition, and Computational Linguistics, PrenticeHall, 2000.
2	Christopher D. Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing. Cambridge, MIT Press, 1999.
Reference Books	
1	James Allen, Natural Language Understanding, Benjamin/Cummings, 2ed, 1995.
2	Eugene Charniak, Statistical Language Learning, MIT Press, 1996.
3	Martin Atkinson, David Britain, Harald Clahsen, Andrew Redford, Linguistics, Cambridge University Press, 1999.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/e-copies%20of%20books/7.Information%20Technology/54.NLP_Language_processing_jurafsky_BOOK.pdf
MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/106101007
2	https://onlinecourses.nptel.ac.in/noc22_cs98/preview

Semester VII

CSE2415- PE III	PE III: Blockchain Technology			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Conceptual understanding of how blockchain technology can be used to innovate and improve business processes.
2. Apply cryptographic hash required for blockchain.
3. Apply the concepts of smart contracts for an application.
4. Design a public blockchain using Ethereum.
5. Design a private blockchain using Hyperledger.
6. Use different types of tools for blockchain applications.

Unit:1	Introduction to Block chain	6 Hours

What is a blockchain, Origin of blockchain (cryptographically secure hash functions), Foundation of blockchain: Merkle trees , Components of blockchain, Block in blockchain, Types: Public, Private, and Consortium, Consensus Protocol, Limitations and Challenges of blockchain

Unit:2	Cryptocurrency & Bitcoin blockchain	7 Hours

Cryptocurrency: Cryptocurrency: Bitcoin, Altcoin, and Tokens (Utility and Security), Cryptocurrency wallets: Hot and cold wallets, Cryptocurrency usage, Transactions in Blockchain, UTXO and double spending problem.

Bitcoin blockchain: Consensus in Bitcoin, Proof-of-Work (PoW), Proof-of-Burn (PoB), Proof-of-Stake (PoS), and Proof-of-Elapsed Time (PoET), Life of a miner, Mining difficulty, Mining pool and its methods

Unit:3	Programming for Blockchain & Introduction to Programming	6 Hours

Programming for Blockchain: Introduction to Smart Contracts, Types of Smart Contracts, Structure of a Smart Contract, Smart Contract Approaches, Limitations of Smart Contracts.

Introduction to Programming: Solidity Programming – Basics, functions, Visibility and Activity Qualifiers, Address and Address Payable, Bytes and Enums, Arrays-Fixed and Dynamic Arrays, Special Arrays-Bytes and strings, Struct, Mapping, Inheritance, Error handling.

Unit:4	Public Blockchain	6 Hours

Introduction to Public Blockchain, Ethereum and its Components, Mining in Ethereum, Ethereum Virtual Machine (EVM), Transaction, Accounts, Architecture and Workflow, Comparison between Bitcoin and Ethereum . Types of test-networks used in Ethereum, Transferring Ethers using Metamask, Mist Wallet,

Ethereum frameworks.		
Unit:5	**Private Blockchain**	**7 Hours**
Introduction, Key characteristics, Need of Private Blockchain, Smart Contract in Private Environment, State Machine Replication, Consensus Algorithms for Private Blockchain - PAXOS and RAFT, Byzantine Faults: Byzantine Fault Tolerant (BFT) and Practical BFT. Introduction to Hyperledger, Tools and Frameworks, Comparison between Hyperledger Fabric & Other Technologies. Hyperledger Fabric Architecture, Components of Hyperledger Fabric: MSP, Chain Codes, Transaction Flow, Working of Hyperledger Fabric, Creating Hyperledger Network		
Unit :6	**Tools and Applications of Blockchain**	**6 Hours**
Corda, Ripple, Quorum and other Emerging Blockchain Platforms, Blockchain in DeFi: Case Study on any of the Blockchain Platforms.		
Total Lecture Hours		**38 Hours**

Textbooks	
1	Blockchain Technology, Chandramouli Subramanian, Asha A. George, Abhillash K. A and Meena Karthikeyen Universities Press
2	Mastering Ethereum, Building Smart Contract and Dapps, Andreas M. Antonopoulos Dr. Gavin Wood, O'reilly
Reference Books	
1	Blockchain for Beginners, Yathish R and Tejaswini N, SPD
2	Blockchain with Hyperledger Fabric, Luc Desrosiers, Nitin Gaur, Salman A. Baset, Venkatraman Ramakrishna Packet Publishing
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Science%20and%20Engineering/
MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/106105235
2	https://onlinecourses.nptel.ac.in/noc22_cs44/preview

Semester VII

CSE2421 - PE IV	Cyber Forensic			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Investigate hardware parts of a computer system for evidences
2. Use different tools for data acquisition and duplication for forensic study
3. Securely store data and evidence collected
4. Create report of forensic investigation made

Unit:1	Introduction	6 Hours

Types of Cyber Crime, Security Attacks, Overview of computer forensics in today's world, computer hardware basics, Computer forensics investigation process, understanding hard disks and file systems, Types of computer forensics.

Unit:2	Computer Forensic	6 Hours

Computer forensic: Data acquisition and duplication, defeating anti-forensics techniques, operating system forensics, Log analysis and event viewer, File auditing, identifying rogue machines, Malware forensic Database forensic.

Unit:3	IT Fraud	6 Hours

IT fraud, Recovery of deleted files, Live Data collection and investigating Linux environment. Password recovery (tools like John the ripper, L0phtcrack, and THC-Hydra), email crimes.

Unit:4	Network Forensics	6 Hours

Network forensics, investigating web attacks, Gathering Tools to create a response toolkit. Hidden files and unauthorized access points. Analyzing network traffic, Sniffers Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap, Netscan etc.

Unit:5	Mobile Forensics	6 Hours

Mobile Forensics, Live Data collection and investigating on android, ios, windows environment, Investigating report generation, investigation process, acquisition types, tools, report generation

Unit :6	Case Studies	6 Hours

Forensics report writing and presentation, Case studies	
Total Lecture Hours	**36 Hours**
Textbooks	
1	Incident Response & Computer Forensics, Second, Mandia, K., Prosise, C., Pepe, M., Tata-McGraw Hill
2	Guide to Computer Forensics and Investigations, Bill Nelson, Amelia Phillips, Frank Enfinger, and Chris Steuart, Thomson Learning
Reference Books	
1	File System Forensic Analysis, Brian Carrier, Wesley
2	Digital Evidence and Computer Crime, Eoghan Casey, Academic Press
3	Windows Forensic Analysis DVD Toolkit (Book with DVD-ROM), Harlan Carvey, Syngress Publication
4	EnCE: The Official EnCase Certified Examiner Study Guide, Steve Bunting, Sybex Publication
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Technology/41-Introductory%20Computer%20%20Forensics.pdf
MOOCs Links and additional reading, learning, video material	
1	Cyber Security and Cyber Forensics (cdac.in)
2	https://onlinecourses.swayam2.ac.in/cec20_lb06/preview

Semester VII

CSE2422 - PE IV	Lab. : Cyber Forensic		L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME						
MSPA – I	MSPA –II	MSPA – III	MSPA – IV	ESE	TOTAL	ESE DURATION
15	15	15	15	40	100	--

Sr. No.	Experiments based on
1	Study practical on cyber-crime and generation of Hash values on file system
2	Perform data accusation and imaging on digital evidences
3	Perform recovery and data carving on digital evidence
4	Explore and analyses tools on Email analysis an investigation
5	Password recovery tools, from RAR, DOC, PDF, windows password
6	Mobile forensics SIM card analysis
7	Mobile data Analysis

Semester VII

CSE2423 - PE IV	Machine Learning Techniques			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

After undergoing the course, student will be able to:

1. Understand various supervised machine learning algorithms
2. Understand various unsupervised machine learning algorithms
3. apply supervised and unsupervised learning on the given set of samples and design the model to accomplish the given task.
4. understand various performance evaluation measures for supervised and unsupervised learning

Unit:1	Introduction to machine learning	6 Hours

Overview of Machine Learning, Types of Machine Learning: Supervised, Unsupervised, Reinforcement learning, Classification, Regression, Supervised and Unsupervised Learning, Learning Associations, Machine Learning Workflow, Examples of Machine Learning Applications.

Unit:2	Supervised Learning-1	6 Hours

Linear and polynomial regression, classification with k-Nearest Neighbours, Naive Bayes Classifiers, Decision Trees, Generalization, logistic regression, bias and variance,Overfitting, and Underfitting

Unit:3	Supervised Learning-2	6 Hours

Random forests, Kernelized Support Vector Machines, Uncertainty in Multiclass Classification, feature engineering and selection, evaluation metrics for supervised learning

Unit:4	Unsupervised Learning	6 Hours

k-Means Clustering , Choosing the Number of Clusters, Semi-Supervised Learning , Introduction to Principle Component Analysis, evaluation metrics for unsupervised learning

Unit:5	Design and Analysis of Machine Learning Experiments	6 Hours

Factors, Response, and Strategy of Experimentation, Randomization, Hypothesis testing, Replication, and Blocking, Guidelines for Machine Learning Experiments , Cross-Validation and Resampling Methods, K-Fold Cross-Validation, Comparing Two Classification Algorithms.

Unit :6	Advances in Machine Learning	6 Hours

Introduction to learning using Neural networks, types of artificial neuron and activation functions, Feedforward vs. Recurrent networks, multi-layer feedforward networks, Introduction to deep learning, deep learning frameworks.

Total Lecture Hours	36 Hours

Textbooks

1	Introduction to Machine Learning", Ethem Alpaydin, The MIT Press, second edition
2	Deep learning:Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning (http://www.deeplearningbook.org/)
Reference Books	
1	Machine Learning", Tom Mitchell, McGraw-Hill Science/Engineering/Math, 1997
2	Introduction to Machine Learning with Python, A Guide for Data Scientists Andreas C. Müller and Sarah Guido ORIELLY
3	Christopher M. Bishop, Pattern Recognition and Machine Learning. http://research.microsoft.com/enus/um/people/cmbishop/prml/.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/e-copies%20of%20books/7.Information%20Technology/60.Introduction_to_Machine_Learning_-_2e_-_Ethem_Alpaydin.pdf
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs24/preview
2	https://onlinecourses.nptel.ac.in/noc21_cs85/preview

Semester VII

CSE2424 - PE IV			Lab. : Machine Learning Techniques		L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME								
MSPA – I	MSPA –II	MSPA – III	MSPA – IV	ESE	TOTAL	ESE DURATION		
15	15	15	15	50	100	--		

Sr. No.	Experiments based on
1	a) Linear regression using linear least squares fit method b) Linear regression with Ordinary least squares method using ML Library
2	Implementing linear classifier using Linear discriminant function
3	Implementing polynomial regression
4	Program for Classification using KNN algorithm
5	Implementing KNN for regression
6	Implementing Naïve Bayes Classifier
7	Decision Trees using Scikit-learn
8	Implementing SVM Classifier
9	Implementing K-means clustering
10	Dimensionality reduction using Principal Component Analysis
11	Implementing a feed forward Neural Network based estimation using Scikit learn
12	Experiment on classification using Pre-trained deep network

Semester VII

CSE2425 - PE IV	Parallel programming			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1.Strengthen understanding of parallel programming
2.Understand challenges in efficient execution of large-scale parallel applications
3.Massive parallelism entails significant hardware and software challenges
4.Implement research-based project component

Unit:1	Introduction	6 Hours

Introduction: Why parallel computing? Shared memory and distributed memory parallelism, Amdahl's law, speedup and efficiency, supercomputers.
Message Passing : MPI basics, point-to-point communication, collective communication, synchronous/asynchronous send/recv, algorithms for gather, scatter, broadcast, reduce

Unit:2	Parallel Communication	6 Hours

Network topologies, network evaluation metrics, communication cost, routing in interconnection networks, static and adaptive routing, process-to-processor mapping.

Unit:3	Performance	6 Hours

Scalability, benchmarking, performance modeling, impact of network topologies, parallel code analysis and profiling.

Unit:4	Designing Parallel Codes	6 Hours

Domain decomposition, communication-to-computation ratio, load balancing, adaptivity, case studies: weather and material simulation codes

Unit:5	Parallel I/O	6 Hours

MPI I/O algorithms, contemporary large-scale I/O architecture, I/O bottlenecks, Job scheduling, RDMA, one-sided communication, NVM, extreme scale computing: issues and trends.

Unit :6	Parallel Algorithms: Basic Principles	6 Hours

Principles of Parallel Algorithm Design, Basic Communication Operations, Analytical Modeling of Parallel Programs

Total Lecture Hours	36 Hours

Textbooks	
1	Peter S Pacheco, An Introduction to Parallel Programming, Morgan Kaufmann, 2011.
2	DE Culler, A Gupta and JP Singh, Parallel Computer Architecture: A Hardware/Software Approach Morgan-Kaufmann, 1998.
3	Marc Snir, Steve W. Otto, Steven Huss-Lederman, David W. Walker and Jack Dongarra, MPI - The Complete Reference, Second Edition, Volume 1, The MPI Core.
4	William Gropp, Ewing Lusk, Anthony Skjellum, Using MPI : portable parallel programming with the message-passing interface, 3rd Ed., Cambridge MIT Press, 2014
Reference Books	
1	JL Hennessy and DA Patterson, Computer Architecture: A Quantitative Approach, 4th Ed., Morgan Kaufmann/Els India, 2006.
2	MJ Quinn, Parallel Computing: Theory and Practice, Tata McGraw Hill, 2002.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Technology/26-2018_Book_IntroductionToParallelComputin.pdf
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_ge20/preview
2	https://onlinecourses.nptel.ac.in/noc22_cs67/preview

Semester VII

CSE2426 - PE IV			Lab. : Parallel programming		L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME								
MSPA – I	MSPA –II	MSPA – III	MSPA – IV	ESE	TOTAL	ESE DURATION		
15	15	15	15	40	100	--		

Practical's based on above Syllabus.

Semester VII

CSE2427 - PE IV	Data Mining & Data Warehousing			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	40	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Understand the functionality of the various data warehousing and data mining components
2. Apply data mining algorithms on sample datasets and analyze the results.
3. Explore recent trends in data mining.
4. Explore Data mining tool/s and emphasize hands-on experience working with all real data sets

Unit:1	Data Warehousing and Business Analysis	5 Hours

Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online
Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.

Unit:2	Data Mining Introduction	6 Hours

Introduction to data mining, Process of data mining, Data Mining Functionalities, Data Pre-processing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation, Classification of Data Mining systems, Data Mining Task primitives, Major issues in Data Mining, Applications of Data Mining

Unit:3	Mining Frequent Patterns and Association Rules	6 Hours

Market Basket Analysis, Frequent Item sets and Association rules, A Priori Algorithm, Improving the efficiency of A priori, FP- growth Algorithm

Unit:4	Classification and prediction	7 Hours

Classification: Introduction, decision tree, building a decision tree- the tree induction algorithm, split algorithm based on information theory, gini index, over fitting and pruning, Bayesian Classification – Rule Based Classification –Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods.

Unit:5	Clustering	6 Hours

Types of data in cluster analysis, Categorization of major clustering methods:
Partitioning methods, Hierarchical methods, Applications of clustering.

Unit :6	Mining Object, Spatial, Multimedia, Text and Web Data	6 Hours

– Mining the World Wide Web, Text Mining, Spatial Data Mining ,Multimedia Data Mining.	
Total Lecture Hours	36 Hours
Textbooks	
1	Data Mining – Concepts and Techniques, Jiawei Han & Micheline Kamber, Morgan Kaufmann
3	Introduction to Data mining, Pang-ning Tan, Michael Steinbach, Vipin Kumar, Pearson
Reference Books	
1	Data Mining Techniques, Arun K Pujari, University Press
2	Data Warehousing, Data Mining & OLAP - Alex Berson and Stephen J. Smith, Tata McGraw – Hill Edition, 2007.
3	Data Warehousing In the Real World, Sam Anahory & Dennis Murray, Pearson
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2	https://nptel.ac.in/courses/106105174

Semester VII

CSE2428 - PE IV: Lab			Data Mining & Data Warehousing		L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME								
MSPA – I	MSPA –II	MSPA – III	MSPA – IV	ESE	TOTAL	ESE DURATION		
15	15	15	15	40	100	--		

Sr. No.	Experiments based on
1	Explore machine learning tool "WEKA"
2	Perform data preprocessing tasks on given data sets
3	Demonstrate performing association rule mining on data sets
4	Demonstrate performing classification on data sets
5	Demonstrate performing clustering of data sets
6	Demonstrate knowledge flow application on data sets- i. Develop a knowledge flow layout for finding strong association rules by using Apriori, FP Growth algorithms ii. Set up the knowledge flow to load an ARFF (batch mode) and perform a cross validation using J48 algorithm

Semester VII

CSE2429 - PE IV	PE IV : Java Full Stack Development			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

CO 1: Understand the core, advance java, cloud and virtualization concepts.
CO 2: Apply the concepts for full stack development.
CO 3: Design different web applications using UI components and Spring framework.
CO 4: Develop fully functional web applications using different frameworks and tools.
CO 5: Implementation of web application using different tools.

Unit:1	**Java Basics**	**6 Hours**
OOP Concepts, Data Structures, Collection Framework, File handling, JDBC, Introduction to JUnit		
Unit:2	**Advance Java Features**	**6 Hours**
Introduction to Java 8 Features, Interface Enhancements, Functional Interfaces, Lambda Expression, ForEach , Method References, Streams API, JavaDocs		
Unit:3	**User Interface Design**	**6 Hours**
Building Responsive Web Pages HTML5, CSS3 and JavaScript, Basic Single Page Applications Using Angular OR React		
Unit:4	**Spring Framework**	**7 Hours**
Working with Spring Core, Dependency Injection, Spring MVC,Spring Boot, Introduction to Hibernate and Spring Microservices		
Unit:5	**Cloud and Virtualization**	**7 Hours**
Virtualization Basics, Introduction to Cloud, RDB Cloud Fundamentals (SaaS, Paas, IaaS), Introduction to AWS (S3 Buckets, RDS), AWS Cloudfront		
Unit :6	**Full Stack Development Tools**	**7 Hours**
Introduction to Maven,Jacoco, SonarLint,Jira, Swagger,Mockito,Docker, Gitrunner		
Total Lecture Hours		**39 Hours**

Textbooks

1	The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Developer, Chris Northwood, first Edition, Apress Publication First Edition

2	Full Stack Web Development For Beginners: Learn Ecommerce Web Development using HTML5,CSS3,Bootstrap, JavaScript,MySQL and PHP, Riaz Ahmed, Amazon Digital Services ,First Edition
Reference Books	
1	Full Stack Java Development with Spring MVC, Hibernate, jQuery, and Bootstrap , Mayur Ramgir Wiley Publication, First Edition
2	Java for Web Development: Create Full-Stack Java Applications with Servlets, JSP Pages, MVC Pattern and Database Connectivity, Sarika Agarwal and Vivek Gupta ,BPB Publication, First Edition
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Science%20and%20Engineering/javabook.pdf
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Science%20and%20Engineering/JavaScript%20Programmer's %20Reference.pdf
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2	https://nptel.ac.in/courses/106105167

Semester VII

CSE2430 - PE IV			Lab. : Java Full Stack Development		L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME								
MSPA – I	MSPA –II	MSPA – III	MSPA – IV	ESE	TOTAL	ESE DURATION		
15	15	15	15	50	100	--		

Sr. No.	Experiments based on
1	Practical based on Collection
2	Practical based on File Handling
3	Practical based on JDBC
4	Practical based on Junit
5	Practical based on Java 8 features
6	Practical based on Streams API
7	Practical based on User Interface Design
8	Practical based on Spring Microservices
9	Web Application Development
10	Web Application Development

Semester VII

CSE2431 - PE IV	PE IV : .Net Full Stack Development			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

After undergoing the course, student will be able to:

1. Understand the concept of .NET full Stack Development using using C#, ASP, MVC Controller.
2. Apply the Concept in .NET full stack development.
3. Design various applications using .NET framework.

Unit:1	**Introduction .NET**	**6 Hours**
Introduction .NET, application and structure of application, Object Oriented Programming Concept in C#, Exceptional Handling, Delegates and Events		
Unit:2	**Introduction to Database**	**6 Hours**
LINQ, SQL Sever, DataBase Object introduction, Sql, Triggers		
Unit:3	**Introduction to Frontend**	**6 Hours**
ADO.NET, HTML, CSS, UI and Front End, Java Script		
Unit:4	**MVC**	**7 Hours**
What is MVC, components, Interaction among components, Program.cs and StartUp.cs file, Configure Services and Configure Methods, Middleware components, Model View Controllers, Creating first app in MVC		
Unit:5	**Implemention Data Validation**	**7 Hours**
Implementing data validation, annonations and Validation Summary and Exception handling mechanims in MVC, what is API, create project, test API, API Controllers, configure Web API,routing, parameter binding		
Unit :6	**DevOps**	**7 Hours**
Introduction to Coding Principle, DevOps, Docker		
Total Lecture Hours		**39 Hours**

Textbooks

1	ASP.NET Core 3 and Angular 9: Full stack web development with .NET Core 3.1 and Angular 9, 3rd Edition Third by Valerio De Sanctis
2	The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern

	Full Stack Web Developer by Chris Northwood
Reference Books	
1	Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker by Frank Zammetti
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Science%20and%20Engineering/dotNET_Tutorial_for_Beginners.pdf
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Science%20and%20Engineering/JavaScript%20Programmer's%20Reference.pdf

Semester VII

CSE2432 - PE IV			Lab. : .Net Full Stack Development		L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME								
MSPA – I	MSPA –II	MSPA – III	MSPA – IV	ESE	TOTAL	ESE DURATION		
15	15	15	15	50	100	--		

Sr. No.	Experiments based on
1	Program Based on object oriented programming concepts in C#
2	Program Based on Exceptional Handling
3	Program Based on Delegates and Events
4	Program Based on LINQ
5	Program Based on SQL Server database objects
6	Program Based on SQL Triggers
7	Program Based on ADO.Net for connectivity with database
8	Program Based on MVC Validations and Exception Handling
9	Web Application project

Semester VII

CSE2441 - PE V	Cloud Computing			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Explain software and hardware support for enterprise and cloud computing.
2. Perform data modelling for enterprise and cloud knowledge bases.
3. Design enterprise and cloud software applications.
4. Implement and run distributed and cloud applications.
5. Ensure security and privacy in enterprise and cloud application while implementing cloud applications methodologies.

Unit:1	Introduction to Cloud Computing	6 Hours

Defining Cloud Computing; Cloud Types and different models-The NIST model, The Cloud Cube Model, Deployment models, Service models; Examining the Characteristics of Cloud Computing; Benefits of cloud computing; Disadvantages of cloud computing; Assessing the Role of Open Standards.

Unit:2	Cloud Architecture, Services and Applications	6 Hours

Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, Saas Vs. Paas, Using PaaS Application Frame works, Software as a Service, Identity as a Service, Compliance as a Service.

Unit:3	Abstraction and Virtualization	6 Hours

Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.

Unit:4	Exploring Cloud Infrastructures	6 Hours

Managing the Cloud-Administrating the Clouds, Management responsibilities, Lifecycle management Cloud Management Products, Emerging Cloud Management Standards, Understanding Service Oriented Architecture- Introducing Service Oriented Architecture.

Unit:5	Managing & Securing the Cloud	6 Hours

Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, the security boundary, Security service boundary, Security mapping, Brokered

cloud storage access, Establishing Identity and Presence.		
Unit :6	**Advance Clouds and Case Studies**	**6 Hours**
Cloud Computing Cost Analysis, basic, Selecting an IaaS Provider, Capacity Planning and Disaster, Recovery in Cloud Computing, AWS Cloud architectural principles, basic/core characteristics of deploying and operating in the AWS Cloud, the key services on the AWS Platform and their common use cases, Define the billing, account management, and pricing models, Introduction to Amazon EC2. Case Studies: Microsoft Azure, Dropbox.		
Total Lecture Hours		**36 Hours**

Textbooks	
1	Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Michael Miller, Springer
2	Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc., Rajkumar Buyya, James Broberg, Andrzej Goscinski, A John Wiley & Sons, Inc. Publication
Reference Books	
1	Mastering cloud computing, Rajkumar buyya, Christian vecchiola, S Thamarai Selvi, Tata Mc-Graw Hill Education Private Limited
2	Cloud Computing a Practical Approach, Anthony T .Velte, Toby J. Velte, Robert Elsenpeter, Tata Mc-Graw-HILL
3	Cloud computing bible, Barrie sosinsky, Wiley publishing
4	https://cloud.google.com/appengine/docs https://www.chef.io/solutions/cloud-management/ https://aws.amazon.com/documentation https://dev.twitter.com/overview/documentation https://developers.facebook.com/ https://www.cloudfoundry.org/ https://puppet.com/blog/implement-a-message-queue-your-cloud-applicati
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/DTEL%20Material/7.Information%20Technology/DTEL%20PPTs /18.CC%20PPT_ADG.pdf
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2	https://nptel.ac.in/courses/106105167

Semester VII

CSE2442 - PE V	Distributed System			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement, etc.
2. Design and develop distributed programs using sockets and RPC/RMI.
3. Differentiate between different types of faults and fault handling techniques in order to implement fault tolerant systems.
4. Analyze different algorithms and techniques for the design and development of distributed systems subject to specific design and performance constrain

Unit:1	Characterization of Distributed Systems	6 Hours

Architecture of Distributed Systems: Characteristics of Distributed System, Motivation, challenges /Issues in the design & development of Distributed System. System Models: Architecture Model, System Architecture, Types of Architectural Model: Client server model, Search engine, Proxy server & caches, Variation on client server model: mobile code, mobile agents. Fundamental Models: Interaction model, failure model, Security model. Distributed Objects & Distributed file System: Inter-process communication, Sockets, middle ware, Group communication, and Remote procedure calls. CORBA, RMI, Distributed file system, Name services, Directory services, File Service types, download/upload model, File sharing semantics, session semantics, Server design: stateless & stateful server, Cache update policies.

Unit:2	Theoretical Foundations	6 Hours

Inherent limitations of distributed systems, Timing issues, clock synchronization, Network time protocol, Lamport's logical clocks, Vector clocks, Casual ordering of messages, Global state, Cuts of Distributed computation, Termination detection.

Unit:3	Distributed Mutual Exclusion	6 Hours

Leader election: Chang Robert Ring based leader election algorithm, Bully algorithm. Classification of mutual exclusion algorithms, Requirements and performance measures of mutual exclusion algorithms, Non Token Based Algorithms: Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm.Token Based Algorithms: SuzukiKasami's Algorithm, Raymond's Algorithm, Comparative performance analysis

Unit:4	**Distributed Deadlock Detection**	**8 Hours**
Resource vs Communication deadlocks, graph theoretic model, deadlock prevention, avoidance, detection, Issues in deadlock detection and resolution, Centralized deadlock detection algorithms, distributed deadlock detection algorithms		
Unit:5	**Agreement Protocols**	**8 Hours**
Synchronous vs. asynchronous computations, model of process failures, authenticated vs. non-authenticated messages. A classification of Agreement problems, Solutions to Byzantine Agreement problem, Applicatons of Agreement algorithms.		
Unit :6	**Failure recovery and Fault Tolerance**	**7 Hours**
Classification of failures. Backward and forward error recovery, Basic approaches of backward error recovery, recovery in concurrent systems, consistent set of checkpoints, synchronous check pointing and recovery, asynchronous check pointing and recovery. Fault Tolerance: Atomic actions and committing, commit protocols, non-blocking commit protocols, Voting protocols, Dynamic voting protocols, Dynamic Vote Reassignment Protocols		
Total Lecture Hours		**36 Hours**

Textbooks	
1	Advanced Concepts In Operating Systems: Distributed, Multiprocessor and Database Operating Systems Mukesh Singhal and Niranjan G. Shivaratri McGraw Hill
2	Distributed Operating Systems Concepts and Design, G Coulouris, Jean Dollimore, Tim Kindberg Addison Wesley
Reference Books	
1	Distributed Algorithms, Nancy Lynch ,Morgan Kaufman
2	Modern Operating Systems , Andrew S. Tanenbaum, Pearson Education
3	Distributed Operating Systems: Concepts and Design, Pradeep K. Sinha, Prentice-Hall of India
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Technology/45-Operating%20System%20Concepts%20(%20PDFDrive%20).pdf
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Science%20and%20Engineering/Operating%20System%20Concept%208thedition.pdf
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs87/preview

Semester VII

CSE2443 - PE V	Human Computer Interaction			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1) Understand the basics of Human Computer Interaction.
2) Demonstrate the Understanding of Interaction between human and computer Components using screen designing concepts.
3) Apply the knowledge of human and computer components for interaction.
4) Evaluate System using different tools and techniques.

Unit:1	Introduction	7 Hours

The human: Human memory, Thinking reasoning and problem solving, Individual differences, Psychology and the design of interactive systems ,Interaction and paradigms: Models of interaction, Frame work and HCI Ergonomics, Interaction styles, Elements of the WIMP(windows, icons, menus, pointers) interface interactivity, The context of the interaction, paradigms for interaction.

Unit:2	Interaction Design	7 Hours

Interaction Design: What is interaction design, Good and poor design, The process of design, User focus, Scenarios, Navigation design, Understanding the problem space, Conceptualizing the design space, Theories, models and frameworks, Screen design and layout, Interaction and prototyping.

Unit:3	HCI	6 Hours

HCI in software process and Design rules: The software life cycle, Usability engineering, Iterative design and prototyping, Design rationale, Principles to support usability, Standards, Guidelines, Golden rules and heuristics, HCI patterns.

Unit:4	Implementation and Evaluation	7 Hours

Implementation supports and Evaluation techniques: Elements of windowing system, Programming application, Using toolkits, User interface management systems, What is evaluation? Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, choosing evaluation methods, analytical evaluation.

Unit:5	Universal Design	6 Hours

Universal Design and User Support: Universal design principles, Multi-modal interaction, Design for diversity, Requirements of user support, Approach to user support, Adaptive help systems, Design user

support systems.		
Unit :6	**Cognitive Models**	**6 Hours**
Cognitive Models and Distributed Cognition: Goal and task hierarchies, Linguistics models, Challenges of display-based systems, Physical models, Cognitive architectures, Scientific Foundation, Description, Case Study.		
Total Lecture Hours		**39 Hours**

Textbooks	
1	Human - Computer Interaction, Alan Dix, Janet Fincay, Gregory D. Abowd and Russell Bealg, Pearson Education, 2003.
2	Designing the user interface, Ben Shneiderman, Pearson Education Asia, 2004
Reference Books	
1	Interaction Design, Preece and Rogers, Sharp, Wiley-India, 2008.
2	The essential guide to user interface design, Wilbert O Galitz, Wiley DreamTech, 2009
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/e-copies%20of%20books/7.Information%20Technology/25.BOOK1-Human_computer_interaction.pdf
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc19_cs86/preview

Semester VII

CSE2444 - PE V	Real Time System			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	40	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1.Clearly differentiate the different issues that arise in designing soft and hard real-time, concurrent, reactive, safety-critical and embedded systems.
2.Explain the various concepts of time that arise in real-time systems.
3.Describe the design and implementation of systems that support real-time applications. Justify and critique facilities provided by real-time operating systems and networks.
4.Design, construct and analyze a small, concurrent, reactive, real-time system.
5.Select and use appropriate engineering techniques, and explain the effect of your design decisions on the behavior of the system.

Unit:1	Basic Real- Time Concepts, Computer Hardware, Language Issues	6 Hours

Basic component Architecture, Real Time Design Issues, Input- Output, Other Devices Language Features, Survey of Commonly Used Programming Languages, Code Generation.

Unit:2	Software life cycle, Real Time Specification and Design Techniques	6 Hours

software life cycle, Non-temporal Transition in the software life cycle, Spiral model, Natural languages, Mathematical Specification, Flow Charts, Structure Charts, Pseudocode and programmable Design Languages,

Unit:3	Intertask Communication and Synchronization, Real Time memory Management, SystemPerformance Analysis and Optimization	6 Hours

Buffering Data, Mail boxes Critical Region, Semaphores, Event Flags and Signals, Deadlock, Process Stack Management, Dynamic Allocation, Static Schemes, Response Time Calculation, Interrupt Latency, Scheduling NP Complete, Relocating Response Times And time Loading, Analysis of Memory Requirements, Reducing Memory Loading, I/O Performance.

Unit:4	Queuing Models, Reliability, Testing, And Fault Tolerance, Multiprocessing Systems	6 Hours

Basic Buffer size Calculation, Classical Queuing Theory, Little's Law, Faults, Failures ,bugs AND effects. Reliability, Testing, Fault Tolerence, Classification of Architectures, Distributed Systems, Non Von Neumann Architectures.

Unit:5	Hardware/ Software Integration, Real Time Applications	6 Hours

Goals of Real Time System Integration, Tools, Methodology, Real Time Systems As Complex System, First Real Time Application Real Time Databases, Real time Image Processing Real Time UNIX, building Real Time Applications with Real Time Programming Languages.

Total Lecture Hours	**36 Hours**

Textbooks	
1	Real Time System, Jane W.S.Liu
2	Real Time Systems Design and Analysis by Phillip A. Laplante,PHI
Reference Books	
1	Hard Real Time Computing Systems Predictable Scheduling Algorithms and applications by GiorgioC. Buttazzo
2	Real Time Design Patterns: Robust Scalable Architecture for Real Time System by BrucePowel Douglass
3	Real Time System: Scheduling, Analysis and Verification by Albert M.K. Change
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/e-copies%20of%20books/7.Information%20Technology/53.Book-Liu-%20Real%20Time%20Systems.pdf
2	
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs98/preview

Semester VII

CSE2445 - PE V	Big Data Analytics			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. **Understand** fundamentals of big data, issues in big data management, big data analytics and its associated applications in intelligent business and scientific computing
2. **Apply** machine Learning algorithms for real world data, to provide analytics
3. **Demonstrate** the Map Reduce programming model to process the big data along with Hadoop tools
4. **Illustrate** the concepts of NoSQL using MongoDB and Cassandra for BigData.

Unit:1	Introduction to Big Data	5 Hours

Data, Characteristics of data and Types of digital data: Unstructured, Semi-structured and Structured, Sources of data, working with unstructured data, Evolution and Definition of big data, Characteristics and Need of big data, Challenges of big data, big data environment terminologies, Big Data Analysis Life Cycle.

Unit:2	Big data analytics and Analytical methods	8 Hours

Overview of business intelligence, Characteristics and need of big data analytics, Classification of analytics, Challenges to big data analytics. Analytical operations: Associations rules- Apriori algorithm, classifications- decision trees, naïve bayes clustering- K means.

Unit:3	Hadoop foundation for analytics	6 Hours

Features, key advantages of Hadoop , key aspects of Hadoop, versions of Hadoop , Hadoop ecosystem ,and Components, HDFS, HBase, Hadoop Technology Stack: Hive, Pig, Zookeeper, Swoop, oozie, flume, etc. Hadoop distributions, Hadoop vs SQL

Unit:4	MapReduce and YARN framework	6 Hours

Introduction to MapReduce, Processing data with MapReduce, map reduce example, Introduction to YARN, YARN architecture , Data serialization and common serialization formats, Big data serialization formats.

Unit:5	NoSQL Databases	5 Hours

Introduction to NoSQL, advantages of NoSQL, SQL vs NoSQL, types of NoSQL databases- Schema-less Models‖: Increasing Flexibility for Data Manipulation-KeyValue Stores- Document Stores - Tabular Stores - Object Data Stores - Graph Databases , Hive -- Sharding –- Hbase

Unit :6	Introduction to MongoDB key features	6 Hours

Introduction to MongoDB key features, data types in MongoDB, MongoDB Query Language.: update remove, insert methods, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document searching, Constructing queries on Databases, documents	
Total Lecture Hours	**36 Hours**
Textbooks	
1	Big Data and Analytics ,Seema Acharya, Subhashini Chhellappan , Willey 2nd edition
2	Professional Hadoop Solutions, Boris lublinsky, Kevin T.Smith, Alexey Yakubovich ,Wiley ISBN: 978-1-118-61193-7 September 2013
3	Understanding Big data , Chris Eaton,Dirk derooset al. , McGraw Hill
4	BIG Data and Analytics ,Sima Acharya, Subhashini Chhellappan , Willey
Reference Books	
1	MongoDB in Action , Kyle Banker, Piter Bakkum, Shaun Verch, Dream tech Press
2	Big Data Analytics with R and Hadoop , Vignesh Prajapati, Packet Publishing
3	Tom White, HADOOP: The definitive Guide, O Reilly, 2012
4	Learning Spark: Lightning-Fast Big Data Analysis Paperback , Holden Karau
MOOCs Links and additional reading, learning, video material	
1. https://onlinecourses.nptel.ac.in/noc20_cs92/preview	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

1st to 6th Semester

(Department of Electronics Engineering

Industrial Internet of Things (IIoT)

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. IoT-203

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2021-22 onward)

(Department of Electronics Engineering)

Industrial IOT

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
First Semester															
1	1	BES	EL	IIOT2101	Basic Electrical Machines	T	3	0	0	3	3	30	30	40	3 Hours
2	1	BES	EL	IIOT2102	**Lab.:** Basic Electrical Machines	P	0	0	2	2	1		60	40	
3	1	HS	GE	IIOT2103	Constitution of India	T	3	0	0	3	3	30	30	40	3 Hours
4	1	BS	GE	IIOT2104	Calculus	T	3	0	0	3	3	30	30	40	3 Hours
5	1	BS	GE	IIOT2105	Semiconductor Physics	T	3	0	0	3	3	30	30	40	3 Hours
6	1	BS	GE	IIOT2106	**Lab.:** Semiconductor Physics	P	0	0	2	2	1		60	40	
7	1	PC	EE	IIOT2107	C Programming	T	3	0	0	3	3	30	30	40	3 Hours
8	1	PC	EE	IIOT2108	**Lab.:** C Programming	P	0	0	2	2	1		60	40	
9	1	BES	ME	IIOT2109	Engineering Materials	T	3	0	0	3	3	30	30	40	3 Hours
					TOTAL FIRST SEM		**18**	**0**	**6**	**24**	**21**				
List of Audit Course															
1	1	HS	GE	GE2131	Universal Human Value	**T**	2	0	0	0	0				
2	1	HS	GE	GE2123	YCCE Communication & Aptitude Preparation (YCAP)	**A**	3	0	0	3	0				
3	2	HS	GE	GE2124	YCCE Communication & Aptitude Preparation (YCAP)	**A**	3	0	0	3	0				
Second Semester															
1	2	BS	GE	IIOT2151	Probabilty theory and Statistical Inference	T	3	0	0	3	3	30	30	40	3 Hours
2	2	BS	GE	IIOT2152	Applied Chemistry	T	3	0	0	3	3	30	30	40	3 Hours
3	2	BS	GE	IIOT2153	**Lab.:** Applied Chemistry	P	0	0	2	2	1		60	40	
4	2	BES	ME	IIOT2154	Engineering Graphics	T	3	0	0	3	3	30	30	40	3 Hours
5	2	BES	ME	IIOT2155	**Lab.:** Engineering Graphics	P	0	0	2	2	1		60	40	
6	2	HS	GE	IIOT2156	Technical Communication	T	3	0	0	3	3	30	30	40	3 Hours
7	2	PC	ME	IIOT2157	Fundamentals of Manufacturing Process	T	3	0	0	3	3	30	30	40	3 Hours
8	2	PC	ME	IIOT2158	**Lab.:** Fundamentals of Manufacturing Process	P	0	0	2	2	1		60	40	
9	2	PC	EE	IIOT2159	**Lab.:** Python Programming	P	0	0	2	2	1		60	40	
					TOTAL SECOND SEM		**15**	**0**	**8**	**23**	**19**				

MSEs* = Two MSEs of 15 Marks each will be conducted and total marks of MSE 1 and MSE 2 MSEs will be considered for Continuous Assessment out of 30.

TA- for Theory : 30 marks on quizzes, activities, attendance etc as included in TA plan of course teacher. TA - for Practical: MSPA will be 15 marks each as included in TA plan of course teacher

TA – for Practical : MSPA will be 15 marks each

		June 2021	1.00
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2021-22 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. IoT-203.1

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

Industrial IOT

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	PC	EE	IIOT2201	Digital Electronics	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	EE	IIOT2202	**Lab. :** Digital Electronics	P	0	0	2	2	1		60	40	
3	3	BS	GE	IIOT2203	Linear Algebra and Graph Theory	T	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	EE	IIOT2204	Electronics Deivces and Circuits	T	3	0	0	3	3	30	20	50	3 Hours
5	3	PC	EE	IIOT2205	**Lab.:** Electronics Deivces and Circuits	P	0	0	2	2	1		60	40	
6	3	PC	EE	IIOT2206	Algorithms and Data Structures	T	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	EE	IIOT2207	**Lab.:** Algorithms and Data Structures	P	0	0	2	2	1		60	40	
8	3	HS	EE	IIOT2208	Engineering Economics and Management	T	3	0	0	3	3	30	20	50	3 Hours
9	3	PC	EE	IIOT2209	Sensors & Actuators for IIOT	T	3	0	0	3	3	30	20	50	3 Hours
					TOTAL THIRD SEM		**18**	**0**	**6**	**24**	**21**				

List of Audit Course

1	3	HS		AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
Fourth Semester															
1	4	PC	EE	IIOT2251	Control System Engineering	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	EE	IIOT2252	**Lab.:** Control System Engineering	P	0	0	2	2	1		60	40	
3	4	PC	EE	IIOT2253	Mechatronics	T	3	0	0	3	3	30	20	50	3 Hours
4	4	PC	EE	IIOT2254	**Lab.:** Mechatronics	P	0	0	2	2	1		60	40	
5	4	PC	EE	IIOT2255	Microprocessor and Interfacing	T	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	EE	IIOT2256	**Lab.:** Microprocessor and Interfacing	P	0	0	2	2	1		60	40	
7	4	PC	EE	IIOT2257	Analog and Digital Communication	T	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	EE	IIOT2258	**Lab.:** Analog and Digital Communication	P	0	0	2	2	1		60	40	
9	4	STR	EE	IIOT2259	Design Tool Lab-1	P	0	0	2	2	2		60	40	
10	4	STR	EE	IIOT2260	**Lab.:** Electronics Workshop	P	0	0	2	2	2		60	40	
					TOTAL FOURTH SEM		**12**	**0**	**12**	**24**	**20**				

List of Audit Course

1	4	HS		GE2121	Environmental Studies	**T**	2	0	0	2	0				
3	4	HS		AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE, IIoT, AIML, CSD, AIDS	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

Industrial IOT

SoE No. IoT-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester															
1	5	PC	EE	IIOT2301	IoT Communication Network	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	EE	IIOT2302	Microcontroller & its Applications	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	EE	IIOT2303	**Lab. :** Microcontroller & its Applications	**P**	0	0	2	2	1		60	40	
4	5	PC	EE	IIOT2304	Data Analytics	**T**	3	0	0	3	3	30	20	50	3 Hours
5	5	PC	EE	IIOT2305	**Lab.:** Data Analytics	**P**	0	0	2	2	1		60	40	
6	5	PC	EE	IIOT2306	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3 Hours
7	5	PC	EE	IIOT2307	**Lab.:** Object Oriented Programming	**P**	0	0	2	2	1		60	40	
8	5	PC	EE	IIOT2308	CNC and Robotics	**T**	3	0	0	3	3	30	20	50	3 Hours
9			EE		**Professional Elective-I ***	**T**	3	0	0	3	3	30	20	50	3 Hours
10	5	STR	EE	IIOT2310	Industrial Visit	**P**	0	0	0	0	1		60	40	
					TOTAL FIFTH SEM		**18**	**0**	**6**	**24**	**22**				

List of Professional Electives-I *

Professional Electives -I

1	5	PE-I		IIOT2311	System C Progrming
2	5	PE-I		IIOT2312	Industry 4.0 and Smart Systems
3	5	PE-I		IIOT2313	Advanced Microprocessor

Audit Courses

1	5	HS		AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE, IIoT, AIDS, CSD, AIML	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

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(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

Industrial IOT

SoE No. IoT-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester															
1	6	PC	EE	IIOT2351	Digital System Design	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	EE	IIOT2352	**Lab.:** Digital System Design	**P**	0	0	2	2	1		60	40	
3	6	PC	EE	IIOT2353	Embedded System Design	**T**	3	0	0	3	3	30	20	50	3 Hours
4	6	PC	EE	IIOT2354	**Lab.:** Embedded System Design	**P**	0	0	2	2	1		60	40	
5	6	PC	EE	IIOT2355	Data Acquisition & Signal Conditioning	**T**	3	0	0	3	3	30	20	50	3 Hours
6	6	PC	EE	IIOT2356	Machine Learning for IIoT	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PC	EE	IIOT2357	**Lab.:** Machine Learning for IIoT	**P**	0	0	2	2	1		60	40	
8	6	PC	EE	IIOT2358	Design Tool **Lab-2**	**P**	0	0	2	2	2		60	40	
9	6	PC	EE	IIOT2359	Cryptograpghy for IIoT	**T**	3	0	0	3	3	30	20	50	3 Hours
10	6	PE	EE		**Professional Elective-II**	**T**	3	0	0	3	3	30	20	50	3 Hours
11	6	PE	EE		**Lab: Professional Elective-II**	**P**	0	0	2	2	1		60	40	
					TOTAL SIXTH SEM		**18**	**0**	**10**	**28**	**24**				

List of Professional Electives- II

Professional Electives-II

1	6	PE-II	EE	IIOT2361	PE-II Digital Image processing
	6	PE-II	EE	IIOT2362	PE-II: **Lab.:** Digital Image processing
2	6	PE-II	EE	IIOT2363	PE-II Flexible Manufacturing System
	6	PE-II	EE	IIOT2364	PE-II: **Lab: :** Flexible Manufacturing System
3	6	PE-II	EE	IIOT2365	PE-II Digital Signal Processing
	6	PE-II	EE	IIOT2366	PE-II **: Lab:** Digital Signal Processing

Audit Courses												
1	6	HS		AU2130	YCCE Communication Aptitude Preparation (YCAP6.3) for CT, IT, CSE, IIoT, AIDS, CSD, AIML	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	June 2022	1.01
		Date of Release	Version

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. IoT-203.1

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

Industrial IOT

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Seventh Semester															
1	7	PC	EE	IIOT2401	Cloud Computing	T	3	0	0	3	3	30	20	50	3 Hours
2	7	PC	EE	IIOT2402	**Lab.:** Cloud Computing	P	0	0	2	2	1		60	40	
3	7	PC	EE	IIOT2403	Internet of Things Applications	T	3	0	0	3	3	30	20	50	3 Hours
4	7	PC	EE	IIOT2404	**Lab.:** Internet of Things Applications	P	0	0	2	2	1		60	40	
5	7	PE	EE		**Professional Elective-III**	T	3	0	0	3	3	30	20	50	3 Hours
6	7	PE	EE		**Professional Elective-IV**	T	3	0	0	3	3	30	20	50	3 Hours
7	7	PE	EE		**Lab:Professional Elective-IV**	P	0	0	2	2	1		60	40	
8	7	PE	EE		**Professional Elective-V**	T	3	0	0	3	3	30	20	50	3 Hours
9	7	STR	EE	IIOT2409	Industrial IoT based Mini Project-3	P	0	0	4	4	2		100		
10	7	STR	EE	IIOT2410	CRT	P	0	0	0	0	2		100		
					TOTAL SEVENTH SEM		**0**	**10**	**25**	**22**	**22**				

List of Professional Electives-III,IV & V

Professional Electives -III

1	7	PE-III	EE	IIOT2411	Power Electronics and Drives
2	7	PE-III	EE	IIOT2412	Wireless Sensor Network
3	7	PE-III	EE	IIOT2413	Additive Manufacturing

Professional Electives -IV

1	7	PE-IV	EE	IIOT2421	PE IV:Industrial Automation
	7	PE-IV	EE	IIOT2422	PE IV: **Lab. :** Industrial Automation
2	7	PE-IV	EE	IIOT2423	PE IV: Design for Manufacturing and Assembly
	7	PE-IV	EE	IIOT2424	PE IV: **Lab.:** Design for Manufacturing and Assembly
3	7	PE-IV	EE	IIOT2425	PE IV: Wireless Communication for IIoT (5 G)
	7	PE-IV	EE	IIOT2426	PE IV: **Lab.:** Wireless Communication for IIoT

Professional Electives -V

1	7	PE-V	EE	IIOT2431	PE V: Cyber Security
2	7	PE-V	EE	IIOT2432	PE V: Operating Systems for IIoT
3	7	PE-V	EE	IIOT2433	PE V: SQL & Non SQL

Eighth Semester															
1	**8**	**STR**		**IIOT2451**	**Major Project/ Industrial Internship Evaluation**	**P**	0	0	12	12	9		60	40	
2	**8**	**STR**		**IIOT2452**	**Extra Curricular Activity Evaluation**	**P**	0	0	0	0	1		100		
					TOTAL EIGHTH SEM		**0**	**12**	**12**	**10**	**10**				
					GRAND TOTAL	**15**	**39**	**22**	**55**	**89**	**158**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

1st Semester

(Department of Electronics Engineering

Industrial Internet of Things (IIoT)

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. IoT-203

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2021-22 onward)

(Department of Electronics Engineering)

Industrial IOT

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
First Semester															
1	1	BES	EL	IIOT2101	Basic Electrical Machines	T	3	0	0	3	3	30	30	40	3 Hours
2	1	BES	EL	IIOT2102	**Lab.:** Basic Electrical Machines	P	0	0	2	2	1		60	40	
3	1	HS	GE	IIOT2103	Constitution of India	T	3	0	0	3	3	30	30	40	3 Hours
4	1	BS	GE	IIOT2104	Calculus	T	3	0	0	3	3	30	30	40	3 Hours
5	1	BS	GE	IIOT2105	Semiconductor Physics	T	3	0	0	3	3	30	30	40	3 Hours
6	1	BS	GE	IIOT2106	**Lab.:** Semiconductor Physics	P	0	0	2	2	1		60	40	
7	1	PC	EE	IIOT2107	C Programming	T	3	0	0	3	3	30	30	40	3 Hours
8	1	PC	EE	IIOT2108	**Lab.:** C Programming	P	0	0	2	2	1		60	40	
9	1	BES	ME	IIOT2109	Engineering Materials	T	3	0	0	3	3	30	30	40	3 Hours
					TOTAL FIRST SEM		**18**	**0**	**6**	**24**	**21**				
List of Audit Course															
1	1	HS	GE	GE2131	Universal Human Value	**T**	2	0	0	0	0				
2	1	HS	GE	GE2123	YCCE Communication & Aptitude Preparation (YCAP)	**A**	3	0	0	3	0				
3	2	HS	GE	GE2124	YCCE Communication & Aptitude Preparation (YCAP)	**A**	3	0	0	3	0				
Second Semester															
1	2	BS	GE	IIOT2151	Probabilty theory and Statistical Inference	T	3	0	0	3	3	30	30	40	3 Hours
2	2	BS	GE	IIOT2152	Applied Chemistry	T	3	0	0	3	3	30	30	40	3 Hours
3	2	BS	GE	IIOT2153	**Lab.:** Applied Chemistry	P	0	0	2	2	1		60	40	
4	2	BES	ME	IIOT2154	Engineering Graphics	T	3	0	0	3	3	30	30	40	3 Hours
5	2	BES	ME	IIOT2155	**Lab.:** Engineering Graphics	P	0	0	2	2	1		60	40	
6	2	HS	GE	IIOT2156	Technical Communication	T	3	0	0	3	3	30	30	40	3 Hours
7	2	PC	ME	IIOT2157	Fundamentals of Manufacturing Process	T	3	0	0	3	3	30	30	40	3 Hours
8	2	PC	ME	IIOT2158	**Lab.:** Fundamentals of Manufacturing Process	P	0	0	2	2	1		60	40	
9	2	PC	EE	IIOT2159	**Lab.:** Python Programming	P	0	0	2	2	1		60	40	
					TOTAL SECOND SEM		**15**	**0**	**8**	**23**	**19**				

MSEs* = Two MSEs of 15 Marks each will be conducted and total marks of MSE 1 and MSE 2 MSEs will be considered for Continuous Assessment out of 30.

TA- for Theory : 30 marks on quizzes, activities, attendance etc as included in TA plan of course teacher. TA - for Practical: MSPA will be 15 marks each as included in TA plan of course teacher

TA – for Practical : MSPA will be 15 marks each

		June 2021	1.00
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2021-22 Onwards

I Semester
IIOT2101: Basic Electrical Machines

Course Objective:
The course objective is to impart knowledge of

- To impart fundamental knowledge of electricalcircuits and machinery.
- To provide problem solving experience and learningof concepts through it in electrical engineering.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Reproduce fundamentals of dc circuits & ac circuits.
CO 2	Explain, construction, working and applications of various electrical machines.
CO 3	Analyze performance of various electrical machines.

CO-PO Articulation Matrix :

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	1	1							1		
CO2	3	3	3	2	2							1		
CO3	3	3	3	3	3							1		2

Unit	Content	Hours
1	**D.C. Circuits:** Basics of electrical circuits. Equivalent resistance, Kirchhoff's Laws. Current and Voltage division rule. Mesh and Nodal analysis of dc circuits. Superposition Theorem. **A.C. Fundamentals:** Generation of alternating voltage. Values of alternating quantity. Average and rms value by mid - ordinate method and method of integration. Form factor and peak factor. Concept of phasor and its mathematical representation. Concept of phasor diagram. Phasor algebra. Power in a.c. circuit. Concept of power factor, reactive power and apparent power with power triangle.	06
2	**Single Phase Transformer:** Working principle. EMF equation. Voltage ratio and turns ratio. Step up and step down transformers. Construction of single phase transformer. Ideal transformer. Transformer on no load with phasor diagram and equivalent circuit. Practical transformer and its equivalent circuit. Referred values. Voltage Regulation. Losses in transformer. Open circuit and Short circuit tests on transformer. Efficiency and condition for maximum efficiency. Types of transformer and their applications.	07
3	**D.C. Motor :** Principle, Torque Equation, Characteristics and applications of various types of D.C. Motors, Starting of D.C. Motors, Speed control of Series and Shunt motors, Power flow in DC machines, Losses and Efficiency in D.C. machines.	07

Unit	Content	Hours
4	**Three Phase Induction Motor :** Construction. Production of rotating magnetic field. Principle of operation. Speed and slip. Frequency of rotor voltage and current. Relationship between rotor copper loss and rotor input. Developed Torque. Torque of an induction motor. Condition for maximum torque. Torque — slip and torque speed characteristics. Applications of three phase induction motor.	07
5	**Stepping Motors:** Principle of operation, Constructional features, Types of stepper Motors, Various modes of operation of Variable reluctance (VR) stepper motors, torque production in Variable Reluctance (VR) stepping motor, Multi stack VR stepper motor, Construction and working of Permanent Magnet (PM) stepper motor, Construction and working of Hybrid stepper motor, Torque angle characteristics of the stepper motor.	06
6	**Permanent Magnet Brushless DC Motors:** Fundamentals of Permanent Magnets, Principle of operation, Magnetic circuit analysis, EMF and Torque equations, Characteristics and control. **Servomotors:** AC Servomotors & DC Servomotors.	07

Text Books:

SN	Title	Edition	Authors	Publisher
1	Basic Electrical Engineering	1st Edition, 2005	T. K. Nagsarkar and M. S. Sukhija	Oxford Higher Education
2	Basic Electrical Engineering	2nd Edition,2006	V. N. Mittle and A. K. Mittal	The McGraw Hill Companies, New Delhi
3	Electrical Technology	2005	B.L.Theraja	S.Chand
4	Permanent Magnet and Brushless DC motors		T. Kenjo and S. Nugatory	England, Clarendon Oxford Press, 1989.

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Basic Electrical Engineering	2nd Edition,2002	I J Nagrath and D. P.Kothari	McGraw Hill, New Delhi
2	Electrical Engineering Fundamentals	2nd Edition,2001	Vincent Del Toro	Prentice Hall India, New Delhi

I Semester
IIOT2102: Lab.: Basic Electrical Machines

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	Perform laboratory experiments and demonstrate competency in collecting, interpreting, analysing data, communicate and present effectively through laboratory journals.

Lab Experiment List:

Expt. No	Name of Experiment
1	To verify Kirchhoff's voltage law and Kirchhoff's current law.
2	To study R —L— C series circuit.
3	To verify Superposition theorem.
4	To study R —L— C parallel circuit.
5	To study balanced three phase star (Y} connected load.
6	To perform O.C. and S.C. tests on a single phase transformer.
7	To study balanced three phase delta (D) connected load
8	To find transformation ratio, regulation and efficiency of a single phase transformer.
9	To study speed control of dc motor.
10	To study speed control of three phase induction motor.

I Semester
IIOT2103: Constitution of India

Course Objective: To enable the student understand the importance of constitution, the structure of executive, legislature, judiciary and analyze federalism in the Indian context and evaluate the Indian Political scenario of the emerging challenges.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Explain the basic concepts of Constitution of India.
CO 2	Describe the various Fundamental rights
CO 3	Analyze the Impact of federalism on the State
CO 4	Explain Industrial Law and Judiciary

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1								2				2		
CO 2												2		
CO 3						4						4		
CO 4														
CO 5									2					

Syllabus:

Unit	Content	Hours
1	**Origin and Meaning** Origin of history of Constitution, Meaning of the constitution law and constitutionalism, Kingship and Republic States in Ancient India	7
2	**Concept of the Constitution of India** Preamble, The union and its territory, Citizenship	6
3	**Federalism** Salient features of Federalism, Structures and features of Indian Federalism, Panchayat Raj System	7
4	**Fundamental Rights** Scheme of the Fundamental rights, duties, Scheme of the Fundamental Right to Equality, The scheme of the Fundamental Duties and its legal status	6

Unit	Content	Hours
5	**Legislative Power** Federal structure and distribution of legislative, Financial power between the Union and the States, Parliamentary Form of Government in India – The constitution power and status of the President of India	7
6	**Challenges to Indian Political Systems** The Executive, Directive principles of State Policy, The Union Judiciary	6

Text Books:

SN	Title	Edition	Authors	Publisher
1	—Social Science"	1st	Dr G.N. Nimbarte	Sankalp Publication, Vidhya Nagar, Nagpur

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Constitution of India	1st	Dr. B. R. Ambedkar	Government of India, Ministry of Law and Justice
2	An Introduction to the Constitution of India	1st	Basu, D.D (2005)	New Delhi, Prentice Hall
3	Working of a Democratic Constitution of India	1st	G. Austin (2004)	New Delhi: Oxford University Press.

Website / Data sheet:

SN	Title
1	https://legislative.gov.in/
2	https://swayam.gov.in/
3	https://legislative.gov.in/constitution-of-india

I Semester
IIOT2104: Calculus

Course Objective: This subject will give basic knowledge of differential Calculus and its application, concept of integration to double and triple integrals and teach various methods for solving higher order differential equations and its applications

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Apply the knowledge of differentiation, limit and continuity to develop the Mathematical concepts to solve engineering problems
CO 2	Determine the expansion and derivatives of functions of Multiple variables and use it to find extreme values of functions
CO 3	Evaluate the improper integrals, multiple integrals and apply it to compute the area and volume of various structures.
CO 4	Solve higher order differential equations and its applications.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO	3	3												
CO	3	3												
CO	3	3	3											
CO	3	3	3											

Syllabus:

Unit	Content	Hours
1	**Differential Calculus** Successive differentiation; Leibnitz theorem, Taylor's and Maclaurin's series for one variable.	7
2	**Limits and Continuity** Functions of several variables, Limit of function of two variables, theorem of limit, simultaneous limits by changing to polar coordinates. Continuity of function of two variables.	6
3	**Partial Differentiation** First and higher order partial derivatives, Euler's theorem, Chain Rule, Jacobians, Taylor's and Maclaurin's series for one variable. Maxima and minima and saddle point of functions of two variables.	7

Unit	Content	Hours
4	**Curve Tracing and Improper Integrals** Tracing of curves, Beta, Gamma functions and its applications.	6
5	**Multiple integrals and their Applications** Elementary double integrals, Change of variables (simple transformations) and Jacobian of transformations, Change of order of integration (Cartesian and polar), Applications to find area, volume, Elementary triple integrals.	7
6	**Differential Equations** Higher order differential equations with constant coefficients. Cauchy's and Legendre's homogeneous differential equations, Applications of differential equations.	6

Text Books:

SN	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	6th Edition	Erwin Kreyzig	John Wiley and Sons,INC
2	Engineering Mathematics	11th revised edition	H.K. Dass	S.Chand, Delhi
3	Advanced Engineering Mathematics	8th revised edition	H.K. Dass	S.Chand, Delhi
4	Higher Engineering Mathematics	42th edition	Dr. B.S. Grewal	Khanna Publishers
5	Applied Mathematics	4th Edition	P.N.Wartikar and J.N.Wartikar	Vidyarthi Griha Prakashan

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Calculus and Analytical Geometry	9th edition	G B Thomas and R L Finney	Addison-Wesley, 1999
2	Calculus		Michael Spivak and Tom Apostol	
3	A text book of Engineering Mathematics		N.P. Bali and Manish Goyal	Laxmi Prakashan,

Website / Data sheet:

SN	Title
1	https://nptel.ac.in/courses/111/106/111106146/
2	https://nitkkr.ac.in/docs/5-Multiple%20Integrals%20and%20their%20Applications.pdf
3	https://nptel.ac.in/courses/111/106/111106100/

I Semester
IIOT2105: Semiconductor Physics

Course Objective :

1.	To learn the fundamental principles of Semiconductor physics specifically concern to quantum physics, quantum computing, basics of semiconductor, sensor, Optical transition, electron motion in electric & magnetic field, electron optic devices and their engineering applications.
2.	To provide problem solving experience and learning of concepts through it in semiconductor physics, inboth, the classroom and the laboratory learning environment.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Co-relate fundamentals of quantum mechanics to solve problems dealing with quantum particle.
CO 2	Justify the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands.
CO 3	Identify the requirements of sensor material for technological application
CO 4	Illustrate optical interactions associated with semiconductor materials for their use in the devices.
CO 5	Analyze the electron motion in electric and magnetic field contributing to electronic display devices.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	3	3	-	-	-	-	-	-	-	-	-	-	-	-

Syllabus:

Unit	Content	Hours
1	**QUANTUM PHYSICS** Wave-particle duality, Electron Diffraction, Wave packet, Heisenberg uncertainty principle, thought experiment, Significance, Applications.	6
2	**PHYSICS OF QUANTUM COMPUTING** Introduction of complex numbers, operators, eigen values, eigen functions. Wave function and its probability interpretation, Schrodinger Equation, Particle in infinite and finite potential well, quantum tunneling, Introduction to Bits and Qubits.	7
3	**BASICS OF SEMICONDUCTORS** Formation of energy bands in solids, valence and conduction band, Classification, pure and doped semiconductors, law of mass action, Conduction mechanism, Direct & indirect band gap semiconductors, Hall effect.	7
4	**SENSORS** Introduction, classification of sensors, performance characteristics, selection criteria, Requirement of sensor material, Role of sensors in industry, Examples: thermal, optical, pressure and acoustic sensors,.	6
5	**OPTICAL INTERACTIONS IN SEMICONDUCTORS** Introduction to optical transitions, metastable state and pumping, optical amplification, Density of states for photon, semiconductor laser, photovoltaic cell, LED.	7
6	**ELEMENTS OF ELECTRONIC DISPLAY** Electron motion in uniform electric and magnetic field, electron refraction, electron lens and Cathode Ray Oscilloscope.	7

Text Books:

SN	Title	Edition	Authors	Publisher
1	A Textbook of Engg. Physics	Revised 14th Edition	M.N.Avadhanulu , P.G.Kshirsagar	S.Chand and Company
2	Electronic Engineering Materials and Devices	TMH edition, 10th reprint	John Allision	Tata McGraw Hill
3	Introduction to Semiconductor Materials and Devices,	5th Edition, 2008	M S Thyagi	Wiley Publication

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Semiconductor Devices Physics and Technology	2nd	S.M Sze	John Wiley & Son, Inc
2	Fundamentals of Physics	10th	David Halliday, Robert Resnick and Jerle Walker, John-Wiley India	John Wiley & Sons Inc
3	Text Book of Optics	Revised	Brijlal and Subramanyam	S. Chand and Company

SN	Title	Edition	Authors	Publisher
4	Laser	2nd	M. N. Avadhanulu	S. Chand and Company
5	Concept of Modern Physics :,	6th	A.Beiser	Tata McGraw-Hill
6	LASERS: Theory and Applications:.	2nd	Thyagarajan K and Ghatak A.K	Macmillan Publication
7	Solid state Physics	9th	S.O.Pillai	New Edge International Publishers
8	Solid State Physics	8th	Palanisamy	SciTech Publishers
9	Solid State Physics	8th	C. Kittel	Willey Publication
10	Instrumentation Devices and Systems	2nd	C.S. Rangan	Tata McGraw-Hill 1998
11	Modern Electronic Instrumentation and Measurement Techniques	2nd	Albert D.Helfrick and William D.Cooper	Prentice Hall of India, 2007

Website / Data sheet:

SN	Title
1	https://www.youtube.com/watch?v=qcE2Wcpm05k
2	https://www.youtube.com/watch?v=OlatlIaqPj8
3	https://www.electronics-tutorials.ws/io/io_1.html

I Semester
IIOT2106: Lab.: Semiconductor Physics

Expt.No.	Course Outcomes	Statement of Course outcomes
		Students are able to
1,3,4,5,8,10,11	CO 2	Justify the characteristics of semiconductor materials in terms of crystal structures, chargecarriers and energy bands.
12	CO 3	Identify the requirements of sensor material for technological application.
7,9	CO 4	Illustrate optical interactions associated with semiconductor materials for their use in the devices.
2,6	CO 5	Analyze the electron motion in electric and magnetic field contributing to electronic display devices.

List of Experiments :

Expt. No	Name of Experiment	CO	PO
1	Determination of Hall coefficient and density of charge carriers using Hall effect.	CO2	PO1,PO2
2	Determination of amplitude and frequency of sinusoidal signal using C.R.O.	CO 5	PO1,PO2
3	The study of V-I characteristics of a semiconductor diode (germanium and silicon) in forward and reverse bias mode.	CO 2	PO1,PO2
4	Determination of Band gap in a semiconductor by four probe method.	CO 2	PO1,PO2
5	Study of V-I characteristics of LED.	CO 2	PO1,PO2
6	To measure the phase shift introduced by a phase shift network using Dual beam CRO.	CO 5	PO1,PO2
7	Determination of wavelength of laser using diffraction grating.	CO 4	PO1,PO2
8	Determination of Band gap in a semiconductor using reverse biased p-n diode .	CO 2	PO1,PO2
9	Determination of divergence of laser beam.	CO 4	PO1,PO2
10	Study of V-I characteristics of Zener diode.	CO 2	PO1,PO2
11	Dependence of Hall coefficient on temperature.	CO 2	PO1,PO2
12	Determination of the velocity of Ultrasonic waves in a non –electrolytic liquid by ultrasonic interferometer	CO 3	PO1,PO2
	Demonstration Experiment		
13	Determination of attenuation of a given optical fibre.		

I Semester
IIOT2107: C Programming

Course Objective:

1. To introduce students to the basic knowledge of programming fundamentals of C language.
2. To impart writing skill of C programming to the students and solving problems.
3. To impart the concepts like looping, array, functions, pointers, structure.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Understand Programing Logic
CO 2	Write algorithm & Draw a flow chart for a given problem
CO 3	Design & Develop programs using different control Flow Statement.
CO 4	Design & Develop programs using basics of Arrays, functions, pointers, structures etc.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	-	-	3	-	-	-	-	-	-		
CO 2	-	2	2	-	-	-	-	-	3	-	-	-		1
CO 3	3	3	2	-	-	2	-	-	3	-	-	-		1
CO 4	3	3	3			2			3					1

Unit	Content	Hours
1	**Introduction to Computer** Introduction to computer system, Algorithms, Flowcharts, Data Representation: Number systems, character representation codes, Binary, octal, hexadecimal and their interconversions. Binary arithmetic, floating point arithmetic, signed and unsigned numbers, Memory storage.	6
2	**Basics in C** History of C Language, Basic structure of C program, Concept of variables, constants anddata types in C, Console IO Operations, Operators and expressions: arithmetic, relational, Logical, Increment and decrement operator, Conditional, bitwise operators, Expressions.	6
3	**Control Flow Statements** Conditional executing using if Statement, If-else Statement,switch Statement , Unconditional Branching using goto statement, while loop and do-while loop, For loop , continue and break.	7
4	**Functions** Functions, Passing Values between Functions , Function Declaration and Prototypes ,Call by Value and Call by Reference .	6

Unit	Content	Hours
5	**Arrays & String** Arrays Declaration and Initializatio, Sample Programs using Arrays, One dimensional array 2-D arrays, Strings Handling	6
6	**Structure & Pointers** Defining C structures, Giving values to members, Array of structure, Nested structure, passing strings as arguments Pointers, Pointers as Function Parameter .	6

Text Books:

SN	Title	Edition	Authors	Publisher
1	A Structured Programming Approach Using C	Third Edition	B.A.Forouzan and R.F. Gilberg	Cengage Learning
2	The C Programming Language	2nd edition	Brian Kernighan and Dennis Ritchie	Prentice Hall

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Let Us C	19 Edition	Yashavant kanetkar	BPB
2	Absolute beginner's guide to C	2 Edition	Greg M. Perry	Publisher: Sams Pub., 1994
3	Computer Programming and Data Structures	3 Edition	E Balagurusamy	Tata McGraw Hill

Website / Data sheet:

SN	Title
1	https://youtu.be/VSEnzzjAm0c

I Semester
IIOT2108: Lab.: C Programming

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	Understand Programing Logic
CO 2	Write algorithm & Draw a flow chart for a given problem
CO 3	Design & Develop programs using different control Flow Statement
CO 4	Design & Develop programs using basics of Arrays, functions, pointers, structures etc

Lab Experiment List:

Expt. No	Name of Experiment
1	Write a C Program to print —Welcome to Internet of Thing"
2	Write a C program to add two numbers (2 and 6) and display its sum
3	Write a C program to multiply two numbers (4 and 5) and display its product.
4	Write a C Program to calculate and display the volume of a CUBE
5	Write a C program to take input of name, roll. no and marks obtained by a student in 4 subjects of 100 marks each and display the name, roll.no with percentage score secured.
6	Write a C program to swap values of two variables .
7	Write a C program to print whether a given number is even or odd.
8	Write a C program to find the largest and smallest among three entered numbers.
9	Write a C program to find whether a character is consonant or vowel
10	Write a C program to print positive integers from 1 to 10.
11	Write a C program to display the following pattern. * * * * * * * * * * * * * * *
12	Write a C program to insert 5 elements into an array and print the elements of the array.
13	Write a C program to calculate factorial of a number
14	Write a C program to find biggest among three numbers
15	Write a C program to store information of 5 students in structure and display it.

I Semester
IIOT2109: Engineering Materials

Course Objective:
Understand the concepts of atomic bonding, crystal structures, imperfections, diffusion, mechanical properties, electron energy, and dislocations as related to processing and performance of engineering materials.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Classify engineering materials based on its structure.
CO 2	distinguish between elastic and plastic behavior of materials
CO 3	Outline various mechanical properties of engineering materials and test them to know properties.
CO 4	Discuss and compare different heat treatment processes of steel.

CO – PO Mapping:

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3			1	2			1	1	2	1	1	1
CO-2	3	3	2		3	2		1	1	1	2	1	3	2
CO-3	3	3	2		3	2		1	1	1	2	1	3	2
CO-4	3	2	2		3	2			1	1	2	1	3	2

Unit	Content	Hours
1	**UNIT I** Introduction of materials, classification of materials. Properties and applications of materials. Crystalline nature of metals, specially microscopic and macroscopic examinations of materials [7 hrs]	7
2	**UNIT II** Alloys and solid solutions, types and their formations, modified Gibbs's phase rule, Lever rule for phase mixtures and their application in system. Study of equilibrium diagrams and invariant reactions. Iron-Iron carbide equilibrium diagram, critical temperatures. Effect of alloying elements. [7 hrs]	7
3	**UNIT III** Elastic and plastic deformation: slip systems, critical resolved shear stress, frank-read source, work hardening, dynamic recovery, strengthening mechanisms, recovery, recrystallization and grain growth, cold and hot working; Mechanical properties: hardness, tensile strength, ductility, resilience and toughness, impact strength, fatigue and creep. [7 hrs]	7
4	**UNIT IV** Heat treatment and its importance. Annealing, Normalizing, Hardening, TTT diagram and its construction and related Heat Treatment Processes such as Austempering, Martempering, Patenting etc. Case / Surface hardening treatments such as Carburizing, Nitriding, Cyaniding, Carbonitriding, Flame and Induction hardening. **[7 hrs]**	7

Unit	Content	Hours
5	**UNIT V** Introduction to types of composites: metal matrix, ceramic matrix, polymer matrix and carbon-carbon composites; Characteristics of polymer matrices, Method of preparation of fibres (glass and carbon**). [7 hrs]**	7
6	**UNIT VI** Non-Ferrous Alloys – Study of non-ferrous alloys such as brasses (Cu-Zn diagram), Bronzes (Cu-Sn diagram), Aluminum Alloys (e.g. Al-Si & Al-Cu diagram), Bearing materials. Powder Metallurgy: Powder manufacture and Conditioning, Production of Sintered Structural Components, Self-lubricating bearing, Cemented Carbides, Ceramics, Sintered Carbide cutting tools. **[7 hrs]**	7

Text Books:

SN	Title	Edition	Authors	Publisher
1	Material science and engineering	Delhi, 2005	V. Raghavan	PHI
2	Fundamentals of Materials Science and Engineering, An Integrated Approach	3rd Edition, 2008.	William D. Callister & David G. Rethwisch,	John Wiley
3	Introduction to Engineering Metallurgy	21st revised edition, 2007	Dr. B K Agrawal	Tata McgraHill
4	Introduction to Physical Metallurgy	29st revised edition, 2009	Sidney H.Avner	McGraw-Hill,1964
5	Engineering Physical Metallurgy and Heat Treatment	21st revised edition, 1988	Yu Lakhtin	Mir publishers, Moscow, Russia
6	Metallurgy for Engineers	4th Revised edition 1987	E C Rollason	E. Arnold,

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Materials Science and Engineering	Singapore, 2002.	W.D. Callister ,	John Wiley & Sons,
2	Principles of Materials Science and Engineering: An Introduction	2008.	W.F. Smith	Tata Mc-Graw Hill
3	Principles of Electronic Engineering Materials	2007.	S. O. Kasap	Tata Mc-Graw Hill,

Website / Data sheet:

S N	Title
1	IISC Banglore : https://nptel.ac.in/courses/112/108/112108150/
2	IIT Madras : https://nptel.ac.in/courses/112/106/112106293/
3	IIT Delhi :https://nptel.ac.in/courses/113/102/113102080/

I Semester
IIOT GE2131: Universal Human Value

Course Objective: To help the students appreciate 'VALUES' and 'SKILLS' by facilitating development of a Holistic perspective towards life, profession , happiness and prosperity as well understand ethical human conduct.

Course Outcome: After completion of the course, student will demonstrate the ability to :-

CO 1	Experiential validation through the way to verify right or wrong.
CO 2	Practice living in harmony with natural acceptance
CO 3	Realise the importance of relationships**.**
CO 4	Recognize the importance of sustainable co-existence in existence

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1								2				2		
CO 2							3					3		
CO 3									1	1		1		
CO 4							1			1		1		

Syllabus:

Unit	Content	Hours
1	**Course Introduction** Need, Basic Guidelines, Content and Process for Value Education, Understanding the need, basic guidelines, content and process for Value Education, Self Exploration–what is it? - its content and process; ‗Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration ,Continuous Happiness and Prosperity- A look at basic Human Aspirations	6
2	**Understanding Harmony in the Human Being** - Harmony in Myself!,Understanding human being as a co-existence of the sentient ‗I' and the material ‗Body', Understanding the needs of Self (‗I') and ‗Body' ,Understanding the Body as an instrument of ‗I' (I being the doer, seer and enjoyer),Understanding the characteristics and activities of ‗I' and harmony in ‗I'	6
3	**Understanding Harmony in the Family** Harmony in Human-Human Relationship, Understanding Harmony in the family – the basic unit of human interaction , Understanding values in human-human relationship; meaning of Nyaya and program for its fulfilment to ensure Ubhay-tript; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas;	5

Unit	Content	Hours
4	**Understanding the harmony in the society** Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and, differentiation; the other salient values in relationship ,Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sahasttva as comprehensive Human Goals,Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! ,Practice Exercises and Case Studies will be taken up in Practice Sessions	6
5	**Understanding Harmony in the Nature and Existence** - Whole existence as Co-existence, Understanding the harmony in the Nature Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature , Understanding Existence as Co-existence (Sah-asttva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence , Practice Exercises and Case Studies will be taken up in Practice Session	6

Text Books:

SN	Title	Edition	Authors	Publisher
1.	The text book R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics,		R.R Gaur, R Sangal, G P Bagaria,	Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

Reference Books:

SN	Title	Edition	Authors	Publisher
1	The teacher's manual R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi, 2010.		R.R Gaur, R Sangal, G P Bagaria	Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

Website / Data sheet:

SN	Title
1	https://swayam.gov.in/nc_details/NPTEL
2	https://www.aicte-india.org/press-realeases/universal-human-values-unique-course-aicte

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

2nd Semester

(Department of Electronics Engineering

Industrial Internet of Things (IIoT)

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. IoT-203

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2021-22 onward)

(Department of Electronics Engineering)

Industrial IOT

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
First Semester															
1	1	BES	EL	IIOT2101	Basic Electrical Machines	T	3	0	0	3	3	30	30	40	3 Hours
2	1	BES	EL	IIOT2102	**Lab.:** Basic Electrical Machines	P	0	0	2	2	1		60	40	
3	1	HS	GE	IIOT2103	Constitution of India	T	3	0	0	3	3	30	30	40	3 Hours
4	1	BS	GE	IIOT2104	Calculus	T	3	0	0	3	3	30	30	40	3 Hours
5	1	BS	GE	IIOT2105	Semiconductor Physics	T	3	0	0	3	3	30	30	40	3 Hours
6	1	BS	GE	IIOT2106	**Lab.:** Semiconductor Physics	P	0	0	2	2	1		60	40	
7	1	PC	EE	IIOT2107	C Programming	T	3	0	0	3	3	30	30	40	3 Hours
8	1	PC	EE	IIOT2108	**Lab.:** C Programming	P	0	0	2	2	1		60	40	
9	1	BES	ME	IIOT2109	Engineering Materials	T	3	0	0	3	3	30	30	40	3 Hours
					TOTAL FIRST SEM		**18**	**0**	**6**	**24**	**21**				
List of Audit Course															
1	1	HS	GE	GE2131	Universal Human Value	**T**	2	0	0	0	0				
2	1	HS	GE	GE2123	YCCE Communication & Aptitude Preparation (YCAP)	**A**	3	0	0	3	0				
3	2	HS	GE	GE2124	YCCE Communication & Aptitude Preparation (YCAP)	**A**	3	0	0	3	0				
Second Semester															
1	2	BS	GE	IIOT2151	Probabilty theory and Statistical Inference	T	3	0	0	3	3	30	30	40	3 Hours
2	2	BS	GE	IIOT2152	Applied Chemistry	T	3	0	0	3	3	30	30	40	3 Hours
3	2	BS	GE	IIOT2153	**Lab.:** Applied Chemistry	P	0	0	2	2	1		60	40	
4	2	BES	ME	IIOT2154	Engineering Graphics	T	3	0	0	3	3	30	30	40	3 Hours
5	2	BES	ME	IIOT2155	**Lab.:** Engineering Graphics	P	0	0	2	2	1		60	40	
6	2	HS	GE	IIOT2156	Technical Communication	T	3	0	0	3	3	30	30	40	3 Hours
7	2	PC	ME	IIOT2157	Fundamentals of Manufacturing Process	T	3	0	0	3	3	30	30	40	3 Hours
8	2	PC	ME	IIOT2158	**Lab.:** Fundamentals of Manufacturing Process	P	0	0	2	2	1		60	40	
9	2	PC	EE	IIOT2159	**Lab.:** Python Programming	P	0	0	2	2	1		60	40	
					TOTAL SECOND SEM		**15**	**0**	**8**	**23**	**19**				

MSEs* = Two MSEs of 15 Marks each will be conducted and total marks of MSE 1 and MSE 2 MSEs will be considered for Continuous Assessment out of 30.

TA- for Theory : 30 marks on quizzes, activities, attendance etc as included in TA plan of course teacher. TA - for Practical: MSPA will be 15 marks each as included in TA plan of course teacher

TA – for Practical : MSPA will be 15 marks each

		June 2021	1.00
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2021-22 Onwards

II Semester
IIoT2151: Probability Theory and Statistical Inference

Course Objective: This course provides an indication of the relevance and important of the probability theory and mathematical statistics in solving practical problems in the field of multidisciplinary engineering applications.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Identify an appropriate probability distribution for a given discrete or continuous random variable and compute probabilities.
CO 2	Make use of probability distributions to solve a given problem.
CO 3	Apply concepts of sampling theory to find probabilities and estimates parameters of various problems.
CO 4	Test the hypothesis and estimate confidence intervals at different levels.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3												
CO 2	3	3												
CO 3	3	3	3											
CO 4	4	4	4											

Syllabus:

Unit	Content	Hours
1	**Random Variables & Probability Distributions** Conditional probability, Baye's theorem. Random variables: Discrete and Continuous random variables, Probability function and Distribution function, Joint distributions. Independent Random variables, Conditional Distribution.	7
2	**Mathematical Expectation** Mathematical Expectation, Variance & Standard Deviation, Moments, Moment generating function, Skewness and Kurtosis.	7
3	**Special Probability Distributions** Binomial, Geometric, Poisson, Exponential, Normal, Central Limit theorem.	6
4	**Sampling Theory** Population and sample. Statistical inference. Sampling with and without replacement. Random samples, population parameters, sample statistics. Sampling distribution of means (known and unknown). Sampling distribution of proportions.	6

Unit	Content	Hours
5	**Estimation** Unbiased and efficient estimates. Point estimates and interval estimates. Confidence interval for means, Confidence interval for proportions, Confidence interval for differences and sums of mean and proportions.	6
6	**Decision Theory** Definition of hypothesis, Testing of hypothesis for large samples using normal distributions. Testing of hypothesis for small distributions (student's t-test, F-test) . Goodness of fit test(Chi-square distribution).	7

Text Books:

SN	Title	Edition	Authors	Publisher
1	The theory and problems of probability and Statistics	3rd edition	M. R. Spiegel	Schaum series. (McGraw Hill)
2	Basic Statistics for Business and economics		E. K.Bowen, M. K.Star	McGraw Hill
3	Probability Theory And Mathematical Statistics For Engineers		V. S. Pugachev	
4	Probability and Statistics	2nd edition	Michael J. Evans and Jeffrey S. Rosenthal	

Reference Books:

SN	Title	Edition	Authors	Publisher
1	A First course in probability	Sixth Edition	Sheldon Ross	Pearson Education
2	Fundamentals of Mathematical statistics	3rd Edition	S. C.Gupta and V.K.Kapoor	
3	Probability and Statistics for Engineering	6th edition	Miller Freund and Johnson.	

Website / Data sheet:

SN	Title
1	https://nptel.ac.in/courses/117/105/117105085/
2	https://nptel.ac.in/courses/111/104/111104032/
3	https://nptel.ac.in/courses/111/105/111105043/

II Semester
IIoT2152: Applied Chemistry

Course Objective:

- To impart intensive and extensive knowledge of the subject enriching students to understand the roleof Chemistry in the field of engineering.
- To keep students abreast with the latest developments and applications of modern materials.
- To gain basic principles, instrumentation and applications of analytical techniques.

Course Outcome: After completion of the course, student will be able to

CO 1	Interpret different thermodynamic functions. (L2)
CO 2	Describe basic concepts of electrochemistry and apply the knowledge for energy storage devices. (L3)
CO 3	Develop better awareness about global environmental concerns. (L2)
CO 4	Classify advanced engineering materials in technological applications. (L2)
CO 5	Develop analytical and instrumental skills. (L3)

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2					1							
CO2	3	1					1							
CO3	2	2												
CO4	3						2							
CO5	3	2					2							

Unit No.	Contents	Max. Hrs.
1	**Energetics**: Introduction, Internal energy, enthalpy, Gibb's free energy, Free energy change and chemical equilibrium. Spontaneous and non-spontaneous processes. I and II law of thermodynamics. Entropy and its significance. Numericals on Internal energy and enthalpy change. Thermodynamic applications to physical and chemical equilibrium.	07
2	**Electrochemistry**: Introduction, metallic and electrolytic conductance, resistance, specific resistance, conductance, specific conductance, equivalent and molar conductance. Variation of conductance with dilution. Electrode and electrode potentials. Nernst Equation. Faraday's laws and Numericals. Industrial applications: Electroforming, Electrowinning, Electrolytic refining.	06

Unit No.	Contents	Max. Hrs.
3	**Energy storage devices** **Basic concepts**: Primary and secondary battery. Energy density, power density, energy efficiency, cycle life, shelf life. Secondary battery: Ni-metal hydride battery, Lithium-ion battery. **H_2-O_2 Fuel cell**: Principle, working, advantages, disadvantages, applications. Differences between battery and a fuel cell. **Supercapacitors**: Definition, types, characteristics and application.	06
4	**Chemical Kinetics** : Introduction, Rate of reaction and factors influencing rate of reaction, order & molecularity of reaction. Kinetic equations of different orders: Zero Order, First Order, Second Order and numericals.	06
5	**Industrial pollution, its impacts on environment and control.** Introduction: Industrial pollution and its types. Sources of pollution in electronic industries. Hazardous waste management. Battery waste management. e-waste pollution, its impact on environment , rules of regeneration of e-waste recycling and its managements as per government norms.	06
6	**Advanced Materials :** **Nanomaterials**: Definition of nanomaterials, nano scale. Carbon Nanotubes and types. **Application of Nanomaterials**: Applications of nanomaterials in medicine, environment, and electronics. Nanotechnology for waste reduction and improved energy efficiency. Threats of Nanomaterials. **Silicon Chips:** Introduction. Physical, chemical, electrical & mechanical properties and applications. **Polymers in electronic industries:** Piezo, pyroelectric**,** Ferroelectric polymers.	07

Text Books:

SN	Title	Edition	Authors	Publisher
1	A Textbook of Engineering Chemistry	Eleventh Edition.	S S. Dara	S.Chand & Co New Delhi
2	Engineering Chemistry	Sixteenth Edition	Jain & Jain;	Dhanpat Rai & sons New Delhi.
3	Physical Chemistry	Eighth edition-2006).	P. W. Atkins,	Oxford Publications
4	Engineering Chemistry		B.Sivasankar	Tata McGraw-Hill

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Chemistry in Engineering		Lloyd A.Munro	Prentice-hall
2	Applied chemistry for engineers		T.S.Gyngell	
3	Engineering Chemistry		B.K.Sharma Krishna Prakashan media private LTD	
4	Chemistry of Advanced Materials		CNR Rao	RSC Publications
5	Handbook of Semiconductor Silicon Technology	1st Edition.	William C. O'Mara, Robert B. Herring	NOYES PUBLICATIONS I "P I Park Ridge, New Jersey. USA.

Website / Data sheet:

SN	Title
1	Silicon Chips: What are Computer Chips Made Of? https://www.intel.com/content/www/us/en/history/museum-making-silicon.html
2	What is silicon, and why are computer chips made from it? https://www.extremetech.com/extreme/208501-what-is-silicon-and-why-are-computer-chips- made-from-it

II Semester
IIoT2153: Lab.: Applied Chemistry

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 2	Describe basic concepts of electrochemistry and apply the knowledge for energy storage devices. (L3)
CO4	Classify advanced engineering materials in technological applications. (L2)
CO 5	Develop analytical and instrumental skills. (L3)

Lab Experiment List:

Expt. No	Name of Experiment (Minimum 4 experiments from Group I & II each and Demonstrations on 2 experiments should be conducted)
	Group I:
1	To determine the strength of a given potassium dichromate solution with N/20 sodium thiosulphate solution.
2	Estimation of Nickel by complexometry.
3	Determination of copper by iodometric titration.
4	Estimation of Fe^{2+} ions by redox titration.
5	Estimation of Fe^{3+} ions by spectrophotometric method.
6	Synthesis of urea formaldehyde resin.
	Group II:
7	Preparation of Printed Circuit Board.
8	Determination of molecular weight of a polymer using Ostwald's viscometer.
9	Determination of ion exchange capacity of a cation exchange resin.
10	Proximate analysis of Coal.
11	Determination of thinner contain in oil paint.
12	Electroplating Copper on Stainless steel.
	Demonstration:
13	Determination of Faradays first law.
14	Determination of Faradays second law.
15	Determination of conductivity of water sample by conductivity meter

II Semester
IIoT2154: Engineering Graphics

Course Objectives:

- To make the students aware of how an industry communicates technical information graphically.
- To understand the principles of presenting necessary information with accuracy and clarity
- To develop skill to draw clearly and rapidly and to read the drawings drawn by others ,effectively using manual and software techniques
- To develop the imagination skills that are essential while creation of successful design.

Course Outcomes: After completion of the course, student will demonstrate the ability to

Course Outcome	*Statement*	*B Level*
CO 1	**Construct** orthographic drawing and isometric drawing of a given object	L3
CO 2	**Evaluate** Projections of various One Dimensional, Two dimensional, Three-dimensional objects	L4
CO 3	**Develop** the lateral surfaces of various solids, their section and intersection**.**	L3
CO 4	**Practice** the use of software tools used for Two dimensional drawings.	L3

CO – PO Mapping:

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	BL
CO1	3	2	-	-	3	-	-	-	2	3	-	3	3	-	L3
CO2	3	2	-	-	3	-	-	-	2	3	-	3	3	-	L4
CO3	3	2	-	-	3	-	-	-	2	3	-	3	3	-	L3
CO4	3	2	-	-	3	-	-	-	2	3	-	3	3	-	L3
Average	3	2	-	-	3		-	-	2	3		3	3	-	-

Unit No.	Contents	Max. Hrs.
I	**Theory of Orthographic Projections:** Introduction, Quadrant system, Theory of orthographic projection, Projection method and principal planes, First and Third angle projections. **[CO1 , CO4]**	**3**
II	**Theory of Isometric Projections:** Theory of isometric projection, Method for drawing isometric views, Different problems on isometric projections. **[CO1 , CO4]**	**2**

Unit No.	Contents	Max. Hrs.
III	**Lines:** Projection of points, Projection of lines, True lengths and inclinations, apparent lengths and inclinations, various positions of lines in different quadrants, Traces of lines, projection of line on auxiliary plane. **[CO2 , CO4]**	2
IV	**Planes and Solids:** Projection planes: (Polygonal Lamina, Circular Lamina), Projection of Perpendicular planes and oblique planes. Auxiliary views (Auxiliary planes) Projection of Solids :(Inclined to One Plane Only) - Polyhedra (Regular and Irregular Polyhedra), Solids of Revolution **[CO2 , CO4]**	4
V	**Section of Solids and Development of Surfaces:** Types of Section planes, Sectional top view, True shape. Development of different solids using Radial line and parallel line methods. **[CO3 , CO4]**	2
VI	**Intersection of Surfaces of solids:** Intersection between similar solids, Intersection between dissimilar solids, Lines and Curves of Intersection. **[CO3 , CO4]**	2

Text Books:

SN	Title	Edition	Authors	Publisher
1	Engineering Graphics with AutoCAD	Revised Edition(2014)	D.M. Kulkarni, A. P. Rastogi and A. K. Sarkar	PHI learning Pvt. Ltd.
2	Engineering Drawing	53 rd Edition 2017	N. D. Bhatt	Charotar Publishing House Pvt. Ltd

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Engineering Drawing	2008	D. A. Jolhe	Tata McGraw Hill Publications
2	Engineering Drawing	2010	K. L. Narayana & P. Kannaiah	SciTech Publication
3	Engineering Drawing	Multicolor revised edition	R. K. Dhawan	S. Chand Publication

Software: Auto CAD

Website / Data sheet:

SN	Title
1	**Engineering Graphics IIT Roorkee** https://youtu.be/ANEvQyt3PnU
2	**Engg Drawing and Computer Graphics** https://nptel.ac.in/courses/112/105/112105294/
3	**Engineering Drawing** https://nptel.ac.in/courses/112/103/112103019/

II Semester
IIoT2155: Lab.: Engineering Graphics

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

Course Outcome	*Statement*	*Level*
CO 1	**Construct** orthographic drawing and isometric drawing of a given object	L3
CO 2	**Evaluate** Projections of various One Dimensional, Two dimensional, Three dimensional objects	L4
CO 3	**Develop** the lateral surfaces of various solids, their section and intersection**.**	L3
CO 4	**Practice** the use of software tools used for Two dimensional drawings.	L3

Lab Experiment List:

Expt. No	Name of Experiment
1	Introduction of AutoCAD Basic Commands
2	Orthographic Projection
3	Isometric Projection
4	Projection of Straight Line
5	Projection of Planar Surface
6	Projection of Solid
7	Section and Development of Solid
8	Intersection of Surfaces
9	Drawing Sheet 1: Convention for various lines, Dimensioning and Orthographic Projection
10	Drawing Sheet 2: Projection of line, planar surface or solid. (Any one)

II Semester
IIoT2156: Technical Communication

Course Objective: Explain the fundamentals of communication and classify different speech sounds of English, using different components of oral communication and draft technical documents precisely .

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Apply different modes for effective communication
CO 2	Competently use the phonology of English language
CO 3	Apply nuances of LSRW skills
CO 4	Communicate through different channels

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1										3				
CO 2										3				
CO 3									3	3				
CO 4										2		2		

Syllabus: Technical Communication

Unit	Content	Hours
1	**Basics of Communication : -** Language as a tool of communication & characteristics of language Process of Communication, Levels of Communication, Flow of Communication, Networks of Communication, Classification of Barriers (Intrapersonal, Interpersonal, Organizational).	7
2	English Phonetics :- Speech Mechanism, Organs of speech, Consonant and Vowels sounds,Worde stress rules	6
3	Interview Skills :- Purpose , expectations of employer and preparation for Interview, Types, Types of Questions & Answering Techniques, Telephonic Interviews – preparation and guidelines, Reading Techniques (Exercise based on Complex Unseen passages	7
4	Oral Skills :- Group Communication- (Purpose, Different types of Group Communication, Organizational GD, GD as a part of selection process), Meeting (purposes, preparation, procedure and minutes of meeting), Listening Skills -definition types and traits	6

Unit	Content	Hours
5	Presentation & Visual Communication :- Presentation and audience analysis, Organizing content, Nuances of presentation, Visual Communication – Introduction & importance, Role & Psychology of color in visual communication.	6
6	Technical Written Communication:- Memo, Email, Report -Types, Characteristics, prewriting aspects of report and preparing writing aspects of report), Types of paragraphs.	7

Text Books:

SN	Title	Edition	Authors	Publisher
1.	Technical Communication		Raman &Sharma	Oxford University Press
2	Textbook of English Phonetics for Indian Students		T.Balasubramaniam	Macmillan India Ltd

Reference Books:

SN	Title	Edition	Authors	Publisher
1	How to Develop Self – Confidence & Influence People by Public Speaking		Dale Carnegie	
2	Communication Skills		Asha Kaul	
3	Body Language		Allen Peas	
4	Gerson's Gerson Communication		Technical	

Website / Data sheet:

SN	Title
1	https://swayam.gov.in/nc_details/NPTEL
2	https://en.wikipedia.org/wiki/Technical_communication
3	https://www.skillsyouneed.com/ips/communication-skills.html

II Semester
IIoT2157: Fundamentals of Manufacturing Process

Course Objective:

- To emphasize the importance manufacturing sciences in the day-to-day life, and to study the basic manufacturing processes and tools used.
- To understand the conventional manufacturing processes like casting, metal forming, and welding process.
- Identify and explain basic components and function of different machine tools.
- Understand the application and limitations of various machining processes with regard to shape formation and surface quality.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Differentiate various Manufacturing processes
CO 2	Elaborate and classify different casting and joining processes.
CO 3	Summarize cutting tool materials and tool geometries for different metals.
CO 4	Analyze appropriate machining processes for different machining conditions.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO-1	PSO-2
CO-1	3	1	2	2	1	2	2	3	1	2	3	2	2	2
CO-2	3	1	2	2	1	2	2	3	1	2	3	2	2	2
CO-3	3	1	2	2	1	2	2	3	1	2	3	2	2	2
CO-4	3	1	2	2	1	2	2	3	1	2	3	2	2	2

Unit	Content	Hours
1	**Introduction:** Understanding Manufacturing, Fundamental Approaches of Manufacturing, Manufacturing Process Specific Advantages and Limitations, Materials and Manufacturing Processes, Classification of Manufacturing Processes, Selection of Manufacturing Processes, Applications of Manufacturing Processes, Effect of Manufacturing Processes on Mechanical Properties	8
2	**Casting:** Introduction and Suitability, Steps of Casting Processes, Casting: Terminology, The Pattern Allowances, Types of moulding and castings, Metal Working Processes, Sheet Metal Operations, Dies and Die sets	7

Unit	Content	Hours
3	**Joining Processes:** Joining of metals, welding and types of welding, brazing, soldering and welding defects, weldability and welding defects	8
4	**Introduction to marching and Cutting tools:** Introduction to marching, types of cutting tools, Tool materials, Tool geometry, Chip Formation, Types of Chips,, tool failure and tool life, Cutting fluids.	7
5	**Conventional Manufacturing Machines-I:** Construction of simple lathe, mechanism and attachments for various operations, machine specifications, basis for selection of cutting speed, feed and depth of cut, Capstan and Turret Lathe and special purpose Machines. Shaper type, specification, types of drives in shapers Planer: specifications, type of planner. Mechanism for planner: Driving mechanism, feeding mechanism	7
6	**Conventional Manufacturing Machines-II:** Milling specifications, types milling machine, Mechanisms and Types of milling cutters. Grinding operations, grinding wheel, specifications & selection, Grinding operations. Drilling machines, tools for drilling, classification of drills, twist drills, type of drilling machines. Drilling machines operations. Reaming operation, description of reamers, type of reaming operations. Boring: types of boring machine, micro boring, boring operations. Broaching: Introduction, type of broaches, and type of broaching machines.	8

Text Books:

SN	Title	Edition	Authors	Publisher
1.	Manufacturing Technology (Metal Cutting & Machine Tools)	2nd Edition (2019)	P N Rao	The McGraw-Hill Companies
2	Manufacturing Science	2nd Edition (2020)	Ghosh & Malik	East West publication
3	Workshop Technology (Volume-II)	2nd Edition (2019	Hajra Choudhary	MPP LTD.

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Manufacturing Engineering & Technology	1st Edition (2019)	S Kalpakjian & SR Schmid	Pearson Education Canada
2	Technology of machine Tools	1st Edition (1984)	Krar & Oswald	McGraw- Hill
3	Processes & Materials of Manufacture	1st Edition (1990)	R Lindberg	Allyn and Bacon Technology & Engineering

Reference Books:

SN	Title	Edition	Authors	Publisher
4	Production Technology	1st Edition (2018)	Karunakaran	HMT
5	Workshop Technology (Volume I & II)	2nd Edition (2019)	Bawa	McGraw-Hill Companies

Website / Data sheet:

SN	Title
1	**Manufacturing Process Meaning and Types** https://www.engineeringarticles.org/manufacturing-process-meaning-and-types/
2	**Metal Forming** https://nptel.ac.in/courses/112/107/112107144/

II Semester
IIoT2158: Lab.: Fundamentals of Manufacturing Process

Course Objective:

- To emphasize the importance manufacturing sciences in the day-to-day life, and to study the basic manufacturing processes and tools used.
- To understand the conventional manufacturing processes like casting, metal forming, and welding process.
- Identify and explain basic components and function of different machine tools.
- Understand the application and limitations of various machining processes with regard to shape formation and surface quality.

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	Differentiate various Manufacturing processes
CO 2	Elaborate and classify different casting and joining processes.
CO 3	Summarize cutting tool materials and tool geometries for different metals.
CO 4	Analyze appropriate machining processes for different machining conditions .

Lab Experiment List:

Expt. No	Name of Experiment	CO
1	Study of Various molding processes.	1,2
2	Study of various types of melting furnaces and cupola in detail.	2
3	Study of different types of wooden pattern	2
4	Preparation of mould making.	2
5	Preparation of casting job along with Study of casting processes.	2
6	Demonstration of working of Lathe Machine and study of its mechanism.	3,4
7	Demonstration of working of Shaper Machine and study of its mechanism	3,4
8	Demonstration of working of Milling machine and study of its mechanism.	3,4
9	Demonstration of working of Drilling machine and study of its mechanism.	3,4
10	Job making involving various operations such as MIG ,TIG welding processes etc.	2
11	Preparation of job on punching press	2
12	Report of foundry visit	2

II Semester
IIoT2159: Lab.: Python Programming

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

Course Outcome	Statement On successful completion of this course, students should be able:	Bloom's Taxonomy Level
CO 1	To **understand** syntax and semantics of language	L1, L2
CO 2	To **understand** and **apply** the basics of the programming language	L2,L3
CO 3	To **analyse** and **apply** special language features	L3,L4
CO 4	To **evaluate** and **create** functions for any application	L5,L6

Lab Experiment List:

Expt. No.	Name of Experiments
1	Installation of IDE and write first program in Python using "variables".
2.	To understand "Data Types" of Python.
3.	To perform different operations on "Strings" in Python.
4.	To understand different "Operators" in Python.
5.	To learn and write program using "List" and "Tuple" in Python.
6.	To learn and write program using "Set" and "Dictionary" in Python.
7.	To learn and write program using Loop statements in Python.
8.	To learn "1D NumPy" of Python.
9.	To learn "2D NumPy" of Python.(Optional)
10.	To learn and write program using functions in Python.(Optional)

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

3rd Semester

(Department of Electronics Engineering

Industrial Internet of Things (IIoT)

June 2022

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

Industrial IOT

SoE No. IoT-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	PC	EE	IIOT2201	Digital Electronics	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	EE	IIOT2202	**Lab. :** Digital Electronics	P	0	0	2	2	1		60	40	
3	3	BS	GE	IIOT2203	Linear Algebra and Graph Theory	T	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	EE	IIOT2204	Electronics Deivces and Circuits	T	3	0	0	3	3	30	20	50	3 Hours
5	3	PC	EE	IIOT2205	**Lab.:** Electronics Deivces and Circuits	P	0	0	2	2	1		60	40	
6	3	PC	EE	IIOT2206	Algorithms and Data Structures	T	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	EE	IIOT2207	**Lab.:** Algorithms and Data Structures	P	0	0	2	2	1		60	40	
8	3	HS	EE	IIOT2208	Engineering Economics and Management	T	3	0	0	3	3	30	20	50	3 Hours
9	3	PC	EE	IIOT2209	Sensors & Actuators for IIOT	T	3	0	0	3	3	30	20	50	3 Hours
					TOTAL THIRD SEM		**18**	**0**	**6**	**24**	**21**				

List of Audit Course

1	3	HS	FY	GE2131	Universal Human Values	**T**	2	0	0						

Fourth Semester															
1	4	PC	EE	IIOT2251	Control System Engineering	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	EE	IIOT2252	**Lab.:** Control System Engineering	P	0	0	2	2	1		60	40	
3	4	PC	EE	IIOT2253	Mechatronics	T	3	0	0	3	3	30	20	50	3 Hours
4	4	PC	EE	IIOT2254	**Lab.:** Mechatronics	P	0	0	2	2	1		60	40	
5	4	PC	EE	IIOT2255	Microprocessor and Interfacing	T	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	EE	IIOT2256	**Lab.:** Microprocessor and Interfacing	P	0	0	2	2	1		60	40	
7	4	PC	EE	IIOT2257	Analog and Digital Communication	T	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	EE	IIOT2258	**Lab.:** Analog and Digital Communication	P	0	0	2	2	1		60	40	
9	4	STR	EE	IIOT2259	Design Tool Lab-1	P	0	0	2	2	2		60	40	
10	4	STR	EE	IIOT2260	**Lab.:** Electronics Workshop	P	0	0	2	2	2		60	40	
					TOTAL FOURTH SEM		**12**	**0**	**12**	**24**	**20**				

List of Audit Course

1	4	HS		GE2121	Environmental Studies	**T**	2	0	0						

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

III Semester
IIOT2201: Digital Electronics

Course Objective:

- The purpose of this course is to develop a strong foundation of digital electronics.
- Understand concepts of combinational and sequential circuits.
- Analyze the synchronous and asynchronous logic circuits.

Course Outcome: After completion of the course, Students will have the ability to

CO 1	Understand, Define and simplify the concept of Digital Electronics Circuits.
CO 2	Apply the concept of different combinational logic circuits which may be used in various digital systems
CO 3	Analyze sequential logic and their applications
CO 4	Design and Analyze the function of different types of counters andMoore and Mealy machines.
CO 5	Conduct experiments to demonstrate the specific application of digital electronics using suitable digital ICs

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2												1	
CO 2	2	2											1	
CO 3	2	2	2										1	
CO 4	2	2	3										1	
CO 5	2	2	2	3										

Syllabus:

Unit	Content	Hours
1	ntroduction to Number Systems and its conversions: Binary Arithmetic, 1's and 2's Complement Arithmetic, Signed Binary Number Arithmetic, Codes- BCD code and Gray Code , BCD arithmetic, Logic Gates.	7

2	Methods to simplify logical Functions: Boolean Laws & Algebras, Sum of Product & Product of Sum, Karnaugh Map (up to 6 Variable)	7
3	Combinational Logic Design: Half & Full Adder, Half & Full Subtractor, Multiplexer, Demultiplexer, Encoder, Decoder, word problems based on combinational circuits	7
4	Sequential Logic Design: Latches and flip-flops(RS, D, JK, JK Master-Slave & T), Excitation & Truth Table, Flip-flop conversions, Shift registers	8
5	Introduction to Synchronous and Asynchronous sequential Circuits: Modulus Counter, Ring counter, Johnson counter, Ripple counter, Design of Synchronous Counter.	7
6	Finite state machine : Moore and Mealy circuits ,sequence detector using Moore and Mealy machines, Method of partition.	6

Text Books:

SN	Title	Edition	Authors	Publisher
1	Modern Digital Electronics	3rd Edition	RP Jain	Tata McGraw Hill
2	Digital Circuits & Microprocessors.	1988	Hebert Taub	Mc Graw Hill

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Fundamentals of Logic Design.	3rd edition 2007.	C.H.Roth	Public Work & Services
2	Engg Approach to Digital Design.	1993	Fletcher	Prentice Hall of India
3	Digital Design.	4th edition 2008	M. Morris Mano	Prentice Hall of India,

Website / Data sheet:

SN	
1	https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials
2	
3	

III Semester
IIOT2202: Lab. : Digital Electronics

Lab Experiment List:

Expt. No	of Experiment
1	To Verify the Truth table for the basic logic gates and universal gates.
2	To Verify the truth table of Basic gates using Universal gates
3	To Implement & Verify Boolean Expression using Basic Logic Gates
4	To Implement & verify Half adder and full adder circuit.
5	To Implement & verify Half subtractor and full subtractor circuit
6	To verify truth table of Multiplexer and Demultiplexer .
7	To Implement BCD to Seven segment Display combinational circuit
8	To Implement & Verify 4bit binary adder circuit.
9	To verify the truth table of S-R & D flip-flop
10	To verify the truth table of J-K & T flip-flop.
11	To Design 2 bit binary synchronous/asynchronous counter
12	To Design Finite State Machine using decoder IC

III Semester
IIOT2203: Linear Algebra and Graph theory

Course Objective: This course provides the mathematical knowledge required to analyze problems encountered in engineering. Students are acquainted with the solution of system of linear equation, eigen values and eigen vectors and they can apply this course in many areas of engineering such as computer graphics, cryptography, wire-less communication, signal processing, robotics and animation.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Solve systems of linear equations using rank of matrix in engineering field.
CO 2	Determine eigenvalues and eigenvectors and solve eigenvalue problems.
CO 3	Explain the concepts of vector space and subspace, span and basis and inner product
CO 4	Find the suitable computing methods and graph theory concepts to solve complex problems.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO	3	3												
CO	3	3												
CO	3	3												
CO	3	3	3											

Syllabus:

Unit	Content	Hours
1	**Elementary matrix operations** Elementary Matrix and their operations, transpose of Matrix, ranks of matrix (Echelon Form) Inverse of matrix by Adjoin Matrix method Consistency of System of Equations. Matrix Decomposition.	6
2	Diagonalization of matrix Eigen Values and Eigen vectors, Linear dependence and independence of Eigen Vectors, Cayley-Hamilton Theorem and Sylvester's Theorem.	6
3	Group Theory Groups, Subgroups and Homomorphism, Cosets and Lagrange's theorem, Normal subgroups, Semi groups and Monoids. Homomorphism of semigroups and monoids, Sub semi groups and sub monoids.	7
4	Ring and Field Definitions and Examples of rings, sub ring, Integral domain, Polynomial ring, Ring homomorphism, Finite field.	7
5	Vector Space Vector Space, Subspace, Sum of Sub space, linear combination, Linear Span and basis, Spanning sets, Ranges and Kernel (null space) of linear transformation	6
6	Graph Theory Basic concepts of graph theory, Paths and circuits, Reach ability and connectedness, Matrix Representation of graphs, Tree and their representation and operations, Rooted trees, Path lengths in rooted trees, Multi graphs and weighted graphs, and graph isomorphism, shortest paths in weighted graphs, Hyper graphs, transitive closure, Spanning trees, Kruskal's algorithm, Prim's algorithm.	7

Text Books:

SN	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	9th Edition	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition	B.S. Grewal	Publisher: S.Chand & Company Limited
3	Linear Algebra		Hoffman and Kunze	prentice Hall of India, New Delhi
4	Linear Algebra and its Applications		Glbert Strang	Nelson Engineering (2007)

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Applied Mathematics for Engineers	3rd edition	L.A. Pipes and Harville	McGraw Hill.
4	Matrix and Linear Algebra,		K.B.Datta	Prentice Hall of India.
5	A text book of Engineering Mathematics		N.P. Bali & Manish Goyal	Laxmi Prakashan

Website / Data sheet:

SN	Title
1	https://archive.nptel.ac.in/courses/111/104/111104137/
2	https://onlinecourses.nptel.ac.in/noc21_ma03/preview
3	https://onlinecourses.nptel.ac.in/noc22_ma10/preview

III Semester
IIOT2204: Electronics Devices and Circuits

Course Objective:

- The purpose of this course is to present a clear consistent picture of the internal physical behavior of many electronic devices so that their studies of electronic circuit and system will be meaningful.
- The purpose of this course is to introduce to the students the basics of biasing transistor **circuits, feedback** amplifiers, rectifiers, & analyzing different two terminal devices.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Analyze different types of semiconductor devices, their operation and characteristics.
CO 2	Design and analyze the DC bias circuitry of BJT and FET.
CO 3	Analyze and model BJT, FET and MOSFET for small signal.
CO 4	Apply concept of feedback to improve stability of circuits.
CO 5	Design circuits using the transistors and oscillators.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO	1	3	2	--	--	--	--	--	--	--	--	--	--	--
CO	1	2	3	--	--	--	--	--	--	--	--	1	--	--
CO	1	3	2	--	--	--	--	1	1	--	--	--	--	--
CO	1	2	3	--	--	--	--	1	1	--	--	--	--	--
CO	1	2	3	--	--	--	--	1	1	--	--	1	--	--

Syllabus:

Unit	Content	Hours
1	**Transistors:** - BJT - structure, operation, characteristics and Biasing BJT structure, Symbol, Basic operation. Input and Output Characteristics in CE, CB and CC configuration, Comparison of transistor configurations. BJT biasing, Stability factor.	06
2	**Transistors:** JFET, MOSFET- structure, operation, characteristics and Biasing JFET: - Structure, Symbol, Basic operation, Drain and Transfer Characteristics. Biasing arrangements for JFET, Universal JFET bias curve, MOSFET: - Structure, Symbol, Basic operation, Drain and Transfer Characteristics. MOSFET Biasing. N-MOS, P-MOS, Comparison of BJT and FET.	08

3	**Single Stage Amplifiers**: BJT small signal model – Analysis of CE, CB, CC amplifiers, Miller's theorem.	08
4	**FET & MOSFET:** small signal model– Analysis of CS, CG and CD amplifiers.	05
5	**Power Amplifiers:** Classes of power amplifiers – Class A, Class B, Class AB, Class C and Class D amplifiers, Analysis of Class A, Class B, Distortions in amplifiers, concept of Total Harmonic Distortion (THD), Comparison of power amplifiers	05
6	**Feedback Amplifiers and Oscillators**: Feedback Amplifiers: - Feedback Concept, Classification of amplifiers based on feedback topology, (Voltage, Current, Trans-conductance and Trans-resistance amplifiers), Effect of negative feedback on various performance parameters of an amplifier, Analysis of one circuit for each feedback topology. Oscillators: - Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillator.	08

Text Books:

SN	Title	Edition	Authors	Publisher
1	Electronic Device and Circuits	Second Edition	Millman & Halkies	Tata McGraw Hill.
2	Electronic devices and Circuits Theory	Eighth edition	Boylestead & Nashelsky	PHI

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Integrated Electronics	Fourth Edition	Millman Halkies	Tata McGraw Hill
2	Electronic Device and Circuits	Fourth Edition	David A. Bell	PHI.
3	Electronic Devices	Seventh Edition	Floyd	Pearson

Website / Data sheet:

SN	Title
1.	https://components101.com/transistors/sl100-pinout-specifications-equivalent-datasheet
2.	https://alltransistors.com/adv/pdfview.php?doc=ao4407.pdf&dire=_aosemi
3.	https://www.electronicshub.org/power-amplifier/#:~:text=A%20power%20amplifier%20is%20an,%2C%20headphones%2C%20RF%20transmitters%20etc.
4.	http://103.152.199.179/YCCE/yccelibrary.html
5.	https://nptel.ac.in/courses/108105159
6.	https://archive.nptel.ac.in/courses/108/105/108105159/

III Semester
IIOT2205: Lab. : Electronics Devices and Circuits

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	**Analyze and Design** analog electronic circuits to compute required parameters.
CO 2	**Conduct** experiments to determine various parameters using hardware and/or simulation tools
CO 3	**Implement** a mini-project and demonstrate the given problem using suitable analog electronic components

Lab Experiment List:

Expt. No	Name of Experiment
1	To plot input & output Characteristics of Common Base Transistor Configuration. Find input & output Resistance and Current Gain.
2	To plot input & output Characteristics of Common Emitter Transistor Configuration. Find input & output Resistance and Current Gain.
3	Analysis of Fixed Bias circuit of transistor.
4	Analysis of Self Bias circuit of transistor
5	To plot the Drain and Transfer characteristics of Field Effect Transistor (FET) in CS mode.
6	To plot the Drain and Transfer characteristics of Metal Oxide Semiconductor Field Effect Transistor (MOSFET) in CS mode.
7	To Plot the Frequency Response of single stage RC coupled CE amplifier with and without feedback
8	To simulate the Frequency Response of Common Source MOSFET Amplifier on LT-spice.
9	To determine the efficiency of Class B push pull power amplifier and to study cross over distortion.
10	To determine the phase shift in RC phase shift oscillator.
11	Mini Project

III Semester
IIOT2206: Algorithms and Data Structures

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Understand the trade-offs of algorithms and programming aspects
CO 2	Apply various operation on data Structure
CO 3	Analyze various types of Data Structure
CO 4	Implement various types of algorithms and analyze performance of system
CO 5	Develop programs using data structures and latest compilers

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO -1	1	1	--	--	--	--	--	--	1	--	--	1	--	--
CO -2	2	3	--	--	2	--	--	--	1	--	--	1	--	--
CO -3	3	3	--	--	2	--	--	--	1	--	--	1	--	--
CO -4	3	3	3	--	3	--	--	--	1	--	1	1	--	--
CO -5	--	--	--	--	3	--	--	--	1	--	1	1	--	--
Average														

Syllabus:

Unit No.	Content	Max. Hrs.
1	Introduction to Algorithms, Basics of Algorithm, Sub Algorithms, Procedures and Functions, Analysis of Algorithms, Time and Space Complexity, Programming aspects with respect to structured programming, Top down and bottom-Up Approach	**7**
2	Arrays, Operations, Types, Representation of 1D, 2D arrays in memory, Sparse Matrices, Sorting, Quick Sort, Merge Sort, Insertion, Radix, Selection and Bubble Sort, Heap Sort, Searching, Linear, Binary Search, Hashing and collision Handling mechanism.	**7**
3	Stack, Fundamentals, Operations, Push , Pop , Applications of Stacks, Evaluation of Expressions, Recursion, Stack Machines and Multiple Stacks, Queues , Operations, Add , Delete, Types of Queues , Priority Queues, Circular Queue, Dequeue	**6**

4	Fundamentals of singly, Doubly, Circular, Linked Stacks and Queues, Examples of Linked List, Circular Linked List, Doubly Linked List and Dynamic Storage Management, Garbage Collection, Compaction and Applications of Linked List, Operations of Polynomials, Generalized Linked List.	**6**
5	Basic Terminology, Binary Tree Traversals, Threaded Storage Representation, Binary Search Tree, Applications of Tree, Preliminary Treatment of AVL Trees, B-Trees, B+ Trees	**7**
6	Basic Terminology, Graph Representation, Matrix, List, Multi-List, Graph Traversals, Breath First Search, Depth First Search, Minimum Cost Spanning Trees, Shortest Path Algorithm, Topological Sort, Critical Path.	**7**

Text Books

SN	Title	Edition	Authors	Publisher
1	Data Structures and Program, Design in C	Second Edition	Kruse, Leung and Tondo	PHI
2	Data Structures, Schuam Series	Fifth Edition	Seymour Lipschutz,G.A. V. Pai	TMH

ence Books

SN	Title	Edition	Authors	Publisher
1	Fundamentals of Data Structures	Fifth Edition	Ellis Horowtiz and Sartaj Sahani	Galgotia,Publications
2	An Introduction to Data Structures with Applications	Second Edition	Tremblay & Sorenson	TMH

Website / Data sheet:

SN	
1.	https://www.programiz.com/dsa
2.	https://opendatastructures.org/
3.	https://www.geeksforgeeks.org/data-structures/
4.	http://103.152.199.179/YCCE/yccelibrary.html
5.	https://nptel.ac.in/courses/106102064

III Semester
IIOT2207: Lab. : Algorithms and Data Structures

CO 1	Understand the trade-offs of algorithms and programming aspects
CO 2	Apply various operation on data Structure
CO 3	Analyze various types of Data Structure
CO 4	Implement various types of algorithms and analyze performance of system
CO 5	Develop programs using data structures and latest compilers

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO -1	1	1	--	--	--	--	--	--	1	--	--	1	--	--
CO -2	2	3	--	--	2	--	--	--	1	--	--	1	--	--
CO -3	3	3	--	--	2	--	--	--	1	--	--	1	--	--
CO -4	3	3	3	--	3	--	--	--	1	--	1	1	--	--
CO -5	--	--	--	--	3	--	--	--	1	--	1	1	--	--
Average														

Experiment List

Expt No.	Name of Experiment
1	Write a program using control Structure & Statements
2	Write a program using If –else structure
3	Write a program using Case Statement
4	Write a program for Functions
5	Write a program for Macros
6	Write a program for Pointers
7	Write a program for Structures
8	Write a program for Linked List
9	Write a program for Doubly linked list
10	Write a program for graphs
11	Write a program for Trees
12	Write a program for Search Algorithms
13	Write a program for Stacks

III Semester
IIOT2208: Engineering Economics and Management

Course Objective: This subject will Provide the knowledge of various concept of economics and management and will introduce the economic alternatives, Marketing and Financial Practices in the Organisation and Engineering field.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Develop perspective about economy based on logical reasoning and estimate the economic outcomes.
CO 2	Interprets comparative advantage of resources.
CO 3	Explain the Functions of Management and identify tools and techniques of Marketing of goods and services
CO 4	Analyze the role of Financial Accountancy and Management in the Organisation

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3						3				3			
CO 2	3						3				3			
CO 3	2						2				2			
CO 4	3						3		3		3			

Syllabus:

Unit No.	Content	Max. Hrs.
1	**Introduction to Economics and engineering Economy:** Economics and engineering economy, Utility analysis- Cardinal, ordinal, Law of diminishing marginal utility, Laws of demand and supply, elasticity of demand, its measurement and application.	6
2	**Engineering Production and Costs** Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Concepts and types of costs, Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation.	7

3	**Market structures - equilibrium output and price** Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination.	**7**
4	**Principle of Management** Evolution of Management Thought : Scientific and Administrative Theory of Management , Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership	**6**
5	**Marketing Management** Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting	**7**
6	**Financial Accountancy and Management :** Definition & Functions of Finance department, Sources of finance, Types of capital, Types of Taxes, Introduction of Accountancy and its rules, Preparation of Books of Account- Jounal, Posting of transaction into ledger and preparation of trial balance, Introduction of trading account, profit and loss account and balance sheet	**6**

Text Books:

SN	Title	Edition	Authors	Publisher
1	Modern Economics	13th Edition	H. L. Ahuja	S. Chand Publisher, 2009
2	Modern Economic Theory	3rd edition	K. K. Devett	S. Chand Publisher,2007
3	Principle of Economics	7th edition	Mankiw N. Gregory	Thomson, 2013
4	Principles of Management	9th edition	Harold Koontz Ramchandra	Tata McGrow hills
5	Marketing Management: Planning, Implementation and Control	3rd Edition	Ramaswamy V.S. and Namakumari S	Macmillian
6	Financial Services	19th Edition	Khan M Y	Tata McGraw Hill, 19

Reference Books:

SN	Title	Edition	Authors	Publisher
1.	Advance Economic Theory	17th Edition	H. L. Ahuja	S. Chand Publisher, 2009
2.	International Trade	12th edition	M. L. Zingan	Vindra Publication, 2007
3.	Macro Economics	11th edition	M. L. Zingan	Vindra Publication, 2007
4.	Monitory Economics:	1st Edition	M. L. Sheth	Himayalaya Publisher, 1995
5.	Economics of Development and Planning	12th edition	S. K. Misra and V. K. Puri	Himalaya Publishing House, 2006.
6.	Foundations of Financial Markets and Institutions	3rd Edition	Fabozzi	Pretice Hall
7.	Fundamentals of Financial Instruments	2nd Edition	Parameshwaran	Wiley India
8.	Marketing Management	3rd Edition	Rajan Saxena	Tata McGraw Hill

Website / Data sheet:

SN	Title
1	https://youtu.be/vOykcERGw9Y
2	https://youtu.be/4GO357Ab1s4
3	https://youtu.be/CSSH0N_xcwo

III Semester
IIOT2209: Sensors & Actuators for IIOT

Course Objective:

- To provide in depth knowledge in physical principles applied in sensing.
- To provide good knowledge of working of different types of sensors used in various application areas.
- To elaborate the theoretical and practical aspects of sensors and actuators, their classifications, recent trends and their applications in day to day life.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	*Understand and explain the concepts of Sensors and Actuators* **.**
CO 2	Explain the working of magnetic sensors and its applications in real time scenario
CO 3	acquire knowledge of Model linear actuators and differentiate various solenoids
CO 4	Evaluate performance characteristics of different types of sensors

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2		-	-	-	1	-	-	-	-	-	-
CO 2	3	2	2	-	-	-	-	1	-	-	-	-	-	-
CO 3	3	2	2	-	-	-	-	1	-	-	-	-	-	-
CO 4	3	2	2	-	-	-	-	1	-	-	-	-	-	-

Syllabus:

Unit	Content	Hours
1	Introduction- Classification of Sensors and Actuators - Magnetic Sensors - Linear and Latching Solenoid Actuators - Stepper Motors - Special Magnetic Devices - Rotary and Linear Actuators - Magnetic Materials and Technology - Soft Magnetic Materials - Hard Magnetic Materials -Coating Technologies - Magnetic Materials Market and Applications	7
2	Magnetic Sensors - Theory of Magnetic Sensors - Magnetic Sensor Analysis - VR Sensors - Solid-State Sensors - Magnetic Sensor Applications - Magnetic Speed Sensor Requirements - Magnetic Speed Sensor Applications - Magnetic Position Sensor Applications - VR Sensor Noise	6

3	PRESSURE SENSOR -Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms – Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezo resistive pressure sensor – Resonator pressure sensor – Measurement of vacuum – McLeod gauge – Thermal conductivity gauges – Ionization gauge, cold cathode and hot cathode types – Testing and calibration of pressure gauges – Dead weight tester.	7
4	POSITION,PROXIMITY,FLOW,LEVELSENSORMeasurement of position using Hall effect sensors. Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor. Flow Sensors: Ultra sonic & Laser. Level Sensors: Ultra sonic & Capacitive	6
5	Linear Actuators - Mathematical Model for Linear Actuators - Fast-Acting Actuators - Disk Solenoids - Plunger Solenoids - Ball Solenoids - Conical Solenoids - Applications of Solenoid Actuators - Long Stroke Solenoid Fuel Pump - Gasoline Injectors - Natural Gas Injectors - Diesel Fuel Injectors - Compressor Solenoid Valves - Transmission Solenoid	8
6	Rotary Actuators - Disk Rotary Actuators - Disk Rotary Actuator Analysis - Disk Rotary Actuator Design - Disk Rotary Actuator Excitation Electromagnetic Circuit - Disk Rotary Actuator Toothed Magnetic Part - Disk Rotary Actuator PM - Claw Pole Rotary Actuators - Claw Pole Rotary Actuator Analysis - Claw Pole Rotary Actuator Design -Claw Pole Rotary Actuator Excitation Electromagnetic Circuit - Claw Pole Actuator Toothed Magnetic Part - Claw Pole Actuator PM - Cylindrical Rotary Actuators - Cylindrical Rotary Actuator PM - Cylindrical Rotary Actuator Excitation Electromagnetic Circuit	8

Text Books:

SN	Title	Edition	Authors	Publisher
1	Measurement Systems – Application and Design	6 th Edition	E.O. Doebelin	Tata McGraw Hill publishing company, 2003
2	Sensors and Actuators in Mechatronics, Design and Applications		Andrzej M. Pawlak	Taylor & Francis Group 2006

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Principles of Industrial Instrumentation	2nd Edition	D. Patranabis	Tata McGraw Hill Publishing Company Ltd, 1996
2	Mechanical and Industrial Measurements		R.K. Jain	Khanna Publishers, New Delhi,1999
3	A Course on Mechanical Measurements, Instrumentation and Control		A.K. Sawhney and P. Sawhney	DhanpathRai and Co, 2004

Website / Data sheet:

SN	Title
1	https://nptel.ac.in/courses/108/105/108105064/
2	https://nptel.ac.in/courses/108/108/108108147/
3	http://103.152.199.179/YCCE/yccelibrary.html

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

4th Semester

(Department of Electronics Engineering

Industrial Internet of Things (IIoT)

June 2022

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

Industrial IOT

SoE No. IoT-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	PC	EE	IIOT2201	Digital Electronics	T	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	EE	IIOT2202	**Lab. :** Digital Electronics	P	0	0	2	2	1		60	40	
3	3	BS	GE	IIOT2203	Linear Algebra and Graph Theory	T	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	EE	IIOT2204	Electronics Deivces and Circuits	T	3	0	0	3	3	30	20	50	3 Hours
5	3	PC	EE	IIOT2205	**Lab.:** Electronics Deivces and Circuits	P	0	0	2	2	1		60	40	
6	3	PC	EE	IIOT2206	Algorithms and Data Structures	T	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	EE	IIOT2207	**Lab.:** Algorithms and Data Structures	P	0	0	2	2	1		60	40	
8	3	HS	EE	IIOT2208	Engineering Economics and Management	T	3	0	0	3	3	30	20	50	3 Hours
9	3	PC	EE	IIOT2209	Sensors & Actuators for IIOT	T	3	0	0	3	3	30	20	50	3 Hours
					TOTAL THIRD SEM		**18**	**0**	**6**	**24**	**21**				

List of Audit Course

1	3	HS	FY	GE2131	Universal Human Values	**T**	2	0	0						

Fourth Semester															
1	4	PC	EE	IIOT2251	Control System Engineering	T	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	EE	IIOT2252	**Lab.:** Control System Engineering	P	0	0	2	2	1		60	40	
3	4	PC	EE	IIOT2253	Mechatronics	T	3	0	0	3	3	30	20	50	3 Hours
4	4	PC	EE	IIOT2254	**Lab.:** Mechatronics	P	0	0	2	2	1		60	40	
5	4	PC	EE	IIOT2255	Microprocessor and Interfacing	T	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	EE	IIOT2256	**Lab.:** Microprocessor and Interfacing	P	0	0	2	2	1		60	40	
7	4	PC	EE	IIOT2257	Analog and Digital Communication	T	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	EE	IIOT2258	**Lab.:** Analog and Digital Communication	P	0	0	2	2	1		60	40	
9	4	STR	EE	IIOT2259	Design Tool Lab-1	P	0	0	2	2	2		60	40	
10	4	STR	EE	IIOT2260	**Lab.:** Electronics Workshop	P	0	0	2	2	2		60	40	
					TOTAL FOURTH SEM		**12**	**0**	**12**	**24**	**20**				

List of Audit Course

1	4	HS		GE2121	Environmental Studies	**T**	2	0	0						

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

IV Semester
IIOT2251: Control System Engineering

Course Objective:
Students will learn:
1 The role of a control engineer in multi-disciplinary teams.
2 To apply the knowledge gained in basic mathematics, physical sciences and engineering courses to derive mathematical models of typical engineering processes.
3 To use transfer function and state space models for control system analysis in time and frequency domain.
4 The importance of stability in control systems and the various methods to determine it.
5 To construct root locus plot and frequency response plots such as polar plot, Bode plot, Nyquist plot etc.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Understand concepts related to linear control system
CO 2	Apply the concepts of control system to obtain the system Transfer function
CO 3	Apply the concepts of control system to obtain the system Transfer function
CO 4	Apply frequency domain analysis method to various linear control systems

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	3	2	-	-	-	-	-	2		-	2	-	-
CO 2	2	3	2	-		-	-	-	2		-	2	-	-
CO 3	2	3	3	-	-	-	-	-	2		-	2	-	-
CO 4	2	3	3	-	-	-	-	-	2		-	2	-	

Syllabus:

Unit	Content	Hours
1	Mathematical modeling of physical systems: Electrical systems - Electromechanical systems, Mechanical systems – Thermal systems	8
2	Open loop control and close loop control with examples. Block diagram algebra & reduction techniques Signal flow graph, its constructions and Mason's gain formula.	7
3	Time domain analysis: Time-domain specifications, various test signals and its importance, steady state error (ess) analysis	7

4	Routh-Hurwitz stability criterion. Root Locus Technique: Definitions - Root locus diagram - Rules to construct root loci - Effect of pole zero additions on the root loci.	8
5	Frequency domain analysis: Frequency response - Bode plot - Polar plot - Nyquist plot – phase margin - gain margin - Nyquist stability criterion – Relative stability analysis	8
6	Controller design: P, PI, PID - Design by Frequency-Response Approach: lag compensation, lead compensation, lead-lag compensation.	7

Text Books:

SN	Title	Edition	Authors	Publisher
1	Control system engineering I. J.	5th Edition	Nagrath& M. Gopal	New Age International
2	Modern control engineering	5th Edition	Katsuhiko Ogata	PHI Learning Private Limited
3	Automatic control systems	7thEdition	B. C. Kuo	PHI Learning Private Limited

Referance Books:

SN	Title	Edition	Authors	Publisher
1	Modern Control Systems	13th edition	Dorf, R.C., Bishop, R.H.,	Prentice Hall

Website / Data sheet:

SN	Title
1.	https://www.youtube.com/watch?v=RcuGxWc0HyQ
2.	https://www.youtube.com/watch?v=39Ggoj2fQ2c
3.	https://nptel.ac.in/courses/108105159
4.	http://103.152.199.179/YCCE/yccelibrary.html
5.	https://onlinecourses.nptel.ac.in/
6.	https://www.youtube.com/watch?v=RcuGxWc0HyQ

IV Semester
IIOT2252: Lab. : Control System Engineering

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	Realize the need of control system and its recent developments. Able to model the system and simulate the model.
CO 2	Analyze the system stability based on time domain, frequency domain and root locus techniques.

Lab Experiment List:

Expt. No	Name of Experiment
1	To Study basic of open loop and closed loop control system
2	Determination of step & impulse response for a first order unity feedback system
3	Determination of step & impulse response for a second order unity feedback system
4	Determination of step & impulse response for a type '0', type '1', type '2' systems
5	Study of bode plot using matlab control system toolbox
6	Study of root locus plot using matlab control system toolbox
7	Determination of nyquist plot using matlab control system toolbox
8	Study the effect of addition of zeros to the forward path transfer function of a closed loop system

IV Semester
IIOT2253: Mechatronics

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Students will be able to model various mechatronic systems.
CO 2	Students will be able to understand the working of various motors used in mechatronic systems
CO 3	Student will be able to analyze the characteristics and use various IC's.
CO 4	Students will be able to analyze the internal hardware structure in Mechatronics Systems.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	3	2	2	1			1	1		2	1	1
CO 2	3	2	2	2					1	1		2	1	1
CO 3	3	2	2	3	1							2	1	1
CO 4	3	2	2	2	2				1	1		2	1	1

Syllabus:

Unit	Content	Hours
1	Introduction, sensors, actuators, modeling of systems. Recent trend of designing machine units along with electronic circuits for operation and supervision of mechanisms. Techniques of interfacing mechanical devices with computer hardware.	7
2	Basic principles ,working and specific applications of armature and field controlled D.C. Motors, Variable voltage and variable frequency control of 3 phase and single phase Induction motors, speed control of synchronous motors, Different types of stepper motors-Constriction ,working and application. Position control of stepper motors.	8
3	Common and commercial I.Cs used for amplification, timing and digital indication. Different types of actuators, working of synchro-transmitter and receiver set, Pressure to current (P/I) and l/P conversion. Electrical and hydraulic servomotors. Design of solenoid plungers and pressure and force amplification devices.	8
4	Add-on cards for sampling and actuation, 4-20 mA ports, AD-DA conversion, Peripheral interface organization, general layout of data bus and data transfer through serial and parallel modes of communication, schemes of computer networking and hierarchy in supervisory control.	7
5	Study of various integrated systems by using block diagrams. Study of systems used in Ink Jet Printers, Photo copying, Washing Machines, IC Engine fuel injection system etc	7
6	General philosophy of Artificial Neural Network simulations, Fuzzy logic for operation and control of Mechatronic systems.	7

Text Books:

SN	Title	Edition	Authors	Publisher
1	Introduction to Mechatronics and Measurement Systems	2007	Michael B.Histand and David G. Alciatore	Tata McGraw-Hill Education
2	Mechatronics	2007	Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ.,	Chapman and Hall, 1991
3	Microprocessor Architecture, Programming and Applications	2002	Ramesh.S, Gaonkar	Prentice Hall

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics	1996	Lawrence J.Kamm	John Wiley and Sons
2	Introduction to Microprocessors for Engineers and Scientists	2004	Ghosh, P.K. and Sridhar	PHI Learning Pvt. Ltd.

Links for E books in YCCE LIBRARY

SN	Link
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

Links for online courses including SWAYAM / NPTEL/ COURSERA/ UDEMY

SN	Link
1	https://onlinecourses.nptel.ac.in/noc21_me27/preview
2	https://nptel.ac.in/courses/112103174
3	https://www.classcentral.com/course/swayam-mechatronics-23047

IV Semester
IIOT2254: Lab. : Mechatronics

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	Model various mechatronic systems.
CO 2	Understand the working of various motors used in mechatronic systems
CO 3	Analyze the characteristics and use various IC's
CO 4	Analyze the internal hardware structure in Mechatronics Systems.

Lab Experiment List:

Expt. No	Name of Experiment
1	Identifications, study and demonstration of different sensors
2	Identifications, study and demonstration of different actuators
3	Demonstration of working of various D-A and A-D converters
4	Development of ladder diagram, programming using PLC for any of the following a) Motors start and stop using 02 different sensors b) Simulation of pedestrian traffic controller c) Simulation of four road junction traffic controller d) Lift or elevator control e) Washing machine control f) Tank level control g) Soft drink vending machine control
5	Trace, interpret and demonstrate working of electro pneumatic system
6	Trace, interpret and demonstrate working of electro hydraulic system
7	Demonstration on Flip Flops and Timers.
8	Verification of P, P+I, P+D, P+I+D control actions using MATLAB
9	Demonstration on different switches and relays.
10	Analysis of control system using software like MATLAB/SIMULINK or equivalent.

IV Semester
IIOT2255: Microprocessor and Interfacing

Course Objective:

1) To understand the architecture, programming and addressing modes of Intel 8085
2) To study the instruction set and programming of 8085
3) To understand various interfacing of devices for various applications.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Describe the architecture of Microprocessor
CO 2	Write Program for an assigned task.
CO 3	Apply different address decoding techniques while interfacing Memory to Microprocessor
CO 4	Analyze and Design interfacing of Peripheral devices to Microprocessor

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO 2	3	-	-	-	2	-	-	-	1	-	-	-	-	-
CO 3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO 4		3	2	-	-	-	-	-	-	-	-	-	-	1
CO 5														

Syllabus:

Unit	Content	Hours
1	Concept of bit, byte, nibble & word, Micro Computer organization with I/O devices and Memory.Microprocessor, address, data & control bus, Register, Memory Organisation.	6
2	Architecture of 8085 Intel microprocessor, Flag Register ,Addressing mode, pins diagram of 8085,Demultiplexing of Address & Data Bus, Generation of various control signals for I/O & Memory Organization	6
3	Basic Instruction set, Subroutine instructions like CALL, PUSH, POP, Programs based on instructions.	6

4	Delay Program,Memory Interfacing - ROM, RAM With 8085, Absolute and Linear decoding techniques.	6
5	MICROPROCESSOR APPLICATIONS – Programmable peripheral IC (8255)- Pin functions, Different Modes & Block Diagram, ADC interfacing , DAC interfacing .	6
6	USART 8251, PIT 8253, Interrupt Structure, Interrupt Controller 8259	6

Text Books:

SN	Title	Edition	Authors	Publisher
1	Microprocessor Architecture ,Programming& Application with the 8085	V'th	Ramesh Gaonkar	Pearson Publication

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Microprocessors & interfacing	2'nd	**D. V. Hall**	Tata Mc-Graw Hill ,2005

Website / Data sheet:

SN	Title
1	Nptel Video : https://www.youtube.com/watch?v=0t4LROuEVnw&list=PLwdnzlV3ogoXgNjr_oe5cWQIbf72ZY4Zf
2	https://www.youtube.com/watch?v=oRPluYsxF28&list=PLuv3GM6-gsE01L9yDO0e5UhQapkCPGnY3&index=7
3	https://www.electronicwings.com/

IV Semester
IIOT2256: Lab.: Microprocessor and Interfacing

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	Describe the architecture of Microprocessor
CO 2	Write Program for an assigned task.
CO 3	Apply different address decoding techniques while interfacing Memory to Microprocessor
CO 4	Analyze and Design interfacing of Peripheral devices to Microprocessor
CO 5	Create software & Hardware solutions for complex problems

Lab Experiment List:

Expt. No	Name of Experiment
1	Determine the Opcode, Number of Bytes and Addressing mode for the following instructions (Microprocessor 8085) Also State Meaning of Instruction
2	Perform Arithmetic and Logical Operations
3	Perform Addition series of data bytes
4	Block Transfer from Source Memory Location to Destination Memory Location
5	Count number of positive data bytes from string
6	Find Largest/ Smallest data byte from string
7	Compare the data bytes from 2 strings
8	Read data from Ports of 8255 and Write data to Ports of 8255
9	Generate square waveform of 2ms using Timer IC 8253
10	Mini Project

IV Semester
IIOT2257: Analog and Digital Communication

Course Objective:

1. To Study different analog and digital modulation techniques.
2. To understand transmitter & receivers in communication systems.
3. To understand basic concept of source coding.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Analyze and compare different analog modulation schemes.
CO 2	Analyze the behavior of a communication system in presence of noise.
CO 3	Investigate pulsed modulation system and analyze their system performance
CO 4	Analyze different digital modulation schemes for communication channels.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1										1		
CO 2	2											1		
CO 3	2	1										1		
CO 4	2	1										1		

Syllabus:

Unit	Content	Hours
1	Basic block diagram of Analog communication system, Modulation techniques: Need for modulation, Basic concepts of Amplitude Modulation: mathematical Analysis, modulation index, frequency spectrum, power requirement of AM, FM, PM, Transmitters.	7
2	Receivers: Basic receiver, Tuned Radio Frequency (TRF), Super heterodyne receiver, AM detectors, FM Detectors, Noise: Types of Noise, signal to noise ratio , Definition of Noise figure, calculation of noise figure.	8
3	Pulse Modulation: Generation and demodulation of pulse amplitude modulation (PAM); pulse width modulation (PWM); pulse position modulation (PPM) , Pulse code modulation (PCM),Time division Multiplexing, Frequency division multiplexing	7
4	Sampling theorem, Sampling and signal reconstruction, Aliasing, Types of sampling, Quantization, PCM, Companding, DPCM, ADPCM, Delta modulation, Adaptive delta modulation	8
5	Digital Modulation techniques: Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) –Phase Shift Keying (PSK) – BPSK – QPSK, Quadrature Amplitude Modulation (QAM), Minimum Shift Keying.	7
6	Source coding and channel coding: Information theory, Huffman coding, LZ coding, Basic concept of convolution code and Linear block code	8

Text Books:

SN	Title	Edition	Authors	Publisher
1	Electronic Communication System ,Fourth Edition,	4th	Gorge Kennedy	Tata McGraw-Hill
2	Digital Communications	4th	Symon Hykin	Wiley, 1988

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Digital and analog communication systems		K. Sam Shanmugam	John Wiley & Sons
2	Communication Electronics , Third Edition, 2007		Louis Frenzel	McGraw-Hill

Website / Data sheet:

SN	Title
1	http://nptel.iitm.ac.in/syllabus/syllabus.php?subjectId=117101055
2	https://nptel.ac.in/courses/117105143
3	http://103.152.199.179/YCCE/yccelibrary.html

IV Semester
IIOT2258: Lab.: Analog and Digital Communication

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	To observe and interpret the performance of AM modulator and demodulator under various changing parameters.
CO 2	To understand FM Modulation and Demodulation.
CO 3	Analyze various pulse modulation techniques.
CO 4	Simulate and conduct experiments on different types of Analog communication subsystems.

Lab Experiment List:

Expt. No	Name of Experiment
1	To study the Generation of Amplitude Modulation using transistor. Calculate modulation index for value of modulating amplitude.
2	To study the Generation of Amplitude Demodulation using Envelop Detector.
3	To study the Generation of Frequency Modulation using IC 8038 function generator.
4	To perform Frequency Demodulation using Foster Seeley Detector.
5	Generation of Pulse Amplitude Modulation using IC 555 & IC 4016.
6	Generation of PWM signal using IC 555.
7	Generation of PPM signal using IC 555.
8	Generation of Pulse Code Mudulation.
9	To perform Time Division Multiplexing (TDM).

IV Semester
IIOT2259: Design Tool Lab-1

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Students Will able to identify different Electronics Components.
CO 2	Students Will be able to work in teamwork
CO 3	Students Will be able to do Artwork, printing, etching & drilling of PCB
CO 4	Students will be able to do mini projects to enhance their practical Knowledge.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO -1	1	1	--	--	--	--	--	--	1	--	--	1	--	--
CO -2	2	3	--	--	2	--	--	--	1	--	--	1	--	--
CO -3	3	3	--	--	2	--	--	--	1	--	--	1	--	--
CO -4	3	3	3	--	3	--	--	--	1	--	1	1	--	--
CO -5	--	--	--	--	3	--	--	--	1	--	1	1	--	--
Average														

Experiment List

Expt No.	Name of Experiment
1	Identification of Various electronic components used in electronics workshop
2	Identification of various equipment used in electronics workshop
3	Testing of various electronics components
4	Soldering and De-Soldering Practice
5	PCB Design using EDA Tools (Orcad Layout Plus /Allegro/ Multisim Ultiboard / EasyEDA / Express PCB)
6	Etching and fabrication
7	Report Writing

IV Semester
IIOT2260: Lab.: Electronics Workshop

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	**Understand** and identify Different Electronics Components.
CO 2	**Apply** the basic knowledge of Electronics Components to select the mini project.
CO3	**Demonstrate** their practical Knowledge to do Artwork, printing, Etching & drilling of PCB for mini project.
CO4	**Build** a mini project and **prepare** a report &small video.

Lab Experiment List:

Expt. No	Name of Experiment
1	Introduction to Various electronic components.
2	Study of various equipment used in electronics workshop.
3	Soldering and De-Soldering Practice of different components on PCB
4	Study of PCB and PCB design process.
5	Mini Project(Assembling electronic circuit on PCB and testing it.)
6	Simulation of electronic circuit using simulation software and Report Writing.

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B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

Industrial IOT

SoE No. IoT-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester															
1	5	PC	EE	IIOT2301	IoT Communication Network	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	EE	IIOT2302	Microcontroller & its Applications	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	EE	IIOT2303	**Lab. :** Microcontroller & its Applications	**P**	0	0	2	2	1		60	40	
4	5	PC	EE	IIOT2304	Data Analytics	**T**	3	0	0	3	3	30	20	50	3 Hours
5	5	PC	EE	IIOT2305	**Lab.:** Data Analytics	**P**	0	0	2	2	1		60	40	
6	5	PC	EE	IIOT2306	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3 Hours
7	5	PC	EE	IIOT2307	**Lab.:** Object Oriented Programming	**P**	0	0	2	2	1		60	40	
8	5	PC	EE	IIOT2308	CNC and Robotics	**T**	3	0	0	3	3	30	20	50	3 Hours
9			EE		**Professional Elective-I ***	**T**	3	0	0	3	3	30	20	50	3 Hours
10	5	STR	EE	IIOT2310	Industrial Visit	**P**	0	0	0	0	1		60	40	
					TOTAL FIFTH SEM		**18**	**0**	**6**	**24**	**22**				

List of Professional Electives-I *

Professional Electives -I

1	5	PE-I		IIOT2311	System C Progrming
2	5	PE-I		IIOT2312	Industry 4.0 and Smart Systems
3	5	PE-I		IIOT2313	Advanced Microprocessor

Audit Courses

1	5	HS		AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE, IIoT, AIDS, CSD, AIML	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
IIOT2301: IoT Communication Network

Course Objective:

1. To understand the basic concepts of data communication, layered model, protocols and interworking between computer networks and switching components in telecommunication systems.
2. To learn basic concepts of internetworking, addressing, routing, concepts and techniques in error detection and correction.
3. An overview of security issues related to data communication in networks

Course Outcome: After completion of the course, student will demonstrate the ability to

CO1	Understand and explain the concept of Data Communication and networks, layered architecture and their applications, transmission Media, Media Access Control Wireless LAN, Network Connecting Devices in Computer Networks.
CO2	Demonstrate Data Link Layer Protocols, Routing Algorithms, congestion Control, TCP/IP protocol, IP addressing.
CO3	Describe design application layer protocols and internet applications such as Electronic Mail, and File Transfer, WWW and HTTP and DNS.
CO4	Explain Cryptography, Digital Signature, Entity Authentication, FIREWALLS, SSL Services

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO	3	-	-	-	-	-	-	1	-	-	-	2	-	-
CO	-	2	-	-	-	-	-	1	-	-	-	2	-	-
CO	3	1	3	-	-	-	-	1	-	-	-	2	-	-
CO	2	2	-	-	-	-	-	1	-	-	-	2	-	-

Syllabus:

Unit	Content	Hours
1	Introduction, network and services: communication network, approaches to network design, types of network, two stage and three stage network. Uses of computer networks, LAN, MAN, WAN, design issues for layers, connection oriented and connectionless services, service primitives, Application and layered architecture, OSI reference model.	7

2	Physical layer and medium access layer:Guided transmission media, Unguided transmission media, multiple access protocols, IEEE standard 802 for LAN and MAN, high speed LANS, repeaters, hubs, bridges, fast Ethernet, Wireless LAN	8
3	Data link layer: .Data link layer design issues, Framing, error detection and correction methods, , Flow Control ,elementary data link protocols, sliding window protocols.	7
4	Network layer and transport layer: network layer design issues, routing, congestion, internetworking, transport layer design issues, transport service primitives, internet transport protocol, TCP/IP architecture, TCP/IP protocol, IP packets, IP addressing, TCP/IP utilities ,wireless TCP and UDP, routers and gateways	8
5	Application layer: Domain name system, electronic mail system, Remote Logging and File Transfer, WWW and HTTP, Multimedia.	7
6	Security: Cryptography,e-mail security, web security, communication security,Digital Signature Entity Authentication, FIREWALLS, SSL Services	8

Text Books:

SN	Title	Edition	Authors	Publisher
1	Data Communications and Networking	5th	Behrouz a Forouzan	Tata Mc. Graw Hill
2	Computer Networks	5th	Tanenbaum	Prentice Hall

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Data and Computer Communication	8th	W. Stallings	Prentice Hall

Website / Data sheet:

SN	Title
1.	https://www.tutorialspoint.com/digital_communication/digital_communication_quick_guide.htm
2.	https://www.javatpoint.com/digital-communication
3.	https://nptel.ac.in/courses/106/105/106105080/
4.	https://nptel.ac.in/courses/106/106/106106091/
5.	https://www.researchgate.net/publication/228597739_Computer_Communication_Networks-Lecture_Notes
6.	http://103.152.199.179/YCCE/yccelibrary.html

V Semester
IIOT2302: Microcontroller & its Applications

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	**Describe** the architecture of 8051, its features and instructions
CO 2	Write program for specific task
CO 3	Analyze and Interface the peripherals to 8051 microcontroller
CO 4	Develop application using 8051 microcontroller
CO 5	Write program and Debug using IDE tool like KEIL uVision5

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2						1	1	1		1	2	
CO 2	3	2						1	1	1		1	2	
CO 3		3	2					1	1	1		1		3
CO 4			3	2				1	1	1		1		3
CO 5				2	3			1	1	1		1		3

Syllabus:

Unit	Content	**Hours**
Unit:1	Overview of 8051 Microcontroller family, Introduction to MCS51 family, Architecture, Memory organization, Internal RAM, Flag Register, Register Banks, SFRs , Functional pin description and various resources of MCS 51,Hardware Overview, Addressing modes, Instruction set.	**7 Hours**
Unit:2	Branching instructions, Bit manipulation instructions, Assembly language Programs., 8051 I/O programming, Logic operations, Data conversion programs, Lookup table access	**7 Hours**
Unit:3	Delay Programs. 8051 programming in C:Data types and time delay, I/O programming, I/O Interfacing and programming for LED, switches, 7 segment display.	**7 Hours**

Unit:4	Timer programming in assembly and C: Various timer operations. SFR related to timer operation. Serial Port programming in assembly and C: Basics of serial communication, RS 232. Serial data transfer programs.	**7 Hours**
Unit:5	Interrupts Control, Interrupts programming in assembly and C, programming timer interrupt, external interrupt, serial interrupt. Interfacing and programming for LCD.	**7 Hours**
Unit :6	Keyboard matrix programming, Interfacing of ADC, DAC, stepper motor and programming. Interfacing RTC, EEPROM using I2C Bus and programming	**7 Hours**
	Total Lecture Hours	**42 Hours**

Textbooks	
1	**The 8051 Microcontroller and Embedded System, by M. A. Mazidi, Prentice Hall**
2	**The 8051 Microcontroller, by Kenneth J. Ayala, West Publishing Company**
Reference Books	
1	"The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2	"Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/yccelibrary.html
2	
MOOCs Links and additional reading, learning, video material	
1	https://www.keil.com/dd/docs/datashts/atmel/at89c51_ds.pdf
2	https://www.electronicwings.com/
3	https://www.tutorialspoint.com/microprocessor/microcontrollers_8051_architecture.htm
4	https://nptel.ac.in/courses/108/105/108105102/

V Semester
IIOT2303: Lab.: Microcontroller & its Applications

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	**Describe** the architecture of 8051, its features and instructions
CO 2	Write program for specific task
CO 3	**Analyze** and Interface the peripherals to 8051 microcontroller
CO 4	**Develop** application using 8051 microcontroller
CO 5	Write program and Debug using IDE tool like KEIL uVision5

Lab Experiment List:

Sr. No.	Name of Experiment
1	Write program to perform arithmetic and logical operation of two nos.
2	2.a: X and Y are two 8 bit nos. present in memory location 40H and 41H. Write program to perform X + Y and store result in M. L. 50H 2.b: X and Y are two 8 bit nos. present in memory location 60H and 61H. Write program to perform X - Y and store result in M. L. 70H
3	Five 8 bit nos. are present from M. L. 40H onwards. Write program to add these nos. and store result in M. L. 50H
4	Ten 8 bit nos. are present from M. L. 40H onwards. Write program to find the greatest no. and store result in M. L. 60H
5	6.a.: Interface LED with 8051 i/o pin P1.4 and write program to blink LED (ON/ OFF duration 1 sec) 6.b: Interface 8 LED's with 8051 i/o pin P1 and write program to turn ON alternate LED.
6	Interface 8 LED's with 8051 i/o pin P1 and write program to turn ON LED one by one from P1.0 to P1.7 after a delay of 1 sec
7	Interface LED with 8051 i/o pin P1.4 and switch with P1.1. Write program to turn on LED if switch is pressed
8	Interface common cathode 7 segment display to P2 of 8051 and write program to display 0 to 9 continuously at an interval of 3 sec.
9	Write program to send "ABC" via serial port of 8051 with 9600 baud rate
10	Interface 2X16 LCD with 8051.Use 8 bit data length and write program to display "HI FRIENDS " in first line from first position. Use P2 for data pins and P0 for control pins

V Semester
IIOT2304: Data Analytics

Course Objective:

- To acquaint the students with data analytic tools
- To acquaint the students with data attributes and data analytics lifecycle
- To familiarize the students with data visualization tools
- To familiarize the students with importance of big data and associated technologies.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Concept of different types of data and its analytics.
CO 2	Understand how the data analysis will be done.
CO 3	Apply the different techniques for data cleaning and visualization.
CO 4	Analyse the Big Data and obtain insight using data analytics mechanisms.
CO 5	Analyse the Data analytics concepts using latest software.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	-	-	2	-	-	-	-	-	-	1	-	-
CO 2	2	2	-	-	2	-	-	-	-	-	-	1	-	-
CO 3	2	1	-	-	2	-	-	-	-	-	-	1	2	-
CO 4	1	-	-	-	2	-	-	-	-	-	-	1	2	-
CO 5	-	-	-	-	3	-	-	1	1	1	-	1	2	2

Syllabus:

Unit	Content	Hours
1	**Working with Data:**Defining Data, Understanding Various Data Types and Structures, Structured Data, Unstructured Data, Characteristics of Data, The History of Data Analytics, Data Analytics vs. Data Analysis, Business Intelligence vs. Data Analytics, The Business Use of Data Analytics, Data Analytics Tools	
2	**Exploring Types of Data Analytics:** Descriptive Analytics, Making Use of Descriptive Analytics, Inferential Statistics in Descriptive Analytics, Diagnostic Analytics, Predictive Analytics, **Data Analytics Lifecycle**: Data Preparation, Model Planning, Model Building, Communicating the Outcomes, Operationalize	

3	**Data Cleaning:** The Common Component in Data Cleansing, Detecting Outliers With Uni-Variate and Multi-Variate Analysis, Extreme Values Analysis, Understanding Probability and Inferential Statistics, Probability Distributions, Common Attributes of Probability, Calculating and Measuring Correlation	
4	**Data Visualization:**Understanding Data Visualization, Data Storytelling For Corporate Decision-Makers, Data Visualization For Analyst, Building Data Art for Activists, Picking the Most Suitable Design Style, Creating a Numerical, Reliable Response, Choosing the Best Data Graphic Type For Your Visualization, Standard Chart Graphics, Comparative Graphics Statistical Plots, Some Popular Data Visualization Tools	
5	**Evolution of Big Data:** Definition of Big Data, Challenges with Big Data, what is Big Data? Why Big Data? Traditional Versus Big Data approach, Big Data framework Big Data Analytics – What is Big Data Analytics? Classification of Analytics, Top Challenges Facing Big Data.	
6	**Hadoop:** What is Hadoop. Core Hadoop Components, Hadoop Ecosystem, Hadoop Limitations.	
	Total Lecture Hours	

Text Books:

SN	Title	Edition	Authors	Publisher
1	DATA ANALYTICS A Comprehensive Beginner's Guide To Learn About The Realms Of Data Analytics From A-Z	Kindle Edition	Benjamin Smith	Amazon Asia-Pacific Holdings Private Limited, 2021
2	DATA ANALYTICS Simple and Effective Tips and Tricks to Learn Data Analytics Effectively	Kindle Edition	Benjamin Smith	Amazon Asia-Pacific Holdings Private Limited, 2021
3	Big Data Analytics	Second	RadhaShankarmani, M Vijayalakshmi	Wiley 2017

Reference Books:

SN	Title	Edition	Authors	Publisher
1	DATA ANALYTICS Advanced Guide to Learn the Realms of Data Analytics Effectively	Kindle Edition	Benjamin Smith	Amazon Asia-Pacific Holdings Private Limited, 2021
2	DATA ANALYTICS-Made Accessible	First Edition	Dr.AnilMaheshwari	--
3	Big Data Analytics with R and Hadoop	First Edition	VigneshPrajapati,	Packt Publishing 2013

Website / Data sheet:

SN	Title
1	https://collegedunia.com/courses/data-analytics/syllabus
2	https://www.mastersindatascience.org/learning/what-is-data-analytics/

		June 2022	1.00	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
IIOT2305: Lab.: Data Analytics

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	Understand the concept of different types of data and its analytics.
CO 2	Understand how the data analysis will be done.
CO 3	Apply the different techniques for data cleaning and visualization.
CO 4	Analyse the Big Data and obtain insight using data analytics mechanisms.
CO 5	Analyse the Data analytics concepts using latest software.

Lab Experiment List:

Expt. No	Name of Experiment
1	Introduction to Python tool for data analytics science
2	Data Pre-processing
3	Data Analysis
4	Data Preparation
5	Data Cleaning
6	Data Visualization
7	Types For Data Visualization
8	Decision Trees
9	Downloading and installing Hadoop; Understanding different Hadoop modes. Start-up scripts, Configuration files.
10	Hadoop Implementation of file management tasks, such as Adding files and directories, Retrieving files and Deleting files

V Semester
IIOT2306: Object Oriented Programming

Course Objective:

- To acquaint the students with concept of object oriented programming
- To acquaint the students with various concepts of OOP
- To familiarize the students with various data structures and their programming
- To familiarize the students with file handling concepts

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Understand the concept of concepts of Object-Oriented Programming
CO 2	Analyze the using the concept of Inheritance, Polymorphism, Overloading
CO 3	Choose the appropriate data structure and algorithm design method for a specified application
CO 4	Develop and use linear and non-linear data structures
CO -5	Create software solutions for complex problems

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO -1	1	3	1	1	1	--	--	--	1	--	1	1	--	--
CO -2	1	3	3	3	2	--	--	--	1	--	1	1	--	--
CO -3	3	3	3	3	3	--	--	--	1	--	1	1	--	--
CO -4	3	2	3	--	--	--	--	--	1	--	1	1	--	--
CO -5	--	--	--	--	3	--	--	--	3	--	--	--	--	--

Syllabus:

Unit No.	Content	Max. Hrs.
1	Principles of Object Oriented Programming (OOP), Software Evaluation, OOP Paradigm, Basic Concepts of OOP, Benefits of OOP, Application of OOP	7
2	Introduction to C++, Tokens, Keywords, Identifiers, Variables, Operators, Manipulators, Expressions and Control Structures, Pointers, Functions, Function Prototyping Parameters Passing in Functions, Values Return by Functions, Inline Functions, Friend and Virtual Functions	7

3	Classes and Objects, Constructors and Destructors, Operator overloading, Type of Constructors, Function Overloading, Inheritance, Types of Inheritance Virtual Functions and Polymorphism	**7**
4	Definition of a data structure, Primitive and Composite data types, Asymptotic notations, Arrays, Operations of Arrays, Order lists, Stacks, Applications of Stack, Infix to Postfix Conversion, Recursion, Queues, Operations of Queues. (7 Hours)	**7**
5	Singly linked list, Operations, Doubly linked list, Operations, Trees and Graphs: Binary tree, Tree traversal; Graph, Definition, Types of Graphs, Traversal (BFS & DFS), Dijkstra`s algorithm	**7**
6	Files, classes for file stream operations, Opening, Closing and Processing files, End of file detection , File pointes, Updating a file , Error Handling during file operations, Command line arguments, Templates, Exception Handling	**7**
	Total Lecture Hours	**42**

Text Books

SN	Title	Edition	Authors	Publisher
1	Object Oriented Programming with C++	4th Edition,2008	E. Balagurusamy	TMH

Reference Books

SN	Title	Edition	Authors	Publisher
1	Object Oriented Programming in Microsoft C++	Third Edition, 2003	Robert Lafore	Galgotia Publications
2	Fundamentals of Data Structures in C++	2002	E. Horowitz and S.Shani	Galgotia Publications
3	Computer algorithms	2008	Horowitz, S.Shani and S.Rajasekaran	Galgotia Publications

Website / Data sheet:

SN	Title
1	https://www.w3schools.com/cpp/cpp_oop.asp
2	https://www.geeksforgeeks.org/object-oriented-programming-oops-concept-in-java/
3	http://103.152.199.179/YCCE/yccelibrary.html
4.	https://archive.nptel.ac.in/courses/106/105/106105224/
5.	https://archive.nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs48/

V Semester
IIOT2307: Lab.: Object Oriented Programming

Course Objective:

- To acquaint the students with concept of object oriented programming
- To acquaint the students with various concepts of OOP
- To familiarize the students with various data structures and their programming
- To familiarize the students with file handling concepts

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Understand the trade-offs of algorithms and programming aspects
CO 2	Apply various operation on data Structure
CO 3	Analyze various types of Data Structure
CO 4	Implement various types of algorithms and analyze performance of system
CO 5	Develop programs using data structures and latest compilers

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO -1	1	1	--	--	--	--	--	--	1	--	--	1	--	--
CO -2	2	3	--	--	2	--	--	--	1	--	--	1	--	--
CO -3	3	3	--	--	2	--	--	--	1	--	--	1	--	--
CO -4	3	3	3	--	3	--	--	--	1	--	1	1	--	--
CO -5	--	--	--	--	3	--	--	--	1	--	1	1	--	--
Average														

Experiment List

Expt No.	Name of Experiment
1	Implement the concept of Class and its data members and member functions in C++
2	Implement the concept of function and operator overloading in C++
3	Implement the concept of friend function
4	Implement the concept of class constructor and its type in C++
5	Implement the concept of Abstraction in C++
6	Implement the concept of all types of inheritance in C++
7	Implement the concept of run time polymorphism in C++
8	Implement the concept of Files using command line arguments in C++
9	Implement the concept of function templates and class template in C++
10	Implement the concept of exception in C++

V Semester
IIOT2308 : CNC and Robotics

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Understand working of subtractive manufacturing
CO 2	Implement CNC programs for various product manufacturing
CO 3	have knowledge of Robotics, automation, robotics motion, sensors, robotic programming and roles of robots in industry
CO 4	Understand the working methodology of robotics and automation, motion and control, machine vision and programming, application of robots in industry

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	2	2	3	1	1					1	1	1
CO 2	3	3	3	2	2	1						1	1	1
CO 3	3	2	3	3	3	1	1					1	1	1
CO 4	3	3	2	3	2	1						1	1	1

Syllabus:

Unit	Content	Hours
1	Concepts of NC, CNC, DNC. Classification of CNC machines, MCU architecture and functionality, Machine Configurations, Types of control, CNC controller's architecture and characteristics, Interpolators.	7
2	Positioning system, Cutter offset compensation, Word address format, Introduction to G and M codes Manual part programming for CNC turning, milling and drilling.	8
3	Tooling system for Machining center and Turning center, work holding devices, of CNC Machines. APT part programming, CAD/CAM programming, Simulation and Verification of CNC programs, Adaptive CNC control techniques. Integration of CNC machines for CIM	8
4	**FUNDAMENTALS OF ROBOT** Robot – Definition – Robot anatomy – Co-ordinate systems, work envelope, types and classification – Specifications – Pitch, yaw, roll, joint notations, speed of motion and pay load – Robot parts and their functions – Need for robots – Different applications..	7

5	**ROBOT PROGRAMMING** Teach pendant programming – Lead through programming – Robot programming languages – VAL programming – Motion commands – Sensor commands – End effecter commands – Simple programs.	8
6	**IMPLEMENTATION** Implementation of robots in industries, Robotics for Automotive sector, Material handling system, medical applications, precision manufacturing system	7
	Total Lecture Hours	45

Text Books:

SN	Title	Edition	Authors	Publisher
1	Robot Engineering An Intergrated approach	2004	Klafter R.D., Chmielewski T.A. and Negin M	Springer
2	Industrial Robotics: Technology, Programming and Applications,	2012	Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and AshishDutta	2ndEdition, Tata McGraw Hill, 2012.
3	Automation in Production system	2002	Mikell P. Groover	Prentice-Hall of India Pvt. Ltd., New Delhi, 2002

Reference Books:

SN	Title	Edition	Authors	Publisher
1	CNC Technology and Programming	2003	Krar, S., and Gill	Industrial Press Inc
2	An Introduction to CNC Machining	1991	Gibbs, D.	Industrial Press
3	Computer Numerical Control Concepts and Programming	1991	Seames, W.S.	Thomson Learning EMEA, Limited
4	Computer Numerical Control for Machining	1993	Lynch, M	McGraw-Hill
5	Computer Control of Manufacturing Systems	2005	Koren Y	Tata McGraw-Hill Education
6	Robotics control, sensing, vision, and intelligence	2004	Fu K.S., Gonzalez R.C., and Lee CSG	Tata McGraw-Hill Education
7	Robotics Technology and Flexible Automation	2001	Deb S.R	Tata McGraw-Hill Education
8	Introduction to Robotics Mechanics and Control	2008	Craig J.J	Pearson Education India

Links for E books in YCCE LIBRARY

SN	Link
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
3	

Links for online courses including SWAYAM / NPTEL/ COURSERA/ UDEMY

SN	Link
1	https://nptel.ac.in/courses/112102103
2	https://nptel.ac.in/courses/112105249
3	https://nptel.ac.in/courses/112105211

V Semester
IIOT2311 : PE-I - System C Progrming

Course Objective:

- To familiarize the students with testing methodology
- To acquaint the students with various modeling technique in verification
- To acquaint the students with use of testbenches

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Understand the design methodology
CO 2	Describe the concepts of combinational modeling
CO 3	model synchronous circuits and testbenches
CO 4	Verify the functionalities

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO -1	2	2	2	2	3	1	1					1	1	1
CO -2	2	2	2	2	2	1						1	1	1
CO -3	2	2	2	3	3	1	1					1	1	1
CO -4	2	2	2	3	2	1						1	1	1
Average	2	2	2	2	3	1	1					1	1	1

Syllabus:

Unit No.	Content	Max. Hrs.
1	Design methodology, capabilities, SystemC RTL, Verifying functionality, Value holders, summary of types , bit types	**7**
2	Data types, bit types, arbitrary width type, logic types, arbitrary width types, singed integer types, precision signed integer, user defined data types	**7**
3	Modelling of combinational logic, reading and writing ports and signals, logical operators, arithmetic operators, relational operators, vectors and ranges, if statement , switch statement , loops, methods, structures, multiple processes and delta delay	**7**

4	Modelling of synchronous logic, modelling of flip-flops, multiple processes, FF with asynchronous and asynchronous preset and clear, Multiple and multi phase clocks, modelling latches,	**7**
5	Three state drivers, multiple drivers, handling don't cares, hierarchy , parametrizing modules, variables and signal assignments, memory model, FSM , Universal shift registers, counters, Johnson decoder, factorial model	**7**
6	Writing testbences , simulation controls, waveforms, monitoring behaviour , tracing aggregate types, constructor arguments, GCD and Filter examples, advanced topics	**7**
	Total Lecture Hours	42

Text Books

SN	Title	Edition	Authors	Publisher
1	SystemC Primer	First Edition	J. Bhaskar	Star Galaxy Publications
2	SystemC: From the Ground Up	Second edition	David C. Black, Jack Donovan, Bill Bunton, Anna Keist	Springer

Reference Books

SN	Title	Edition	Authors	Publisher
1	System Design with SystemC		Grötker, T., Liao, S., Martin, G., Swan, S	springer

Website / Data sheet:

SN	Title
1	https://www.learnsystemc.com/
2	https://www.doulos.com/training/systemc-tlm-20/comprehensive-systemc/

Links for E books in YCCE LIBRARY

SN	Link
1	http://103.152.199.179/YCCE/yccelibrary.html

Links for online courses including SWAYAM / NPTEL/ COURSERA/ UDEMY

SN	Link
1	https://www.udemy.com/course/system-programming/

V Semester
IIOT2312 : PE-I - Industry 4.0 and Smart Systems

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Articulate the recent manufacturing trends related to Industry 4.0 and its implementation
CO 2	Interpret concepts and basic framework necessary for smart manufacturing
CO 3	Develop understanding about harnessing smartness into manufacturing processes from the data
CO 4	Able to find the applications of all the areas in day to day life.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3	2	1					1	1	1	1	1
CO 2	3	3	3	2		1						1	1	1
CO 3	3	2	3	2	2						1		1	1
CO 4	3	3	2	2		1				1		1	1	1

Syllabus:

Unit	Content	Hours
1	**Introduction to Industry 4.0** The Various Industrial Revolutions, Digitalization and the Networked Economy, Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0, The Journey so far: Developments, Comparison of Industry 4.0 Factory and Today's Factory, Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation	8
2	**Road to Industry 4.0** Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services, Smart Devices and Products, Smart Logistics, Smart Cities, Predictive Analytics	7
3	**Related Disciplines, System, Technologies for enabling Industry 4.0** Cyber physical Systems, Robotic Automation and Collaborative Robots, Support System for Industry 4.0, CNC and FMS system integration	7
4	**Smart Manufacturing** Introduction to manufacturing processes and systems; Industrial revolutions, Background and concept of smart manufacturing. Models and key technologies for smart technologies, Automated manufacturing processes, Elements of smart manufacturing process; sensing elements and IoT technologies	8

5	**IoT Applications and Tools of Industry** Applications of IoT: Manufacturing, Healthcare, Education, Aerospace and Defence, Agriculture, Transportation and Logistics, Impact of Industry 4.0 on Society: Impact on Business, Government and People. Tools for Artificial Intelligence, Big Data and Data Analytics, Virtual Reality, Augmented Reality, IoT, Robotics	8
6	Business issues in Industry 4.0, Opportunities and Challenges, Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world	7
	Total Lecture Hours	45

Text Books:

SN	Title	Edition	Authors	Publisher
1	Cloud Based Cyber-Physical Systems in Manufacturing,	2019	Wang L, and Vincent W X,	Springer.
2	Digital Twin Driven Smart Manufacturing	2019	Tao F, Zhang M, and Nee A Y C,	Academic Press.

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Industrial Internet of Things – Cyber manufacturing Systems,	2017	Jeschke S, Brecher C, Song H, and Rawat D B,	Springer
2	Designing the Internet of Things	2013,1st edition,	A. McEwen and H. Cassimally	Wiley

Links for E books in YCCE LIBRARY

SN	Link
1	https://ebooks.wileyindia.com/explore;searchText=INDUSTRY%204.0;mainSearch=1;themeName=Default-Theme
2	https://link.springer.com/search?query=INDUSTRY+4.0&facet-content-type=Book

Links for online courses including SWAYAM / NPTEL/ COURSERA/ UDEMY

SN	Link
1	https://nptel.ac.in/courses/106105195
2	https://www.classcentral.com/course/udemy-arduino-proteus-pcb-design-iot-industry-40-87630

V Semester
IIOT2313 : PE-I - Advanced Microprocessor

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Describe the architecture of Microprocessor
CO 2	Write Program for an assigned task.
CO 3	Apply different address decoding techniques while interfacing Memory to Microprocessor
CO 4	Analyze and Design interfacing of Peripheral devices to Microprocessor

CO – PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1
CO1	3	3	2	2	3	1	1					3	3
CO2	3	3	2	2	3	1	1					2	3
CO3	3	3	2	2	3	1	1	2	2	2	1	3	3
CO4	3	3	2	2	3	1	1	2	2	2	1	2	3

Syllabus:

Unit	Content	Hours
1	**Microprocessor organization** Introduction to Microprocessor based systems, Register Organization and Architecture and Signal Description of 8086	6
2	**8086 Instruction set and Programming Concepts** Machine Language Instruction formats for 8086, addressing modes and assembler directives, Basic programming	7
3	**8086: Special Processor activities** Processor RESET and Initialization, HALT, TEST and synchronization with External signals, Subroutine instructions like CALL, PUSH, POP, Programs based on instructions.	7
4	**Concepts of Memory & IO Interfacing** Basics of Memory and I/O Interfacingwith 8086, Types of decoding techniques.	6
5	**Interfacing of basic Peripherals** Programmable peripheral Interface 8255- Block Diagram, Pin functions, Different Modes of operation& Interfacing with 8086	6
6	**Special Purpose Programmable Peripheral devices and their interfacing** Interfacing of Programmable Interval Timer 8253 and Programmable Communication Interface 8251 USART with 8086	7
	Total Lecture Hours	39

Text Books:

SN	Title	Edition	Authors	Publisher
1	Advanced Microprocessors and Peripherals	-	A K Ray, K. M. Bhurchandi	Tata McGraw Hill Publishing

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Microprocessors & interfacing	2'nd Edition	D. V. Hall	Tata Mc-Graw Hill
2	Microprocessor 8086: Architecture, Programming and Interfacing	-	Sunil Mathur	pHI publications

Links for online courses including SWAYAM / NPTEL/ COURSERA/ UDEMY

SN	Link
1	Nptel Video:https://www.youtube.com/watch?v=0t4LROuEVnw&list=PLwdnzlV3ogoXgNjr_oe5cWQIbf72ZY4Zf
2	https://www.youtube.com/watch?v=oRPluYsxF28&list=PLuv3GM6-gsE01L9yDO0e5UhQapkCPGnY3&index=7
3	https://www.electronicwings.com/

V Semester
IIOT2310 : Industrial Visit

V Semester
(Audit Course)
AU2126 : YCCE Communication Aptitude Preparation (YCAP5.1)

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

6th Semester

(Department of Electronics Engineering

Industrial Internet of Things (IIoT)

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Electronics Engineering)

Industrial IOT

SoE No. IoT-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Sixth Semester															
1	6	PC	EE	IIOT2351	Digital System Design	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	EE	IIOT2352	**Lab.:** Digital System Design	**P**	0	0	2	2	1		60	40	
3	6	PC	EE	IIOT2353	Embedded System Design	**T**	3	0	0	3	3	30	20	50	3 Hours
4	6	PC	EE	IIOT2354	**Lab.:** Embedded System Design	**P**	0	0	2	2	1		60	40	
5	6	PC	EE	IIOT2355	Data Acquisition & Signal Conditioning	**T**	3	0	0	3	3	30	20	50	3 Hours
6	6	PC	EE	IIOT2356	Machine Learning for IIoT	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PC	EE	IIOT2357	**Lab.:** Machine Learning for IIoT	**P**	0	0	2	2	1		60	40	
8	6	PC	EE	IIOT2358	Design Tool **Lab-2**	**P**	0	0	2	2	2		60	40	
9	6	PC	EE	IIOT2359	Cryptograpghy for IIoT	**T**	3	0	0	3	3	30	20	50	3 Hours
10	6	PE	EE		**Professional Elective-II**	**T**	3	0	0	3	3	30	20	50	3 Hours
11	6	PE	EE		**Lab: Professional Elective-II**	**P**	0	0	2	2	1		60	40	
					TOTAL SIXTH SEM		**18**	**0**	**10**	**28**	**24**				

List of Professional Electives- II

Professional Electives-II

1	6	PE-II	EE	IIOT2361	PE-II Digital Image processing
	6	PE-II	EE	IIOT2362	PE-II: **Lab.:** Digital Image processing
2	6	PE-II	EE	IIOT2363	PE-II Flexible Manufacturing System
	6	PE-II	EE	IIOT2364	PE-II: **Lab: :** Flexible Manufacturing System
3	6	PE-II	EE	IIOT2365	PE-II Digital Signal Processing
	6	PE-II	EE	IIOT2366	PE-II **: Lab:** Digital Signal Processing

Audit Courses												
1	6	HS		AU2130	YCCE Communication Aptitude Preparation (YCAP6.3) for CT, IT, CSE, IIoT, AIDS, CSD, AIML	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

Chairperson	Dean (Acad. Matters)	June 2022	1.01
		Date of Release	Version

Applicable for AY 2022-23 Onwards

VI Semester
IIOT2351: Digital System Design

Course Objective:

- Expose students to the advanced design techniques and methodology and industrial standard EDA tools in Digital Circuits and Systems design

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Understand hardware description language and able to design and simulate digital systems using different abstraction levels
CO 2	Design and analyse combinational and sequential logic circuits.
CO 3	Understand and apply timing issues in multiple contexts and design the circuit.
CO 4	Understand programmable devices and able to design digital systems using modern design tools

Syllabus:

Unit	Content	Hours
1	HDL Based Design flow, Requirements of HDL, Design Methodologies, Different Modelling styles, Introduction to Verilog, Elements of Verilog, Verilog Module definition, Elements of Module ,Basic Concepts in Verilog, Reserved Keywords, Syntax & Semantics, Comments, Identifiers, Number Representation, System Representation, Verilog Ports, Verilog Data Types, Wire & Variables, Physical & Abstract, Constants, Parameter, Verilog Data Operators.	8
2	Data Flow Modeling, Delay, Continuous Assignment, Delayed Continuous assignment Design entry in Verilog & Test bench, Combinational blocks design, Compilation and synthesis, Timing analysis resolving signal values	7
3	Structural Modeling Feature, Module Instantiation, Gate level Primitives, Gate Delays, Switch Level Primitives, User Defined Primitives.	7
4	Behavioral Modeling, Initial, Always, Procedural Assignment, Sequential & Parallel Blocks, Timing Control, Procedural Statements, Conditional Statements, if case loop repeat forever etc, Event Based Timing Control, Latch Models, FF Models, State Machine Coding ,Moore and Mealy Machines.	8
5	Combinational & sequential system Design examples like Shift Registers, Counters, Barrel Shifters, Multi bit Adders , Multi bit Multiplier, Arithmetic Logic Unit.	8
6	Digital Design Fundamentals, Combinational & Sequential design issues, Introduction to programmable devices, PLA, PAL, PROM, Structure of CPLDs, Introduction to FPGA, Architecture, CLB, IOB, Programmable Interconnect Points, Different type of programmable switches used in PLDs.	7
	Total Lecture Hours	45

		June 2022	1.00	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Text Books:				
SN	**Title**	**Edition**	**Author**	**Publisher**
1	Verilog HDL : A Guide to Digital Design and Synthesis	2nd Edition	Samir Palnitkar	2003

Reference Book:				
	Title	**Edition**	**Author**	**Publisher**
1	Verilog Digital System Design	Second Edition	ZainalabedinNavabi	Tata McGraw Hill , 2009

Website / Data sheet:

SN	Title
1	https://www.chipverify.com/verilog/verilog-tutorial
2	https://www.asic-world.com/verilog/veritut.html
3	http://103.152.199.179/YCCE/yccelibrary.html
4	https://nptel.ac.in/courses/106105165 https://onlinecourses.nptel.ac.in/noc20_cs63/preview https://nptel.ac.in/courses/108103179 https://onlinecourses.nptel.ac.in/noc21_ee97/preview

VI Semester
IIOT2352: Lab.: Digital System Design

SN	Experiment Name
1.	Write Verilog Codes of basic gates using Bitwise Operator .Test it with test stimuli generated by test bench.
2.	Write Verilog Codes of 2:1 and 4:1 Multiplexer using Bitwise Operator .Test it with test stimuli generated by test bench.
3.	Write Verilog Codes of 2:4 and 3:8 Decoder using Bitwise Operator .Test it with test stimuli generated by test bench.
4.	Write Verilog Codes of half and full adder using Bitwise Operator .Test it with test stimuli generated by test bench.
5.	Write verilog code using conditional assignment statement. Test it with test stimuli generated by test bench.
6.	Write a Structural Verilog code of full adder using half adder. Test it with test stimuli generated by test bench.
7.	Write a Structural Verilog code of 4:1 multiplexer using 2:1 multiplexer. Test it with test stimuli generated by test bench.
8.	Write a Structural Verilog code of 4-bit Ripple carry Adder using full adder. Test it with test stimuli generated by test bench.
9.	Write a Behavioural Verilog code of multiplexers using if statements. Test it with test stimuli generated by test bench.
10.	Write Verilog code for Mealy and Moore sequence detector.(using overlapping allowed and not allowed)

Text Books:

Title	Edition	Author	Publisher
Verilog HDL : A Guide to Digital Design and Synthesis	2nd Edition	Samir Palnitkar	2003

Reference Book:

Title	Edition	Author	Publisher
Verilog Digital System Design	Second Edition	ZainalabedinNavabi	Tata McGraw Hill , 2009

VI Semester
IIOT2353: Embedded System Design

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Describe the ARM microprocessor architectures, its features and instructions
CO 2	Write program for specific task
CO 3	Analyze and Interface the peripherals to ARM based microcontroller
CO 4	Develop embedded system application using ARM based microcontroller
CO 5	Write program and Debug using IDE tool like KEIL MDK410 and Code Composer Studiofor ARM

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO	3	2						1	1	1		1	2	
CO	3	2						1	1	1		1	2	
CO		3	2					1	1	1		1		3
CO			3	2				1	1	1		1		3
CO				2	3			1	1	1		1		3

Syllabus:

Unit	Content	Hours
Unit:1	Introduction to embedded system, Overview of Microprocessor, Microcontroller and ARM, RISC and CISC Architecture, ARM processor features, ARM architecture, ARM Modes.	7 Hours
Unit:2	ARM instruction set, ARM and Thumb mode, Assembly Language Programs	7 Hours
Unit:3	Stack operation, instructions, Control Transfer Instructions, Subroutine, Exceptions, Software Interrupt SWI, and Programs	7 Hours
Unit:4	Program array multiplication, Hardware ARM LPC 2148 pins and signals, PWM Program Interrupt pins Interrupt Handler, DC motor Control using PWM, DAC and ADC working principle	7 Hours

Unit:5	Interfacing and programing: I/O with Arduino / LPC2148/ MSP430 Ti Launchpad Interfacing of Switch, LED, and 7 segment display	7 Hours
Unit :6	Interfacing and programing: I/O with Arduino / LPC2148/ MSP430 Ti Launchpad. Interfacing of Sensors and Actuators, Sensors like LDR, Temp, Gas Sensor and LCD Design Application using ARM	7 Hours
	Total Lecture Hours	**42 Hours**

Textbooks	
1	ARM System–on-chip Architecture, by Steve Furber, Pearson Education Asia Publication
2	Embedded Linux, Hardware, Software and interfacing, by Craig Hallabaugh, Addison-Wesley Professional Publication

Reference Books	
1	ARM System Developer's Guide: Designing and Optimizing, by Sloss Andrew N, Symes Dominic & Wright Chris, Morgan Kaufman Publication
2	MSP 430 Data sheet, by Texas Instrument
3	LPC 2148 data sheet, by NXP (Philips

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/yccelibrary.html

MOOCs Links and additional reading, learning, video material	
1	https://www.arm.com/resources/education/education-kits/efficient-embedded-systems
2	https://www.electronicwings.com/
3	https://nptel.ac.in/courses/106/105/106105193/

VI Semester
IIOT2354: Lab.: Embedded System Design

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	Describe the ARM microprocessor architectures, its features and instructions
CO 2	Write program for specific task
CO 3	Analyze and Interface the peripherals to ARM based microcontroller
CO 4	Develop embedded system application using ARM based microcontroller
CO 5	Write program and Debug using IDE tool like KEIL MDK410 and Code Composer Studiofor ARM

Lab Experiment List:

Sr. No.	Name of Experiment
1	a) Write program to perform addition of two16 bit nos. and store result in R5 b)Write program to perform subtraction of two 16 bitbit nos. and store result in R5
2	a)Write program to perform AND operation on two 16 bit nos. and store result in R6 b)Write program to perform OR operation on two 16 bit nos. and store result in R6 c)Write program to perform EOR operation on two 16 bit nos. and store result in R6
3	Write program to add two nos. x and y present in memory at address 4000000H and 40000004H and store in memory 40000008H
4	Write program to add Five 8 bit nos. present in memory from address 40000004H and store result in memory 4000 0030H
5	Write program to multiply data of two array zi = xi * yi · xi and yi are 32 bit nos · array1 (xi) stored from address 40000000H · array 2 (yi) stored from address 40000020H · no. of elements in array i = 5 · Store result array3 (zi) from address 40000040H
6	Compare two strings of 3 ASCII characters, One string starts at 0x40000000 and other at 0x40000010. If both the string match store 11H in memory location 0x40000030 otherwise store 22H in memory location 0x40000030.
7	Draw Interfacing of LED with LPC2148 and write program to blink LED connected to port pin P0.7 of LPC2148
8	Draw Interfacing of LED with LPC2148 and Write program to blink 8 LEDs alternately connected to port pins P1.16 to P1.23 of LPC2148

9	Draw Interfacing of common cathode 7 segment display with LPC2148 and write program to display 0 to 9 at an interval of 1 sec. 7 segment display is connected to port pins P1.16 to P1.23 of LPC2148.
10	Draw interfacing of LCD 16x2 with LPC2148 and write program to display your **FIRST NAME** in first line.

VI Semester
IIOT2355: Data Acquisition & Signal Conditioning

Course Objective:

- The course gives an overview about the data acquisition methods, to acquaint students with ADCs and DACs and various data acquisition techniques

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	**Understand** the Data acquisition system and Signal Conditioning Components.
CO 2	**Analyze** the Knowledge of Serial data Communication and interface standards.
CO 3	**Remember** the different boards and field buses used for data acquisition Systems.
CO 4	**Understands** the use of Ethernet, Medium Access control and USB

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	-	-	-	-	-	--	-	-	-	1	-	-
CO 2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO 3	3	-	1	-	-	-	-	-	-	-	-	1	-	-
CO 4	3	2	2	-	-	-	-	-	-	-	-	1	-	-

Syllabus:

Unit	Content	Hours
1	Definition of data acquisition and control, Fundamentals of data acquisition, Signal conditioning, Data acquisition and control system configuration, Computer plug-in I/O, Distributed I/O, Stand-alone or distributed loggers/controllers, Analog and digital signals: Classification of signals, Sensors and transducers, Transducer characteristics, Resistance temperature detectors (RTDs), Thermistors, Thermocouples, Strain gauges, Wheatstone bridges.	7
2	Signal conditioning: Types and classes, Field wiring and signal measurement, Noise and interference, Minimizing noise, Shielded and twisted-pair cable.	6
3	Plug-in data acquisition boards, A/D Boards, Single ended Vs differential signals, Resolution, dynamic range and accuracy of A/D boards, Sampling rate and the Nyquist theorem, Sampling techniques, D/A boards, Digital I/O boards.	7

4	Serial data communications, Transmission modes – simplex and duplex, RS-232-C interface standard, RS-485 interface standard, Comparison of the RS-232 and RS-485 standards, Serial interface converters, Protocols, Error detection	7
5	IEEE 488 Standard, Introduction, Electrical and mechanical characteristics, Physical connection configurations, Device types, Bus structure, GPIB handshaking, Device communication, Requirements of IEEE 488.2 controllers, Standard commands for programmable instruments (SCPI).	6
6	Ethernet and field buses for data acquisition, Physical layer, Medium access control, Difference between 802.3 and Ethernet, The universal serial bus (USB), USB overall structure, Topology.	6
	Total Lecture Hours	**39 Hours**

Text Books:

SN	Title	Edition	Authors	Publisher
1	Data Acquisition for Instrumentation and Control Systems	10 June 2003	John Park and Steve Mackay	Elsevier

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Electronic Analog Digital Conversion	1 st Edition	H. Schmid	Tata McGraw Hill
2	Data Converters	1 st Edition, 1993	B. S. Sonde	Tata McGraw Hill

Website / Data sheet:

SN	Title
1	http://103.152.199.179/YCCE/yccelibrary.html
2	https://nptel.ac.in/courses/108/105/108105062

VI Semester
IIOT2356: Machine Learning for IIoT

Course Objective:
Students should be able to

- Understand the concepts of machine learning and regression models
- Understand the concept of classification for model evaluation.
- Learn Supervised and unsupervised learning algorithms.
- Learn the concept of artificial neural network and deep networks

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	**Apply** the knowledge of Mathematics and programming to build machine learning models
CO 2	**Analyze** different use cases to evaluate the performance of the models
CO 3	**Design and develop** application models using supervised and unsupervised learning algorithms
CO 4	**Compare** different machine learning techniques and **demonstrate the comprehension** of the trade-offs involved in design choices

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO -1	3	3	1	1	1	-	-	-	-	-	-	3	-	-
CO -2	3	3	3	2	3	-	-	-	-	-	-	3	-	-
CO -3	**3**	**3**	**3**	**2**	**3**	**2**	**-**	**2**	**-**	**1**	**-**	**2**	**-**	**-**
CO -4	**3**	**3**	**2**	**2**	**2**	**2**	**-**	**2**	**-**	**1**	**-**	**2**	**-**	**-**
Average	**3**	**3**	**2.25**	**1.75**	**2.25**	**2**		**2**		**1**		**2.5**		

Syllabus:

Unit No.	Content	Max. Hrs.
1	**Regression:** Supervised and Unsupervised Learning, Regression, Model and Cost Function, Gradient Descent, Multivariate Linear Regression, Feature Scaling, Gradient Descent for multivariable	7

2	**Classification:** Classification, Hypothesis Representation, Decision Boundary, Cost function and Gradient Descent, Multi-classification, Regularization, Model Evaluation	6
3	**Supervised Learning:** KNN, SVM, Decision tree, Naive Bayes Classifiers, Random Forest	6
4	**Unsupervised learning:** K-means clustering, Hierarchical Clustering, DBSCAN Clustering, PCA, Anomaly Detection, Recommender System	6
5	**Artificial Neural Network:** Introduction to neural network, Activation Functions, Perceptron rule, Back propagation	6
6	**Deep Learning:** Introduction to deep learning, building blocks of CNN, Computational Complexity, Lenet, Alexnet, **New topics to be announced time to time**	7
	Total Lecture Hours	**38 Hours**

Text Books:

Text books:				
1	Understanding Machine Learning. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/copy.html	2017	ShaiShalev-Shwartz and Shai Ben-David.	Cambridge University Press.
2	The Elements of Statistical Learning. https://web.stanford.edu/~hastie/ElemStatLearn/	2009	Trevor Hastie, Robert Tibshirani and Jerome Friedman.	Second Edition
3	Pattern Recognition and Machine Learning. https://www.microsoft.com/en-us/research/people/cmbishop/downloads/	2006	Christopher Bishop.	Springer

Reference books:				
1	Foundations of Data Science.	2017	Avrim Blum, John Hopcroft and RavindranKannan.	
2	Deep Learning, Part II, http://www.deeplearningbook.org/	2016	Goodfellow, I., Bengio, Y., Courville, A.	MIT Press
3	Machine Learning: A Probabilistic Perspective	2012	Kevin P. Murphy	MIT Press

Website / Data sheet:

SN	**Title**
1	
2	

VI Semester
IIOT2357: Lab.: Machine Learning for IIoT

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	**Apply** the knowledge of Mathematics and programming to build machine learning models
CO 2	**Analyze** different use cases to evaluate the performance of the models
CO 3	**Design and develop** application models using supervised and unsupervised learning algorithms
CO 4	**Compare** different machine learning techniques and **demonstrate the comprehension** of the trade-offs involved in design choices

Lab Experiment List:

Expt. No	Name of Experiment
	Apply Following Techniques on different use cases. Apply, analyse, develop and demonstrate different ML models and evaluate it using Python
1	Data Pre-processing and cleaning
2	Linear Regression
3	Non Linear Regression
4	K-Nearest Neighbours
5	Decision Tree
6	Support Vector Machine
7	K-Means Clustering
8	Hierarchical Clustering
9	Content based Recommendation System
10	Collaborative filtering Recommendation System

VI Semester
IIOT2358 : Design Tool Lab-2

Course Objective:

- To acquaint the students with real life problems and their solution by developing small projects

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Analyze the data acquisition systems
CO 2	Design and develop Wireless applications
CO 3	Develop projects on ARM processor
CO 4	Solve scientific problems using software programming

Experiment List

Expt No.	Name of Experiment
1	Mini project -01 (MSPA-1 Evaluation for 15 Marks) Analog discovery kit
2	Mini project -02 (MSPA-2 Evaluation for 15 Marks) ESP8266 applications
3	Mini project -03 (MSPA-3 Evaluation for 15 Marks) ARM based projects
4	Mini project -04 (MSPA-4 Evaluation for 15 Marks) Software programming for solving scientific problems

VI Semester
IIOT2359 : Cryptograpghy for IIoT

Course Objective:

- To Know mathematics behind Cryptography
- To understand attacks effect on Security
- To familiarize with different types Encryption –Decryption Techniques
- To impart knowledge on Network security

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Solve and relate mathematic concepts behind the cryptographic algorithms.
CO 2	Explain basic concepts and algorithms of cryptography
CO 3	Evaluate the role played by various security mechanisms like passwords
CO 4	Understand IP security

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	-	-	1	-	-	-	-	-	-	2	-	-
CO 2	2	2	2	2		-	-	-	1	2	-	-	-	-
CO 3	3	2	2	2	1	-	-	-	1	2	-	-	-	-
CO 4	2	2	1	-	1	-	-	-	-	1	-	-	-	-
CO 5														

Syllabus:

Unit	Content	Hours
1	Cryptography Mathematics: Integer Arithmatic, Modular Arithmatic, Euclidiean Algorithm, Modulo operator, Congruence,Primitiveroots,Inverses, Extended Eculidian Algorithm.	6
2	Introduction to Security:-Security Goals ,Cryptographic Attacks, Services and Mechanisms, Techniques.	6
3	Traditional Symmetric Key Ciphers:-Kerchoff's Principal, Substitution Ciphers (mono alphabetic ciphers, poly alphabetic ciphers)-Transposition Ciphers-Stream and Block Ciphers. Modern Symmetric Key Ciphers:- Substitution Box-Permutation Box.	6

4	Symmetric Key Block Cipher :Fiestel and Non-Fiestel Ciphers, Data Encryption Standard (Encryption , Decryption , Key Generation Algorithm), Advanced Encryption Standard (AES) (Encryption , Decryption , Key Generation Algorithm).	6
5	Public Key Cryptosystems : - Knapsack Cryptosystem ,RSA Cryptosystem , Rabin Cryptosystem (Encryption, Decryption ,Key Generation)	6
6	Network Layer Security : - IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload- Intruders, Internet Key Exchange Algorithm (Diffie-Hellman Key Exchange)	6
	Total Lecture Hours	**36 Hours**

Text Books:

SN	Title	Edition	Authors	Publisher
1	Cryptography and Network Security	Second Edition	Behrouz A. Forouzan	Mcgraw-Hill

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Cryptography and Network Security Principles and Practices .	4'th	William Stallings	(Pearson Edu Asia)

Website / Data sheet:

SN	Title
1	Nptel Video : https://www.youtube.com/watch?v=Q-HugPvA7GQ&list=PL71FE85723FD414D7
2	https://www.youtube.com/watch?v=LWU11bLvXKI&list=PLJ5C_6qdAvBFAuGoLC2wFGruY_E2gYtev&index=36

VI Semester
IIOT2361 : PE-II Digital Image processing

Course Objectives

- The objective of this course is to introduce the students to the concepts of Digital Image Processing so that it can be used in advanced studies and projects.

Course Outcomes

After completion of the course, student will demonstrate the ability to:

Course Outcome	Course Outcome Statement	Bloom's Taxonomy Level
CO 1	A**pply** the basic concepts of digital image processing and digital image geometry to interpret image data	L3
CO 2	A**pply**the image enhancement and restoration techniques in spatial and frequency domain to improve quality of image	L3
CO 3	A**nalyze** digital Image usingedge detection and region merging/splitting/growing techniques for image segmentation	L4
CO 4	A**pply** different compression techniques to **estimate** image compression	L3
CO 5	**Conduct** experiments using MATLAB for processing the digital images	L3

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1												
CO 2	2	2											2	
CO 3	2	3	2										2	
CO 4	2	3												
CO 5					3			2	2	2		2	2	

Syllabus :

Unit	Content	Hours
1	Introduction to image processing: Fundamental steps in digital image processing, Elements of visual perception, Image sensing and acquisition, Basic Concepts in Sampling and Quantization, representing digital images, representation of colour image.	7
2	Image Enhancement: Some basic gray level transformations, Histogram Processing, Histogram modification, Image subtraction, spatial filtering, Sharpening Spatial filters, use of first and second derivatives for enhancement; LoG, Image Enhancement in the Frequency Domain, Gaussian filters, homomorphic filtering, pseudo colouring: intensity slicing, Gray level to colour transformation	7

3	Image Segmentation: Some Basic Relationships between pixels, point, line and edge detection, Gradient operators, Canny edge detection, Edge linking and boundary detection. Hough transform, Chain codes, boundary segments, skeletons, Boundary descriptors, Fourier descriptors	7
4	Threshold based Image Segmentation: The role of illumination, global thresholding, adaptivethresholding, use of boundary characteristics for histogram improvement and local thresholding, Region-based segmentation, region-based segmentation, region growing, region splitting and merging.	7
5	Image Restoration: Degradation model, Algebraic approach to restoration, Inverse filtering, Least mean square filters, Constrained Least Squares Restoration, Interactive Restoration	7
6	Imagecompression: Redundancies and their removal methods, Fidelity criteria, Image compression models, Source encoder and decoder, Error free compression, Lossy compression.	7
	Total Lecture Hours	**42 Hours**

Text Books:

SN	Title	Edition	Authors	Publisher
1	Digital Image processing	4th Edition	Rafael C. Gonzalez, Richard E Woods	Wesley/ Pearson Education
2	Fundamentals of Digital Image processing	2nd Edition	A.K.Jain	Prentice Hall od India

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Digital Image Processing	2nd Edition	William K. Pratt	John Wilely

Website / Data sheet:

SN	Title
1	Nptel Video :Dr. P.K. Biswas ,Video Lectures on NPTEL website https://nptel.ac.in/courses/117105079

VI Semester
IIOT2362 : PE-II: Lab.: Digital Image processing

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	A**pply** the basic concepts of digital image processing and digital image geometry to interpret image data
CO 2	A**pply**the image enhancement and restoration techniques in spatial and frequency domain to improve quality of image
CO 3	A**nalyze** digital Image usingedge detection and region merging/splitting/growing techniques for image segmentation
CO 4	A**pply** different compression techniques to **estimate** image compression
CO 5	**Conduct** experiments using MATLAB for processing the digital images

Lab Experiment List:

Expt. No	Name of Experiment
1	Image Fundamentals 1. Read and display RGB Image , Observe three different image planes of RGB image 2. Convert RGB image to Grayscale Image 3. Determine negative of image using a) imcomplement function b) Using for loop logic c)Find difference of output for above two methods
2	Spatial Image Enhancement 1. Image Thresholding 2. Intensity Slicing (enhance perticular range of intencities) 3. Intensity modification using log and antilog
3	Image Transform 1. DFT : Verify the magnitude and phase interchanging effect of two images of same size 2. DCT: Reconstruction of image using fewer coeffients of DCT (Information in DCT is concentrated on left most corner)
4	Bit plane Slicing 1. Creation of 8 bit plane images and display the same. 2. Reconstruct image using B7+B6, B7+B6+B5, B7+B6+B5+B4 bit planes. 3. Reconstruct image using MSB bit planes and LSB bit planes
5	Histogram Equalization 1. Perform Image enhancement using imhist command from Matlab Perform Image enhancement using program developed for histogram equalisation
6	Spatial Filtering 1. Perform Spatial filtering on image having noise with Averaging Filter mask (3x3,5x5,9x9,25x25) b. Median Filter mask
7	Edge detection Edge detection using different directional Prewitt, Sobel operators
8	Transform domain Filtering 1. Perform Transform domain filtering on image having noise with a)Butterworth filter Low pass b) Gaussian Filter

VI Semester
IIOT2363 : PE-II Flexible Manufacturing System

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Develop FMS using the most appropriate technique
CO 2	Implement FMS concept in a manufacturing environment
CO 3	Explain the role of automation in manufacturing
CO 4	Classify automation equipment and assembly systems into different categories

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	3	2	1					1	1	1	1
CO 2	3	3	2	2	2	1						1	1	1
CO 3	3	3	3	2	1						1		1	1
CO 4	3	3	3	2	2	1							1	1

Syllabus:

Unit	Content	Hours
1	FMS concept, Components of FMS, FMS Layouts, FMS planning and implementation. Tool Management systems-Tool monitoring, Work holding devices Modular fixturing, flexible fixturing, flexibility, quantitative analysis of flexibility, application and benefits of FMS	7
2	Automated material handling system, AGVs, Guidance methods, AS/RS	8
3	Group Technology, Part families, Part classification and coding, Production flow analysis, Machine cell design, Applications and Benefits of Group Technology	8
4	Structure of a Process Planning, Process Planning function, CAPP - Methods of CAPP, CAD based Process Planning, Retrieval process planning, Generative Process Planning with expert system, Inventory management: Materials requirements planning - basics of JIT	7
5	Monitoring and quality control: Types of production monitoring system, process control & strategies, direct digital control - Supervisory computer control – computer aided quality control - objectives of CAQC, QC and CIM, contact, non-contact inspection methods, CMM and Flexible, Inspection systems, Integration of CAQC with CIM.	7
6	Integrated approach of FMS system, FMS for Automotive sector, FMS integration for IoT, simulation software for FMS system integration	7
	Total Lecture Hours	**42 Hours**

Text Books:

SN	Title	Edition	Authors	Publisher
1	Computer aided Design and Manufacturing	1987	Groover M.P.,	Prentice Hall of India
2	Computer control of manufacturing system	1986	YoremKoren	McGraw Hill,
3	CAD/CAM/CIM	2000	Radhakrishnan. P, Subramanyam. S	New Age International Publishers,

Reference Books:

SN	Title	Edition	Authors	Publisher
1	"Principles of Computer Integrating Manufacturing"	1999	Kant Vajpayee. S.	Prentice Hall of India
2	"CIM – Towards the factory of the Future"	1994	Scheer. A.W.	Springer-Verlag

Links for E books in YCCE LIBRARY

SN	Link
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

Links for online courses including SWAYAM / NPTEL/ COURSERA/ UDEMY

SN	Link
1	https://nptel.ac.in/courses/112102103
2	https://nptel.ac.in/courses/112105249
3	https://nptel.ac.in/courses/112105211

VI Semester
IIOT2364 : PE-II: Lab: : Flexible Manufacturing System

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	Develop FMS using the most appropriate technique
CO 2	Implement FMS concept in a manufacturing environment
CO 3	Explain the role of automation in manufacturing
CO 4	Classify automation equipment and assembly systems into different categories

Lab Experiment List:

Expt. No	Name of Experiment
1	Creation and simulation of palletizing operation
2	Creation and simulation of Pick and Place (XYZ) operation
3	Creation and simulation of production operation involving simultaneous control of machining centers
4	Creation and simulation of part separation operation on multiple conveyors
5	Creation and simulation of part separation operation on multiple conveyors
6	Creation and simulation of sorting operation based on part height and weight on multiple conveyors using a sorting station equipped with vision sensor
7	Creation and simulation of AGV path planning
8	Creation and simulation of Arc and Spot-Welding cell
9	To write and execute a robot program to perform a repetitive pick & place operation
10	To write and execute a robot program to perform a palletizing operation
11	To write and execute a robot program to perform a packaging operation
12	To write and execute a robot program to perform an assembly operation

VI Semester
IIOT2365 : PE-II Digital Signal Processing

Course Objective:

This course will provide

- Classification of discrete time signals and system.
- Properties and Applications of Discrete Fourier Transform
- Design of Filter Structures and Different Filtering Techniques (FIR/IIR) in DSP
- Introduction to Multi- rate Signal Processing

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	**Apply the** concepts of trigonometry, complex algebra, Fourier transform, z-transform and concepts of signals and system to analyze DSP problems and demonstrate it using software tool
CO 2	**Acquire knowledge, Apply and analyze** the operations on Digital signals Systems and demonstrate it using software tool
CO 3	**Design, implement, analyze and demonstrate digital** filters for processing of discrete time signals in basic and advance form like multi-rate filters
CO 4	**Design and demonstrate** fundamental knowledge of Digital signal processing using modern Engineering tool. Also develop creative and innovative designs that achieve desired performance criteria within specified objectives and constraints, understand the need for lifelong learning and continuing professional education

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO -1	3	3	2	2	3	3	-	-	-	-	2	1	-	-
CO -2	3	3	3	3	3	3	-	-	-	-	1	1	-	-
CO -3	3	3	2	2	2	3	-	-	-	-	1	1	-	-
CO -4	3	3	3	3	3	3	-	-	-	-	1	1	-	-

Syllabus:

Unit	Content	Hours
1	Discrete Time (DT) Signals and System, Classification of DT signals, classification of DT systems, linear Convolution, Sampling and reconstruction.	
2	Discrete Time Fourier Transform, Discrete Fourier Transform, Computation of DFT, Properties of DFT, convolution of data sequences, FFT algorithms, Decimation in time, Decimation in Frequency	
3	Digital Filter structures: FIR digital filter structures, IIR digital filter structures, Lattice structures, Finite word length effect	

4	IIR Digital filter Design, Bilinear transformation, Impulse invariant transformation, Low pass IIR digital filters, Butterworth and Chebyshev filter	
5	FIR Digital Filter Design, FIR filter design using windowing techniques	
6	Multi-rate Digital Signal processing fundamentals, sampling rate alteration, multi-rate structures, Decimator and Interpolator and Multistage design.	
	Total Lecture Hours	**00 Hours**

Text Books:

SN	Title	Edition	Authors	Publisher
1.	Digital Signal Processing – Principles, Algorithms and Applications	3rd Edition ,1996	J. G. Proakis, D. G. Manolakis	PHI
2.	Digital Signal Processing- A Computer Based Approach	4th Edition, 2013	SanjitMitra	TMH

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Discrete Time Signal Processing	2nd edition, 1999	V. Oppenheim, R, W, Schafer	PHI

Website / Data sheet:

SN	Title
1	
2	
3	

VI Semester
IIOT2366 : PE-II : Lab: Digital Signal Processing

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	**Apply the** concepts of trigonometry, complex algebra, Fourier transform, z-transform and concepts of signals and system to analyze DSP problems and demonstrate it using software tool
CO 2	**Acquire knowledge, Apply and analyze** the operations on Digital signals Systems and demonstrate it using software tool
CO 3	**Design, implement, analyze and demonstrate digital** filters for processing of discrete time signals in basic and advance form like multi-rate filters
CO 4	**Design and demonstrate** fundamental knowledge of Digital signal processing using modern Engineering tool. Also develop creative and innovative designs that achieve desired performance criteria within specified objectives and constraints, understand the need for lifelong learning and continuing professional education

Lab Experiment List:

Expt. No	Name of Experiment
1	Generation of CT signal and discrete time signal & to verify sampling effect.
2	Generation of Discrete Time Signal
3	Operations on Discrete Time Signals
4	Convolution
5	To find the DFT and IDFT of the signals
6	FIR Filter Design
7	IIR Filter Design
8	Upsampling and Downsampling

VI Semester
(Audit Course)
AU2130 : YCCE Communication Aptitude Preparation (YCAP6.3)

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

1st to 6th Semester

(Department of Information Technology)

Computer Science and Design

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. CSD-203

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2021-22 onward)

(Department of Information Technology)

Computer Science and Design

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE
							L	T	P	Hrs		MSEs*	TA**	ESE	
First Semester															
1	1	BS	GE	CSD2101	Calculus, Sequences and Series	T	3	0	0	3	3	30	30	40	3
2	1	BS	GE	CSD2102	Applied Physics	T	3	0	0	3	3	30	30	40	3
3	1	BS	GE	CSD2103	Lab.: Applied Physics	P	0	0	2	2	1		60	40	
4	1	HS	GE	CSD2104	Constitution of India	T	3	0	0	3	3	30	30	40	3
5	1	BES	CV	CSD2105	Engineering Mechanics	T	3	0	0	3	3	30	30	40	3
6	1	BES	CV	CSD2106	Lab.:Engineering Mechanics	P	0	0	2	2	1		60	40	
7	1	BES	IT	CSD2107	Introduction to Computer Programming	T	3	0	0	3	3	30	30	40	3
8	1	BES	IT	CSD2108	Lab.: Introduction to Computer Programming	P	0	0	2	2	1		60	40	
					TOTAL FIRST SEM		**15**	**0**	**6**	**21**	**18**				

List of Audit Course

1	1	HS	GE	GE2131	Universal Human Value	**T**	2	0	0	0	0				
2	1	HS	GE	GE2123	YCCE Communication & Aptitude Preparation (YCAP)	**A**	3	0	0	3	0				
3	2	HS	GE	GE2124	YCCE Communication & Aptitude Preparation (YCAP)	**A**	3	0	0	3	0				

Second Semester															
1	2	BS	GE	CSD2151	Probability & Statistics	T	3	0	0	3	3	30	30	40	3
2	2	BS	GE	CSD2152	Applied Chemsitry	T	3	0	0	3	3	30	30	40	3
3	2	BS	GE	CSD2153	Lab: Applied Chemsitry	p	0	0	2	2	1		60	40	
4	2	HS	GE	CSD2154	Technical Communication	T	3	0	0	3	3	30	30	40	3
5	2	HS	GE	CSD2155	Lab:Technical Communication	P	0	0	2	2	1		60	40	
6	2	BES	EE	CSD2156	Digital Circuit Design	T	3	0	0	3	3	30	30	40	3
7	2	BES	EE	CSD2157	Lab.:Digital Circuit Design	P	0	0	2	2	1		60	40	
8	2	BES	EL	CSD2158	Basic Electrical Machines	T	3	0	0	3	3	30	30	40	3
9	2	BES	EL	CSD2159	Lab:Basic Electrical Machines	P	0	0	2	2	1		60	40	
10	2	BES	ME	CSD2160	Lab.: Engineering Design	P	0	0	4	4	2		60	40	
					TOTAL SECOND SEM		**15**	**0**	**12**	**27**	**21**				

MSEs* = Two MSEs of 15 Marks each will be conducted and total marks of MSE 1 and MSE 2 MSEs will be considered for Continuous Assessment out of 30.

TA- for Theory : 30 marks on quizzes, activities, attendance etc as included in TA plan of course teacher. TA - for Practical: MSPA will be 15 marks each as included in TA plan of course teacher

TA – for Practical : MSPA will be 15 marks each

		June 2021	**1.00**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2021-22 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

Computer Science and Design

SoE No. CSD-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS	GE	CSD2201	Linear Algebra	**T**	3	1	0	4	4	30	20	50	3 Hours
2	3	PC	IT	CSD2202	Microprocessors and Microcontrollers	**T**	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	IT	CSD2203	Lab:Microprocessors and Microcontrollers	**P**	0	0	2	2	1		60	40	
4	3	PC	IT	CSD2204	Data Structures	**T**	4	0	0	4	4	30	20	50	3 Hours
5	3	PC	IT	CSD2205	Lab:Data Structures	**P**	0	0	2	2	1		60	40	
6	3	PC	IT	CSD2206	Computer System Organization	**T**	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	IT	CSD2207	Theoretical Foundation of Computer Sciences	**T**	3	0	0	3	3	30	20	50	3 Hours
8	3	PC	IT	CSD2208	Software Lab-I	**P**	0	0	4	4	2		60	40	
					TOTAL THIRD SEM		**16**	**1**	**8**	**25**	**21**				
Fourth Semester															
1	4	BS	IT	CSD2251	Discrete Mathematics and Graph Theory	**T**	3	1	0	4	4	30	20	50	3 Hours
2	4	PC	IT	CSD2252	Operating Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	IT	CSD2253	**Lab :** Operating Systems	**P**	0	0	2	2	1		60	40	
4	4	PC	IT	CSD2254	Computer Networks	**T**	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	IT	CSD2255	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	IT	CSD2256	**Lab:**Object Oriented Programming	**P**	0	0	2	2	1		60	40	
7	4	PC	IT	CSD2257	Design and Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	IT	CSD2258	**Lab**.:Design and Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
9	4	PC	IT	CSD2259	Software Lab-II	**P**	0	0	4	4	2		60	40	
					TOTAL FOURTH SEM		**15**	**1**	**10**	**26**	**21**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

List of Audit Course

1	3	HS		GE2121	Environmental studies	**T**	2	0	0	2	0	
2	3	HS		AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0	
3	4	HS		AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE, IIoT, AIML, CSD, AIDS	**A**	3	0	0	3	0	

		June 2022	**1.01**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

Computer Science and Design

SoE No. CSD-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE
							L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester															
1	5	HS	IT	CSD2301	Cyber Laws & Professional Ethics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	IT	CSD2302	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	IT	CSD2303	**Lab:** Database Management Systems	**P**	0	0	2	2	1		60	40	
4	5	PC	IT	CSD2304	Principles of Compiler Design	**T**	3	0	0	3	3	30	20	50	3 Hours
5	5	PC	IT	CSD2305	**Lab.:**Principles of Compiler Design	**P**	0	0	2	2	1		60	40	
6	5	PE	IT		**Professional Elective-1**	**T**	3	0	0	3	3	30	20	50	3 Hours
7	5	PE	IT		**Lab : Professional Elective-1**	**P**	0	0	2	2	1		60	40	
8	5	OE	IT		**Open Elective - 1**	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5	OE	IT		**Open Elective - 2**	**T**	3	0	0	3	3	30	20	50	3 Hours
10	5	STR	IT	CSD2306	Seminar	**P**	0	0	2	2	1		100		
					TOTAL FIFTH SEM		**18**	**0**	**8**	**26**	**22**				
Professional Elective 1															
1	5	**PE1**	IT	CSD2310	Digital Image Processing										
	5	**PE1**	IT	CSD2311	**Lab:** Digital Image Processing										
2	5	**PE1**	IT	CSD2312	Machine Learning										
	5	**PE1**	IT	CSD2313	**Lab:** Machine Learning										
3	5	**PE1**	IT	CSD2314	Data Visualization										
	5	**PE1**	IT	CSD2315	**Lab:** Data Visualization										
4	5	**PE1**	IT	CSD2316	Computer Graphics										
	5	**PE1**	IT	CSD2317	**Lab:** Computer Graphics										
5	5	**PE1**	IT	CSD2318	Internet of Things										
	5	**PE1**	IT	CSD2319	**Lab**: Internet of Things										
Open Elective 1 & 2															
1	5	**OE1**	IT	CSD2331	Computer Graphics										
2	5	**OE1**	IT	CSD2332	Multimedia Design										
3	5	**OE2**	IT	CSD2341	Advanced Web Designing										
4	5	**OE2**	IT	CSD2342	Virtual Reality										

Audit Courses															
1	5	HS		AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE, IIoT, AIDS, CSD, AIML	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.01**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

Computer Science and Design

SoE No. CSD-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE
							L	T	P	Hrs		MSEs*	TA**	ESE	
Six Semester															
1	6	HS	IT	CSD2351	Management Studies	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	IT	CSD2352	Software Architecture & Design	**T**	3	0	0	3	3	30	20	50	3 Hours
4	6	PC	IT	CSD2353	Computer Game Design and Programming	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PC	IT	CSD2354	Lab: Computer Game Design and Programming	**P**	0	0	2	2	1		60	40	
6	6	PE2	IT		**Professional Elective-II**	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PE2	IT		**Professional Elective-II Lab**	**P**	0	0	2	2	1		60	40	
8	6	STR	IT	CSD2355	Design Workshop	**P**	0	0	4	4	2		60	40	
9	6	OE3	IT		**Open Elective-III**	**T**	3	0	0	3	3	30	20	50	3 Hours
10	6	OE4	IT		**Open Elective-IV**	**T**	3	0	0	3	3	30	20	50	3 Hours
					TOTAL SIX SEM		**18**	**0**	**8**	**26**	**22**				

Professional Elective 2					
1	6	**PE2**	IT	CSD2361	Multimedia Design & Processing
	6	**PE2**	IT	CSD2362	**Lab:** Multimedia Design & Processing
2	6	**PE2**	IT	CSD2363	Advanced Web Designing
	6	**PE2**	IT	CSD2364	**Lab**: Advanced Web Designing
3	6	**PE2**	IT	CSD2365	Design Manufacturing and Assembly
	6	**PE2**	IT	CSD2366	**Lab.:** Design Manufacturing and Assembly
4	6	**PE2**	IT	CSD2367	UX &UI Design
	6	**PE2**	IT	CSD2368	**Lab.** UX &UI Design
5	6	**PE2**	IT	CSD2369	Introduction to Deep Learning
	6	**PE2**	IT	CSD2370	**Lab.:** Introduction to Deep Learning
Open Elective -III					
1	6	**OE3**	IT	CSD2381	Computer Graphics
2	6	**OE3**	IT	CSD2382	Multimedia Design
Open Elective- IV					
3	6	**OE4**	IT	CSD2391	Advanced Web Designing
4	6	**OE4**	IT	CSD2392	Virtual Reality

Audit Courses												
1	6	HS		AU2130	YCCE Communication Aptitude Preparation (YCAP6.3) for CT, IT, CSE, IIoT, AIDS, CSD, AIML	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

1st Semester

(Department of Information Technology)

Computer Science and Design

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

Computer Science and Design

SoE No. CSD-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE
							L	T	P	Hrs		MSEs*	TA**	ESE	
First Semester															
1	1	BS	GE	CSD2101	Calculus, Sequences and Series	T	3	0	0	3	3	30	20	50	3 Hours
2	1	BS	GE	CSD2102	Applied Physics	T	3	0	0	3	3	30	20	50	3 Hours
3	1	BS	GE	CSD2103	Lab.: Applied Physics	P	0	0	2	2	1		60	40	
4	1	HS	GE	CSD2104	Constitution of India	T	3	0	0	3	3	30	20	50	3 Hours
5	1	BES	CV	CSD2105	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3 Hours
6	1	BES	CV	CSD2106	Lab.:Engineering Mechanics	P	0	0	2	2	1		60	40	
7	1	BES	IT	CSD2107	Introduction to Computer Programming	T	3	0	0	3	3	30	20	50	3 Hours
8	1	BES	IT	CSD2108	Lab.: Introduction to Computer Programming	P	0	0	2	2	1		60	40	
					TOTAL FIRST SEM		**15**	**0**	**6**	**21**	**18**				
List of Audit Course															
1	1	HS	GE	GE2131	Universal Human Value	**T**	2	0	0	0	0				
2	1	HS	GE	AU2121	YCCE Communication Aptitude Preparation (YCAP1)	**A**	3	0	0	3	0				
3	2	HS	GE	AU2122	YCCE Communication Aptitude Preparation (YCAP2)	**A**	3	0	0	3	0				
Second Semester															
1	2	BS	GE	CSD2151	Probability & Statistics	T	3	0	0	3	3	30	20	50	3 Hours
2	2	BS	GE	CSD2152	Applied Chemistry	T	3	0	0	3	3	30	20	50	3 Hours
3	2	BS	GE	CSD2153	Lab: Applied Chemistry	p	0	0	2	2	1		60	40	
4	2	HS	GE	CSD2154	Technical Communication	T	3	0	0	3	3	30	20	50	3 Hours
5	2	HS	GE	CSD2155	Lab:Technical Communication	P	0	0	2	2	1		60	40	
6	2	BES	EE	CSD2156	Digital Circuit Design	T	3	0	0	3	3	30	20	50	3 Hours
7	2	BES	EE	CSD2157	Lab.:Digital Circuit Design	P	0	0	2	2	1		60	40	
8	2	BES	EL	CSD2158	Basic Electrical Machines	T	3	0	0	3	3	30	20	50	3 Hours
9	2	BES	EL	CSD2159	Lab:Basic Electrical Machines	P	0	0	2	2	1		60	40	
10	2	BES	ME	CSD2160	Lab.: Engineering Design	P	0	0	4	4	2		60	40	
					TOTAL SECOND SEM		**15**	**0**	**12**	**27**	**21**				

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TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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Applicable for AY 2022-23 Onwards

I Semester
CSD2101: Calculus, Sequences and Series

Objective	Course Outcome
1. To give basic knowledge of sequence and Series. 2. To explain the differential calculus and its applications. 3. To extend the concept of integration to double and triple integrals. 4. To teach various methods for solving higher order differential equations and its applications.	Students will be able to 1. Apply the knowledge of differentiation, sequence and series to solve engineering problems. 2. Determine the expansion and derivatives of functions of several variables and use it to find extreme values of functions. 3. Evaluate the improper integrals, multiple integrals and apply it to compute the area and volume of various structures. 4. Solve higher order differential equations and its applications.

Unit No.	Contents	Max. Hrs.
1	**Sequence and Series** Sequence, types of sequence, test of convergence of sequences, Cauchy sequence, infinite series, power series, Alternating series, tests of convergence and absolute convergence of series.	6
2	**Ordinary Differentiation** Successive differentiation; Leibnitz theorem, Taylor"s and Maclaurin"s series for functions of single variable and its applications.	7
3	**Partial Differentiation** First and higher order derivatives of Functions of several variables, Euler"s theorem, Chain Rule, Jacobians, Maxima and minima and saddle point of functions of two variables.	7
4	**Curve Tracing and Improper Integrals** Tracing of curves, Beta, Gamma functions and its applications.	6
5	**Multiple integrals** Elementary double integrals, Change of variables (simple transformations), Coordinate Transformation, Change of order of integration (Cartesian and polar), Elementary triple integrals and Applications to find area, volume.	7
6	**Differential Equations** Higher order differential equations with constant coefficients. Cauchy"s and Legendre"s homogeneous differential equations, Applications of differential equations	6

Text Books

1. Advance Engineering Mathematics by Erwin Kreyzig,John Wiley and Sons,INC.
2. Engineering Mathematics - by H.K. Dass, 11th revised edition, 2003, S.Chand, Delhi.
3. Advanced Engineering Mathematics - by H.K. Dass, 8th Ed, 2007, S.Chand, Delhi.
4. Engineering Mathematics by Dr. B.S. Grewal
5. Applied Mathematics by P.N.Wartikar and J.N.Wartikar,,Pune Vidyarthi Griha Prakashan, Pune

I Semester
CSD2101: Calculus, Sequences and Series

Reference Books

1. G B Thomas and R L Finney: Calculus and Analytical Geometry, 9th ed, Addison-Wesley, 1999.
2. Calculus-by Michael Spivak and Tom Apostol (Vols I and II)
3. N.P. Bali and Manish Goyal, A text book ofEngineering Mathematics, LaxmiPrakashan, Reprint 2008.

I Semester

CSD2102: Applied Physics

Course Objective :

1.	Enable the students to comprehend the basics of the latest advancements in Physics viz., Quantum Physics, Crystal structure, semiconductor, lasers, optical fibres and electronic display.
2.	To provide problem solving experience in theory and laboratory in Quantum Physics, Crystal structure, semiconductor, lasers, optical fibre and electronic display.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Co-relate fundamentals of quantum mechanics to solve problems dealing with quantum particle.
CO 2	Analyze crystal structures in terms of lattice parameters with identification of crystal planes.
CO 3	Assess the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands.
CO 4	Illustrate working principle of lasers and optical fibres for their use in the field of industry.
CO 5	Analyze the motion in electric field and magnetic field and its applications to electron optic devices.

CO – PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2												
CO 2	2	2												
CO 3	2	2												
CO 4	3	3												
CO 5	3	3												

Unit No.	Contents	Max. Hrs.
1	**QUANTUM PHYSICS** Wave-particle duality, Wave packet, Heisenberg uncertainty principle, Interpretation of wave function, Schrodinger Equations, Particle in infinite and finite potential well, quantum tunneling, Introduction to Bits and Qubits.	7
2	**CRYSTALLOGRAPHY** Introduction, Unit cell characteristics: SC, BCC and FCC unit cells, Crystal planes andMiller indices, Bragg's law, Voids: Tetrahedral and octahedral.	6
3	**BAND THEORY OF SOLIDS** Formation of energy bands in solids, Classification and energy band diagrams,	7

	Structure of semiconductor with band diagram, Intrinsic and extrinsic semiconductors,Law of mass action, Carrier transport, conductivity, Hall Effect.	
4	**LASERS** Interaction of radiation with matter, Population Inversion and Optical resonance cavity, Three and four level laser, Ruby laser, He-Ne laser, diode laser, Properties and engineering applications of laser	7
5	**FUNDAMENTALS OF FIBRE OPTICS** Principle, structure and classification, Acceptance angle, Numerical aperture, Lossesin optical fibres, Applications as sensor.	6
6	**ELECTRON BALLISTICS AND OPTICS** Motion of a charged particle in uniform electric and magnetic field, Cross field configuration; Electron refraction, Electron lens, CRO.	7

Text Books:

SN	Title	Edition	Authors	Publisher
1	A Textbook of Engg. Physics	Revised	M.N.Avadhanulu , P.G.Kshirsagar	S.Chand and Company
2	Electronic Engineering Materials and Devices	TMH edition, 10th reprint	John Allision	Tata McGraw Hill

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Fundamentals of Physics	10^{th}	David Halliday, Robert Resnick and Jerle Walker,John-Wiley India	**John Wiley & Sons Inc**
2	Text Book of Optics	Revised	Brijlal and Subramanyam	S. Chand and Company
3	Laser	2^{nd}	M. N. Avadhanulu	S. Chand and Company
4	Concept of Modern Physics	6^{th}	A.Beiser	Tata McGraw-Hill
5	LASERS: Theory and Applications.	2^{nd}	Thyagarajan K and GhatakA.K	Macmillan Publication
6	Solid state Physics	9^{th}	S.O.Pillai	New Edge International Publishers
7	Solid State Physics	8^{th}	Palanisamy	SciTech Publishers
8	Solid State Physics	8^{th}	C. Kittel	Willey Publication
9	Engineering Physics	1^{st}	B.K.Pandey,S.Chaturvedi	Cengage Learning
10	Engineering Physics	2^{nd}	H. K. Malik, A. K. Singh	Tata McGraw-Hill

I Semester
CSD2103 : Lab. Applied Physics

Expt.No.	Course Outcomes	Statement of Course outcomes Students are able to
5	CO 2	Analyze crystal structures in terms of lattice parameters with identification of crystal planes.
1,3,4,8,11	CO 3	Assess the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands.
7,9,10,12	CO 4	Illustrate working principle of lasers and optical fibres for their use in the field of industry.
2,6	CO 5	Analyze the motion in electric field and magnetic field and its applications to electron optic devices.

Lab Experiment List:

Expt. No	Name of Experiment	CO	PO
1	Determination of Hall coefficient and density of charge carriers using Hall effect.	CO3	PO1,PO2
2	Determination of amplitude and frequency of sinusoidal signal using C.R.O.	CO 5	PO1,PO2
3	The study of V-I characteristics of a semiconductor diode (germanium and silicon) in forward and reverse bias mode.	CO 3	PO1,PO2
4	Determination of Band gap in a semiconductor by four probe method.	CO 3	PO1,PO2
5	A study of cubic space lattices and atomic packing in solids.	CO 2	PO1,PO2
6	To measure the phase shift introduced by a phase shift network using Dual beam CRO.	CO 5	PO1,PO2
7	Determination of wavelength of laser using diffraction grating.	CO 4	PO1,PO2
8	Determination of Band gap in a semiconductor using reverse biased p-n diode .	CO 3	PO1,PO2
9	Determination of divergence of laser beam.	CO 4	PO1,PO2
10	Determination of Acceptance angle and numerical aperture of a given optical fiber	CO 4	PO1,PO2
11	Dependence of Hall coefficient on temperature.	CO 3	PO1,PO2
12	Determination of attenuation of a given optical fibre.	CO 4	PO1,PO2
Demonstration Experiment			
13	Determination of the velocity of Ultrasonic waves in a non –electrolytic liquid by ultrasonic interferometer		

I Semester
CSD2104 – Constitution of India

Objective	Course Outcome
1. To enable the student understand the importance of constitution 2. To understand the structure of executive, legislature and judiciary 3. To analyze federalism in the Indian context 4. To understand philosophy of fundamental rights and duties 5. To understand and evaluate the Indian Political scenario of the emerging challenges.	1. Explain the basic concepts of Constitution of India. 2. Describe the various Fundamental rights 3. Analyze the Impact of federalism on the State 4. Explain Industrial Law and Judiciary.

Unit	Contents	Hrs
1	**Origin and Meaning** Origin of history of Constitution, Meaning of the constitution law and constitutionalism, Kingship and Republic States in Ancient India	6
2	**Concept of the Constitution of India** Preamble, The union and its territory, Citizenship	6
3	**Federalism** Salient features of Federalism, Structures and features of Indian Federalism, Panchayat Raj System	6
4	**Fundamental Rights** Scheme of the Fundamental rights, duties, Scheme of the Fundamental Right to Equality, The scheme of the Fundamental Duties and its legal status	7
5	**Legislative Power** Federal structure and distribution of legislative, Financial power between the Union and the States, Parliamentary Form of Government in India – The constitution power and status of the President of India	7
6	**Challenges to Indian Political Systems** The Executive, Directive principles of State Policy, The Union Judiciary	7

Text Books :

1. Dr G.N. Nimbarte, (2018) "Social Science" Sankalp Publication, Vidhya Nagar, Nagpur

Reference Books :

1. G. Austin (2004) Working of a Democratic Constitution of India, New Delhi: Oxford University Press.

2. A.S. Altekar, (2016) State and Government in Ancient India, Motilal Banarsidass Publishing House, New Delhi.

3. Basu, D.D (2005), An Introduction to the Constitution of India, New Delhi, Prentice Hall.

4. A. Vanaik and R. Bharghava (eds) (2010) Understanding Contemporary India: Critical Perspectives, New Delhi: Orient Blackswan.

5. A.G. Noorani (2000): Constitution questions in India: The President, Parliament and the Status, New Delhi: Oxford University Press.

6. Singh, M.P & Saxena, R (2008) Indian Politics: Contemporary Issues and Concerns. New Delhi: PHI Learning.

7. Constitution of India: Dr. B. R. Ambedkar: Government of India.

I Semester
CSD2105: Engineering Mechanics

Course Objective	Course Outcomes
1. To make student aware about fundamental concept of static and dynamics 2. To introduce the basic concepts of planar force system 3. To understand the properties of surface, moment of inertia and mass moment of inertia 4. To learn the dynamics variables applied to kinetics of particles.	1 **Describe** the fundamental concepts of statics and dynamics. 2 **Apply** the basic concepts of applied mechanics for solution of problems on planar force system with and without friction. 3 **Determine** the properties of surface like centroid, moment of inertia, etc. for planar surfaces and mass moment of inertia for rigid body. 4 **Analyze** the dynamic variables of kinetics of particles and simple lifting machine.
Mapped POs :- 1,2,12	

Unit I: Resultant of Plane Force System
Resultant: Fundamental concepts, system of forces, laws of mechanics, principle of transmissibility of forces, Resolution and Resultant of a 2-Dimensional force system, Moment of force, Principle of moment, Couple, Equivalent force couple system.

Unit II: Equilibrium of Plane Force System and Friction

Equilibrium: Free body diagrams, Conditions of equilibrium, types of supports, types of beams, types of loads, Application to 2D force system.
Friction: Plane friction, belt friction

Unit III: Resultant of special Force System

Resultant: Resultant of a 3-Dimensional force system, Moment of force, Principle of moment, Wrench.
Equilibrium: Conditions of equilibrium, Application of equilibrium to 3D force system.

Unit IV: Properties of Surfaces
Centroid: Introduction, First Moment of Area, Problem on Centroid of composite sections.
Area Moment of Inertia: Introduction, Second Moment of Area, Radius of Gyration, Transfer Theorem, Product of Inertia, Moment of Inertia and Product of Inertia with respect to inclined axes, Principal Moments of Inertia.

Unit V: Virtual Work Method and Kinetics of Particle
Virtual Work Method: Introduction, Principle of virtual work, Application to beam and frame.
Kinetics of Particle: D‟ Alembert‟s principle, Translation of bodies and interconnected particles.

Unit VI: Work Energy and Impulse Momentum Method
Work Energy Method: Introduction, Conservation of energy and problems on connected bodies.
Impulse Momentum Method: Definitions, Principle of conservation of momentum, elastic impact of two bodies, coefficient of restitution, application of impulse momentum method.

I Semester
CSD2105: Engineering Mechanics

Textbooks:

1. Beer F.P. and Johnston E.R; Vector Mechanics for Engineers, 9th edition Tata McGraw Hill Publication, New Delhi. 2007
2. Nelson A., Engineering Mechanics (Statics and Dynamics), ed 2009, Tata Mc-Grew Hill Education Pvt. Ltd., New Delhi, 2009
3. Dubey N.H., Engineering Mechanics (Statics and Dynamics) first edition 2013, Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, 2013

Reference Books:

1. Timoshenko S, Young D.H and Rao J.V, Engineering Mechanics, McGraw Hill Publication, New Delhi, 2007
2. Bhattacharyya B., Engineering Mechanics, Oxford University Press, New Delhi, 2008
3. Hibbeler R.C, Engineering Mechanics (Statics and Dynamics), Pearson Publication, Singapore, 2000
4. Shames I.H. and Rao J.V., Engineering Mechanics (Statics and Dynamics), First Edition, Pearson Publication, New Delhi, 2003
5. Singer F.L, Engineering Mechanics (Statics and Dynamics), Harper and Rowe publication, New Delhi, 1994.
6. http://nptel.ac.in/courses

I Semester
CSD2106: LAB.: Engineering Mechanics

SN	Minimum Ten Practical's to be performed from the list as below
1	To determine support reactions of a Simply Supported Beam experimentally and analytically.
2	To determine the forces in the members of a Jib Crane Apparatus experimentally and graphically.
3	To determine the coefficient of friction between two surfaces of different material on Plane Friction Apparatus.
4	To determine the coefficient of friction of Coil Friction Apparatus.
5	To determine the forces in members of a Shear Leg Apparatus experimentally and manually.
6	To determine the mass moment of inertia of a fly wheel using Fly Wheel Apparatus
7	To determine efficiency and law of machine of Differential Axel & Wheel machine.
8	To determine efficiency and Law of machine of Single Purchase Crab machine.
9	To determine efficiency and Law of machine of Double Purchase Crab machine.
10	To find support reactions of a simply supported beam using graphical method and hand calculation.
11	To find the forces in the member of truss using graphical method and hand calculation.
12.	To find for a composite figure by using Mohr"s circle and hand calculation, (1) Principle moment of inertia (2) Moment of inertia and product of inertia about any inclined axis.

Reference Books:-

1) Nelson A., Engineering Mechanics (Statics and Dynamics), ed 2009, Tata Mc-Graw Hill Education Pvt Ltd, New Delhi, 2009
2) Dubey N.H., Engineering Mechanics (Statics and Dynamics) first edition 2013, Tata Mc-Graw Hill Education Pvt Ltd, New Delhi, 2013
3) Beer F.P. and Johnston E.R; Vector Mechanics for Engineers, 9th edition Tata Mc-Graw Hill Publication, New Delhi. 2007

I Semester
CSD2107 : Introduction to Computer Programming

Course Objective	Course Outcomes
• To impart fundamental knowledge of computer • To provide problem solving experience through C Programming.	• Understand computer system, basics of algorithm & flowchart, and demonstrate straight line program using basic „C" programming language constructs. • Implement basic Linux commands and simple programs using different constructs in C. • Design & Develop programs using different loop control structures, user defined functions, and Pointers. • Analyze and apply concepts of different dimensional Arrays as a data structure & development of programs using the same. • Design and develop programs using basics of Strings, Structures, union and Files in 'C' language.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3											
CO3	2	2										
CO4		1	2									
CO5	2	2	2									
Average:	**2.5**	**1.67**	**2**									

Unit No.	Contents	Max. Hrs.
1	Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Algorithms & Conventions used in writing algorithms, Flowcharts. Overview of Programming Language, sample „C" code, compiler, operating system, running „C" programs, Types of programming errors.	06
2	Character set, variables, identifiers & keywords, Data types, Operators, Types of operators and expressions, sizeof() operator, constants and its types, Symbolic constant, typedef statement, Introduction to library functions, basic input/output statements, precedence of operators, write straight line programs, Decision control statements: if, if - else and nested if-else statements, else-if ladder statement, switch-case control statement, Programming Examples.	08

I Semester
CSD2107 : Introduction to Computer Programming

Unit No.	Contents	Max. Hrs.
3	Loop Structures: While, do while and for loops, break and continue statement, ‚goto" statement, C programs based on these loop structures.	07
4	Concept of functions, Modular programming, user defined and library functions, function prototypes, formal parameters, actual parameters, return types, function call- call by value, C programs using functions, Recursive functions, comparing recursion against iteration, C programs using recursive functions, Concepts of pointer.	08
5	Introduction to Arrays, One dimensional array, array manipulation, insertion, deletion of an element, searching techniques- Linear and binary search, sorting techniques - Bubble, insertion and selection sort.Two dimensional array: programs for basic matrix operations-addition, multiplication and transpose, converting a matrix in upper or lower triangular matrix, Array as function arguments.	09
6	Introduction to strings, string handling functions. Introduction to structures and Union. Concepts of files, Types of files, file opening in various modes, file closing, reading and writing text files, concept of pre-processor directives and macros, Command line Argument.	06

Textbooks:

T1: The C Programming Language.	J.B.W.Kernighan & D.M.Ritchie	Prentice Hall
T2: Mastering C	K.R.Venugopal & S.R. Prasad	TMH,2007.

Reference Book

R1:Problem Solving And Program Design In C	Jeri. R. Hanly, Elliot B. Koffman	Pearson Education
R2: Programming with C	Byron Gottfried	Schaum;s Outline Series
R3: How to solve it by computers	R. G. Dromey	Prentice Hall India

I Semester
CSD2108 : Lab - Introduction to Computer Programming

Course Objective	Course Outcomes
• To impart fundamental knowledge of computer • To provide problem solving experience through C Programming.	• Understand computer system, basics of algorithm & flowchart, and demonstrate straight line program using basic „C" programming language constructs. • Implement basic Linux commands and simple programs using different constructs in C. • Design & Develop programs using different loop control structures, user defined functions, and Pointers. • Analyze and apply concepts of different dimensional Arrays as a data structure & development of programs using the same. • Design and develop programs using basics of Strings, Structures, union and Files in 'C' language.

CO - PO Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3											
CO3	2	2										
CO4		1	2									
CO5	2	2	2									
Average:	**2.5**	**1.67**	**2**									

List of Practical

SN	Unit	Name Of The Practical	Remark	CO'S Mapped	PO'S Mapped
1(A)		Introduction to Linux Operating system & it"s different commands.	**Manual**	**CO 1**	**PO 1**
1(B)		Introduction to Vi editor, Compilation and Execution of a program in Linux.	**Manual**	**CO 1**	**PO 1**
1(C)		Introduction to Turbo C, Compilation and Execution of a program on Turbo C.	**Manual**	**CO 1**	**PO 1**
2	**II**	A) Write a program in c accept radius us input from keyboard and display the area and circumference of circle	**Arithmetic Operators**	**CO 2**	**PO 1, PO 2**
	II	B) Write C program using conditional operators to display maximum number if any three number are inputted	**Conditional Operator**		

I Semester
CSD2108 : Lab Introduction to Computer Programming

SN	Unit	Name Of The Practical	Remark	CO'S Mapped	PO'S Mapped
3	II	A) Write a program which accept any character as input and check whether entered character is vowel or not.	**Simple if**	**CO 2**	**PO 1, PO 2**
	II	B) Write a program which accepts any year as input and check whether entered year is leap year or not and display the appropriate message.	**Nested if**		
	II	c) Write a C program to input electricity unit charge and calculate the total electricity bill according to the given condition: For first 50 units Rs. 3.50/unit For next 100 units Rs. 4.00/unit For next 100 units Rs. 5.20/unit For unit above 250 Rs. 6.50/unit An additional surcharge of 20% is added to the bill.	**Ladder if**		
4	II	Write a Menu Driven C program using Switch Case to perform the following operations on a four digit positive integer number entered by the user. 1. To display the number in reverse order. 2. To display sum of the digits of the number. 3. To display a number by adding one in each digit. 4. Exit.	**Switch Case**	**CO 2**	**PO 1, PO 2**
5	III	Write a C program to input any number and find the how many digits and also find the factorial of highest digit.	**For / While Loop**	**CO 3**	**PO 2, PO 3**
6	III	Write a C program to display sum of the following series. Sum $=1+\frac{x^1}{1!}+\frac{x^2}{2!}+\frac{x^3}{3!}+\ldots\ldots\ldots+\frac{x^n}{n!}$	**Do While Loop**	**CO 3**	**PO 2, PO 3**
7	III	Write a C program to print following pyramid. * * * * * * * * * *	**Nested For Loop**	**CO 3**	**PO 2, PO 3**
8	IV	A) Write a function which accepts a number a Check Whether a Number is Prime or not, your function returns 1 if a number is a prime number, otherwise 0.	**Functions**	**CO 4**	**PO 1, PO 2, PO 3**
	IV	B) C Program to Find Factorial of a Number Using Recursion.	**Recursion**	**CO 4**	**PO 1, PO 2, PO 3**
9	V	Write a C program to sort an array of integers using Bubble Sort.	**1D Array**	**CO 5**	**PO 1, PO 2, PO 3**

I Semester
CSD2108 : Lab Introduction to Computer Programming

SN	Unit	Name Of The Practical	Remark	CO'S Mapped	PO'S Mapped
10	V	Write a C program to print the transpose of matrix.	2D Array	CO 5	PO 1, PO 2, PO 3
11	V	A)Write a program in C to find the length of a string without using library function	Strings	CO 5	PO 1, PO 2, PO 3
12	VI	Define a structure called cricket that will describe the following information: player name,team name, batting average. Using cricket,declare an array player with 5 elements and write a program to read the information about all the 5 players and print a team-wise list containing names of player with their batting average.	Structures	CO 6	PO 2, PO 3
13	VI	Write a C program to Copy one file to another file in C	Files	CO 6	PO 2, PO 3

I Semester
GE2131- Universal Human Values (Audit Course)

COURSE OBJECTIVE:	COURSE OUTCOMES
This introductory course input is intended ➢ To help the students appreciate 'VALUES' and 'SKILLS' ➢ To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity ➢ To highlight plausible implications of Holistic understanding in terms of ethical human conduct.	**On completion of this course, students will be able to** ➢ Experiential validation through the way to verify right or wrong. ➢ Practice living in harmony with natural acceptance ➢ Understand the importance of relationships.

Unit No.	Contents	Max. Hrs.
1	**Course Introduction** **Need, Basic Guidelines, Content and Process for Value Education** ➢ Understanding the need, basic guidelines, content and process for Value Education ➢ Self Exploration–what is it? - its content and process; „Natural Acceptance" and Experiential Validation- as the mechanism for self-exploration ➢ Continuous Happiness and Prosperity- A look at basic Human Aspirations	6
2	**Understanding Harmony in the Human Being - Harmony in Myself!** ➢ Understanding human being as a co-existence of the sentient „I" and the material „Body" ➢ Understanding the needs of Self („I") and „Body" ➢ Understanding the Body as an instrument of „I" (I being the doer, seer and enjoyer) ➢ Understanding the characteristics and activities of „I" and harmony in „I"	6
3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** ➢ Understanding Harmony in the family – the basic unit of human interaction ➢ Understanding values in human-human relationship; meaning of Nyaya and program for its fulfilment to ensure Ubhay-tript; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship ➢ Understanding the meaning of Vishwas; Difference between intention and competence ➢ Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship ➢ Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sahasttva as comprehensive Human Goals	5

	➢ Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! ➢ Practice Exercises and Case Studies will be taken up in Practice Sessions	
4	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence** ➢ Understanding the harmony in the Nature ➢ Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation in nature ➢ Understanding Existence as Co-existence (Sah-asttva) of mutually interacting units in all-pervasive space ➢ Holistic perception of harmony at all levels of existence ➢ Practice Exercises and Case Studies will be taken up in Practice Session	6

Text Books :

The primary resource material for teaching this course consists of

a. The text book R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

Reference Books :

The teacher's manual
R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi, 2010.

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

2nd Semester

(Department of Information Technology)

Computer Science and Design

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

Computer Science and Design

SoE No. CSD-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE
							L	T	P	Hrs		MSEs*	TA**	ESE	
First Semester															
1	1	BS	GE	CSD2101	Calculus, Sequences and Series	T	3	0	0	3	3	30	20	50	3 Hours
2	1	BS	GE	CSD2102	Applied Physics	T	3	0	0	3	3	30	20	50	3 Hours
3	1	BS	GE	CSD2103	Lab.: Applied Physics	P	0	0	2	2	1		60	40	
4	1	HS	GE	CSD2104	Constitution of India	T	3	0	0	3	3	30	20	50	3 Hours
5	1	BES	CV	CSD2105	Engineering Mechanics	T	3	0	0	3	3	30	20	50	3 Hours
6	1	BES	CV	CSD2106	Lab.:Engineering Mechanics	P	0	0	2	2	1		60	40	
7	1	BES	IT	CSD2107	Introduction to Computer Programming	T	3	0	0	3	3	30	20	50	3 Hours
8	1	BES	IT	CSD2108	Lab.: Introduction to Computer Programming	P	0	0	2	2	1		60	40	
					TOTAL FIRST SEM		**15**	**0**	**6**	**21**	**18**				
List of Audit Course															
1	1	HS	GE	GE2131	Universal Human Value	**T**	2	0	0	0	0				
2	1	HS	GE	AU2121	YCCE Communication Aptitude Preparation (YCAP1)	**A**	3	0	0	3	0				
3	2	HS	GE	AU2122	YCCE Communication Aptitude Preparation (YCAP2)	**A**	3	0	0	3	0				
Second Semester															
1	2	BS	GE	CSD2151	Probability & Statistics	T	3	0	0	3	3	30	20	50	3 Hours
2	2	BS	GE	CSD2152	Applied Chemistry	T	3	0	0	3	3	30	20	50	3 Hours
3	2	BS	GE	CSD2153	Lab: Applied Chemistry	p	0	0	2	2	1		60	40	
4	2	HS	GE	CSD2154	Technical Communication	T	3	0	0	3	3	30	20	50	3 Hours
5	2	HS	GE	CSD2155	Lab:Technical Communication	P	0	0	2	2	1		60	40	
6	2	BES	EE	CSD2156	Digital Circuit Design	T	3	0	0	3	3	30	20	50	3 Hours
7	2	BES	EE	CSD2157	Lab.:Digital Circuit Design	P	0	0	2	2	1		60	40	
8	2	BES	EL	CSD2158	Basic Electrical Machines	T	3	0	0	3	3	30	20	50	3 Hours
9	2	BES	EL	CSD2159	Lab:Basic Electrical Machines	P	0	0	2	2	1		60	40	
10	2	BES	ME	CSD2160	Lab.: Engineering Design	P	0	0	4	4	2		60	40	
					TOTAL SECOND SEM		**15**	**0**	**12**	**27**	**21**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.01**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

II Semester

CSD2151 – Probability & Statistics

Objective	Course Outcome
1. This course provides an indication of the relevance and important of the probability theory in solving practical problems in the field of multidisciplinary engineering applications. 2. To provide undergraduate foundation in both probability distributions and mathematical statistics relevant to engineering problems. 3. To teach mathematical skill sustained from this course to form a suitable base for analytical and theoretical concept encountered in engineering profession.	Students will be able to 1. Identify an appropriate probability distribution for a given discrete or continuous random variable and compute probabilities. 2. Make use of probability distributions to solve real life problems. 3. Apply concepts of sampling theory to find probabilities and estimates parameters of various problems. 4. Inspect scientific data, use proper curve fitting and find correlation, regression of variables.

Unit No.	Contents	Max. Hrs.
1	**Random Variables & Probability Distributions** Conditional probability, Baye's theorem. Random variables: Discrete and Continuous random variables, Probability function and Distribution function, Joint distributions. Independent Random variables, Conditional Distribution.	7
2	**Mathematical Expectation** Mathematical Expectation, Variance & Standard Deviation, Moments, Moment generating function, Skewness and Kurtosis.	7
3	**Special Probability Distributions** Binomial, Geometric, Poisson, Exponential, Normal distributions, Central Limit theorem.	6
4	**Sampling Theory** Population and sample. Statistical inference. Sampling with and without replacement. Population parameters, sample statistics. Sampling distribution of means. Sampling distribution of proportions.	6
5	**Estimation** Unbiased and efficient estimates. Point estimates and interval estimates. Confidence interval for means, Confidence interval for proportions, Confidence interval for differences and sums of mean and proportions.	7
6	**Curve Fitting** Fitting of straight line, $y = a + bx$, a parabola $y = a + bx + cx^2$, exponential curves and power curves by method of least squares; Lines of regression and correlation; Rank correlation.	6

Text Books

1. Advanced Engineering Mathematics - by H.K. Dass, 8th Ed, 2007, S.Chand, Delhi.
2. Engineering Mathematics by Dr. B.S. Grewal
3. The theory and problems of probability and Statistics: M. R. Spiegel, Schaum series. (McGraw Hill)
4. Basic Statistics for Business and economics by E. K.Bowen, M. K.Star (McGraw Hill)

Reference Books

1. A First course in probability by Sheldon Ross, Sixth Edition, Pearson Education.
2. Fundamentals of Mathematical statistics by S. C.Gupta and V.K.Kapoor.
3. Probability and Statistics for Engineering 6th edition, Miller Freund and Johnson.
4. Higher Engineering Mathematics, Dr. V. Ramana , Tata McGraw Hill.

II Semester
CSD2152 – Applied Chemistry

Objective	Course Outcome
• To impart intensive and extensive knowledge of the subject enriching students to understand the roleof Chemistry in the field of engineering. • To keep students abreast with the latest developments and applications of modern materials. • To gain basic principles, instrumentation and applications of analytical techniques.	(1) Interpret different thermodynamic functions. (L2) (2) Describe basic concepts of electrochemistry and apply the knowledge for energy storage devices. (L3) (3) Illustrate chemical reaction rate. (L3) (4) Classify advanced engineering materials in technological applications. (L2) (5) Develop analytical and instrumental skills. (L3)

Unit No.	Contents	Max. Hrs.
1	**Energetics**: Introduction, Internal energy, enthalpy, Gibb's free energy, Free energy change and chemical equilibrium. Spontaneous and non-spontaneous processes. I and II law of thermodynamics. Entropy and its significance. Numericals on Internal energy and enthalpy change. Thermodynamic applications to physical and chemical equilibrium.	07
2	**Electrochemistry**: Introduction, metallic and electrolytic conductance, resistance, specific resistance, conductance, specific conductance, equivalent and molar conductance. Variation of conductance with dilution. Electrode and electrode potentials. Nernst Equation. Faraday's laws and Numericals. Industrial applications: Electroforming, Electrowinning, Electrolytic refining.	06
3	**Energy Storage Devices** **Basic concepts**: Primary and secondary battery. Energy density, power density, energy efficiency, cycle life, shelf life. Secondary battery: Ni-metal hydride battery, Lithium-ion battery. **\H_2-O_2 Fuel cell**: Principle, working, advantages, disadvantages, applications. Differences between battery and a fuel cell. **Supercapacitors**: Definition, types, characteristics and application.	06
4	**Chemical Kinetics** : Introduction, Rate of reaction and factors influencing rate of reaction, order & molecularity of reaction. Kinetic equations of different orders: Zero Order, First Order, Second Order and numericals.	06

Unit No.	Contents	Max. Hrs.
5	**Polymeric Materials :** **Conducting Polymers**: Intrinsic and extrinsic conducting polymers, doping, factors responsible for conduction. Synthesis and applications of conducting polymers like polyacetylene, polyaniline, polypyrrole. **Liquid Crystal Polymers**: Phases of LCP's, general properties and applications. **Biodegradable Polymers –** Synthesis, properties and applications of polylactic acid and polycaprolactone. **Smart materials:** Properties and applications of shape memory alloys, chromoactive, photoactive and magnetorheological materials.	07
6	**Advanced Materials :** **Nanomaterials**: Definition of nanomaterials, nano scale. Carbon Nanotubes and types. **Application of Nanomaterials**: Applications of nanomaterials in medicine, environment, and electronics. Nanotechnology for waste reduction and improved energy efficiency. Threats of Nanomaterials. **Silicon Chips:** Introduction. Physical, chemical, electrical & mechanical properties and applications. **Polymers in electronic industries:** Piezo, pyroelectric**,** Ferroelectric polymers.	07

Text Books:

SN	Title	Edition	Authors	Publisher
1	A Textbook of Engineering Chemistry	Eleventh Edition.	S S. Dara	S.Chand & Co New Delhi
2	Engineering Chemistry	Sixteenth Edition	Jain & Jain;	Dhanpat Rai & sons New Delhi.
3	Physical Chemistry	(Eighth edition-2006).	P. W. Atkins,	Oxford Publications
4	Engineering Chemistry		B.Sivasankar	Tata McGraw-Hill

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Chemistry in Engineering		Lloyd A.Munro	Prentice-hall
2	Applied chemistry for engineers		T.S.Gyngell	
3	Engineering Chemistry		B.K.Sharma Krishna Prakashan media private LTD	
4	Chemistry of Advanced Materials		CNR Rao	RSC Publications
5	Handbook of Semiconductor Silicon Technology	1st Edition.	William C. O'Mara, Robert B. Herring	NOYES PUBLICATIONS I "P I Park Ridge, New Jersey. USA.

Website / Data sheet:

SN	Title
1	Silicon Chips: What are Computer Chips Made Of? https://www.intel.com/content/www/us/en/history/museum-making-silicon.html
2	What is silicon, and why are computer chips made from it? https://www.extremetech.com/extreme/208501-what-is-silicon-and-why-are-computer-chips- made-from-it
3	**1) Wafer processing**https://www.hitachi- hightech.com/global/products/device/semiconductor/ process.html

II Semester
CSD2153 – Lab : Applied Chemistry

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 2	Describe basic concepts of electrochemistry and apply the knowledge for energystorage devices. (L3)
CO4	Classify advanced engineering materials in technological applications. (L2)
CO 5	Develop analytical and instrumental skills. (L3)

Lab Experiment List:

Expt. No	Name of Experiment (Minimum 4 experiments from Group I & II each and Demonstrations on 2 experiments should be conducted)
	Group I:
1	To determine the strength of a given potassium dichromate solution with N/20 sodium thiosulphate solution.
2	Estimation of Nickel by complexometry.
3	Determination of copper by iodometric titration.
4	Estimation of Fe^{2+} ions by redox titration.
5	Estimation of Fe^{3+} ions by spectrophotometric method.
6	Synthesis of urea formaldehyde resin.
	Group II:
7	Preparation of Printed Circuit Board.
8	Determination of molecular weight of a polymer using Ostwald's viscometer.
9	Determination of ion exchange capacity of a cation exchange resin.
10	Proximate analysis of Coal.
11	Determination of thinner contain in oil paint.
12	Electroplating Copper on Stainless steel.
	Demonstration:
13	Determination of Faradays first law.
14	Determination of Faradays second law.
15	Determination of conductivity of water sample by conductivity meter

II Semester
CSD2154 : Technical Communication

Course Objectives	Course Outcome
1. To Explain the fundamentals of communication 2. To Classify the different speech sounds of English 3. To Apply Different components of oral communication 4. To Draft technical documents	Upon completion of the course, students will have the ability to, 1. Apply different modes for effective communication 2. competently use the phonology of English language 3. Apply nuances of LSRW skills 4. Communicate through different channels

Unit No.	Contents	Max. Hrs.
1	**Basics of Communication** Language as a tool of communication & characteristics of language Process of Communication, Levels of Communication, Flow of Communication, Networks of Communication, Classification of Barriers (Intrapersonal, Interpersonal, Organizational).	6
2	**English Phonetics** Speech Mechanism, Organs of speech, Consonant and Vowels sounds, Worde stress rules	6
3	**Interview Skills** Purpose , expectations of employer and preparation for Interview, Types, Types of Questions & Answering Techniques, Telephonic Interviews – preparation and guidelines, Reading Techniques (Exercise based on Complex Unseen passages	5
4	**Oral Skills** Group Communication- (Purpose, Different types of Group Communication, Organizational GD, GD as a part of selection process), Meeting (purposes, preparation, procedure and minutes of meeting), Listening Skills -definition types and traits	6
5	**Presentation & Visual Communication** Presentation and audience analysis, Organizing content, Nuances of presentation, Visual Communication – Introduction & importance, Role & Psychology of color in visual communication.	6
6	**Technical Written Communication** Memo, Email, Report -Types, Characteristics, prewriting aspects of report and preparing writing aspects of report), Types of paragraphs.	6

Text Books :

1. Technical Communication, Raman & Sharma, Oxford University Press
2. Textbook of English Phonetics for Indian Students, T. Balasubramaniam, Macmillan India Ltd

Reference Books :

1. How to Develop Self – Confidence & Influence People by Public Speaking, Dale Carnegie
2. Communication Skills, Asha Kaul
3. Body Language, Allen Peas
4. Gerson's Gerson – Technical Communication

II Semester
CSD2155: Lab. - Technical Communication

Sr. No.	List of Experiment
1	Handson for Consonants and vowel sounds
2	Identifying the pragmatic meaning of the text
3	Mock Sessions for Interview
4	Grooming session for effective use of body language
5	Visual Media – preparing poster boards, advertising product
6	Group Discussion

II Semester
CSD2156 – Digital Circuit Design

Objective	Outcomes
➢ Develop a strong foundation of digital electronics. ➢ Understand concepts of combinational and sequential circuits. ➢ Analyze the synchronous and asynchronous logic circuits.	Students will be able to: 1. Simplify combination logic circuits using Boolean algebra. 2. Understand and demonstrate the various codes and illustrate their addition substraction. 3. Simply and exhibit the methods to solve logical functions using K-map and Quine Mc-Cluskey methods and apply it to implement combinational logic circuits. 4. Design and analyze Synchronous and Asynchronous sequential Circuits.

Unit	Contents	Hrs
1	Number system and codes:Binary: octal, hexadecimal and decimal Number systems and their inter conversion, BCD numbers (8421-2421), gray code, excess–3 code, ASCII codes. Binary addition and subtraction, signed and unsigned binary numbers, 1's and 2's complement representation.	6
2	Boolean Algebra: Basic logic circuits: Logic gates (AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR and their truth tables,), Universal Gates, Laws of Boolean algebra, De-Morgan's theorem.	6
3	Minimization Techniques: Min term, Max term, POS, SOP, K-Map, Simplification by Boolean theorems, don't care condition. Quine Mc-Cluskey method	6
4	Combinational Logic: The Half adder, the full adder, subtractor circuit. Multiplxer de-multiplexer, decorder, BCD to seven segment Decorder, encoders	6
5	Sequential Circuits: Flip flop, set-reset laches, R-S flip-flop, D-flip flop, J-K Flip-flop, Master slave Flip flop, T flip-flop, excitation table of flip-flops.	7
6	Registers & Counters: Synchronous/Asynchronous counter operation, Up/down synchronous counter, application of counter, Serial in/Serial out shift register, Serial in/Serial out shift register, Serial in/parallel out shift register, parallel in/ parallel out shift register, parallel in/Serial out shift register, Bi-directional register.	7

TEXT BOOKS

1. M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
2. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 6thEdition, TMH, 2003.
3. Anandkumar- fundamental of digital circuit. 3rd edition. PHI

Reference Books:

1) Modern Digital Electronics , RP Jain, Tata McGraw Hill, 3rd Edition
2) Fundamentals of Logic Design, C.H.Roth, Public Work & Services, 3rd edition 2007.
3) Engg Approach to Digital Design, Fletcher, Prentice Hall of India 1993.
4) Digital Circuits & Microprocessors, Hebert Taub, Mc Graw Hill, 1988.

II Semester
CSD2157 : Lab.- Digital Circuit Design

Objective	Outcomes
➢ Develop a strong foundation of digital Electronics. ➢ Understand concepts of combinational and sequential circuits. ➢ Design and develop combinational and sequential circuits	Students will be able to: 1. Simplify combination logic circuits using Boolean algebra and exhibit the methods to solve logical functions using K-map and Quine-Mc-Clauskey methods. 2. Understand and apply the concept of combinational logic circuits in various digital systems. 3. Understand and demonstrate the various codes and illustrate concept of logic family with their characteristics. 4. Understand the working of Flip-flops and its use to design Synchronous counters and Design and demonstrate finite state machines.

Expt. No.	Name of Experiments
1.	Introduction to LogicAid software and commands. Verifications of functions using Logic Aid and comparing the results with manual results.
2.	Introduction to Bread Board and Verify Truth Tables of basic Logic gates using Bread Board.
	Virtual Lab: **An Initiative of Ministry of Human Resource Development Under the National Mission on Education through ICT**
3.	Construction of half/ full adder using XOR and NAND gates and verification of its operation.
4.	Verify Binary to Gray and Gray to Binary conversion using NAND gates only.
5.	Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates.
6.	Verify the truth table of RS, JK, T and D flip-flops using NAND & NOR gates.
7	Design and verify the 4- Bit Synchronous/ Asynchronous Counter using JK Flip Flop.
	Using SPICE
8	Introduction to SPICE Digital model and commands. Verify Truth Tables of basic Logic gates & Universal Gates **using SPICE.**
9	Design & verify Truth Table of Half adder & Full adder circuits **using SPICE.**
10	Design & verify Truth Table of 4:1 Multiplexer & 1: 4 Demultiplexer circuits **using SPICE.**

II Semester
CSD2158 : Basic Electrical Machines

Course Objective:

The course objective is to impart knowledge of

- To impart fundamental knowledge of electricalcircuits and machinery.
- To provide problem solving experience and learningof concepts through it in electrical engineering.

Course Outcome: After completion of the course, student will demonstrate the ability to

CO 1	Reproduce fundamentals of dc circuits & ac circuits.
CO 2	Explain, construction, working and applications of various electrical machines.
CO 3	Analyze performance of various electrical machines.

CO-PO Articulation Matrix :

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	1	1							1		
CO2	3	3	3	2	2							1		
CO3	3	3	3	3	3							1		2

Unit	Content	Hours
1	**D.C. Circuits:** Basics of electrical circuits. Equivalent resistance, Kirchhoff's Laws. Current and Voltage division rule. Mesh and Nodal analysis of dc circuits. Superposition Theorem. **A.C. Fundamentals:** Generation of alternating voltage. Values of alternating quantity. Average and rms value by mid - ordinate method and method of integration. Form factor and peak factor. Concept of phasor and its mathematical representation. Concept of phasor diagram. Phasor algebra. Power in a.c. circuit. Concept of power factor, reactive power and apparent power with power triangle.	06
2	**Single Phase Transformer:** Working principle. EMF equation. Voltage ratio and turns ratio. Step up and step down transformers. Construction of single phase transformer. Ideal transformer. Transformer on no load with phasor diagram and equivalent circuit. Practical transformer and its equivalent circuit. Referred values. Voltage Regulation. Losses in transformer. Open circuit and Short circuit tests on transformer. Efficiency and condition for maximum efficiency. Types of transformer and their applications.	07
3	**D.C. Motor :** Principle, Torque Equation, Characteristics and applications of various types of D.C. Motors, Starting of D.C. Motors, Speed control of Series and Shunt motors, Power flow in DC machines, Losses and Efficiency in D.C. machines.	07

4	**Three Phase Induction Motor :** Construction. Production of rotating magnetic field. Principle of operation. Speed and slip. Frequency of rotor voltage and current. Relationship between rotor copper loss and rotor input. Developed Torque. Torque of an induction motor. Condition for maximum torque. Torque — slip and torque speed characteristics. Applications of three phase induction motor.	07
5	**Stepping Motors:** Principle of operation, Constructional features, Types of stepper Motors, Various modes of operation of Variable reluctance (VR) stepper motors, torque production in Variable Reluctance (VR) stepping motor, Multi stack VR stepper motor, Construction and working of Permanent Magnet (PM) stepper motor, Construction and working of Hybrid stepper motor, Torque angle characteristics of the stepper motor.	06
6	**Permanent Magnet Brushless DC Motors:** Fundamentals of Permanent Magnets, Principle of operation, Magnetic circuit analysis, EMF and Torque equations, Characteristics and control. **Servomotors:** AC Servomotors & DC Servomotors.	07

Text Books:

SN	Title	Edition	Authors	Publisher
1	Basic Electrical Engineering	1st Edition, 2005	T. K. Nagsarkar and M. S. Sukhija	Oxford Higher Education
2	Basic Electrical Engineering	2nd Edition,2006	V. N. Mittle and A. K. Mittal	The McGraw Hill Companies, New Delhi
3	Electrical Technology	2005	B.L.Theraja	S.Chand
4	Permanent Magnet and Brushless DC motors		T. Kenjo and S. Nugatory	England, Clarendon Oxford Press, 1989.

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Basic Electrical Engineering	2nd Edition,2002	I J Nagrath and D. P.Kothari	McGraw Hill, New Delhi
2	Electrical Engineering Fundamentals	2nd Edition,2001	Vincent Del Toro	Prentice Hall India, New Delhi

II Semester
CSD2159 : Lab.: Basic Electrical Machines

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 1	Perform laboratory experiments and demonstrate competency in collecting, interpreting, analysing data, communicate and present effectively through laboratory journals.

Lab Experiment List:

Expt. No	Name of Experiment
1	To verify Kirchhoff's voltage law and Kirchhoff's current law.
2	To verify Superposition theorem.
3	To perform O.C. and S.C. tests on a single phase transformer.
4	To find transformation ratio, regulation and efficiency of a single phase transformer.
5	To study speed control of dc motor.
6	To perform load test on dc motor.
7	To study speed control of three phase induction motor.
8	To perform load test on three phase induction motor.

II Semester
CSD2160 – Lab.: Engineering Design

Objectives:	Course outcomes:
1. The objective of learning Engineering Design is to make the students aware of how an industry communicates technical information graphically. 2. An engineer need to have three skills, he must be able to imagine, draw clearly and rapidly and to read the drawings drawn by others. 3. Engineering Design aims in teaching the principles of accuracy and clarity while presenting the information necessary for creation of products. 4. It also develops the critical thinking ability through visualisation that are essential while creation of successful design.	CO 1 Identify different orthographic views using knowledge of geometrical entities . CO 2 Translating the geometries from 2D to 3D and vice versa. CO 3 Visualisation of models using different rendering effects. CO 4 Record and Transform part and assembly motion into animation.

List of Practicals
1. Basic introduction to geometrical entities
2. Visualizing different orthographic views for the given 3-D object
3. Creation of 3-D to 2-D views using any CAD software
4. Creation of 2-D to 3-D objects using any CAD software
5. Modification of 3-D objects using special geometrical features
6. Creation of realistic representation of models using any CAD software
7. Evaluating true-to-life models using textures and appearance effects
8. Rendering of models using different environments, lighting conditions, shading effects
9. Capturing the motion of parts and assemblies using any CAD software
10. Creation of animation and exporting the file to any windows based media software

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

3rd Semester

(Department of Information Technology)

Computer Science and Design

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

Computer Science and Design

SoE No. CSD-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS	GE	CSD2201	Linear Algebra	**T**	3	1	0	4	4	30	20	50	3 Hours
2	3	PC	IT	CSD2202	Microprocessors and Microcontrollers	**T**	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	IT	CSD2203	Lab:Microprocessors and Microcontrollers	**P**	0	0	2	2	1		60	40	
4	3	PC	IT	CSD2204	Data Structures	**T**	4	0	0	4	4	30	20	50	3 Hours
5	3	PC	IT	CSD2205	Lab:Data Structures	**P**	0	0	2	2	1		60	40	
6	3	PC	IT	CSD2206	Computer System Organization	**T**	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	IT	CSD2207	Theoretical Foundation of Computer Sciences	**T**	3	0	0	3	3	30	20	50	3 Hours
8	3	PC	IT	CSD2208	Software Lab-I	**P**	0	0	4	4	2		60	40	
					TOTAL THIRD SEM		**16**	**1**	**8**	**25**	**21**				
Fourth Semester															
1	4	BS	IT	CSD2251	Discrete Mathematics and Graph Theory	**T**	3	1	0	4	4	30	20	50	3 Hours
2	4	PC	IT	CSD2252	Operating Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	IT	CSD2253	**Lab :** Operating Systems	**P**	0	0	2	2	1		60	40	
4	4	PC	IT	CSD2254	Computer Networks	**T**	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	IT	CSD2255	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	IT	CSD2256	**Lab:**Object Oriented Programming	**P**	0	0	2	2	1		60	40	
7	4	PC	IT	CSD2257	Design and Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	IT	CSD2258	**Lab**.:Design and Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
9	4	PC	IT	CSD2259	Software Lab-II	**P**	0	0	4	4	2		60	40	
					TOTAL FOURTH SEM		**15**	**1**	**10**	**26**	**21**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

List of Audit Course

1	3	HS		GE2121	Environmental studies	**T**	2	0	0	2	0	
2	3	HS		AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0	
3	4	HS		AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE, IIoT, AIML, CSD, AIDS	**A**	3	0	0	3	0	

		June 2022	**1.01**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

III Semester
CSD2201 – Linear Algebra

Objective	Course Outcome
1. To provide mathematical knowledge required to analyze problems encountered in engineering. 2. The students are acquainted with the solution of system of linear equation, eigen values and eigen vectors. 3. To apply principles of matrix algebra to linear transformations and inner products. 4. Student can apply this course in many areas of engineering such as computer graphics, cryptography, wire-less communication, signal processing, robotics and animation.	1. Solve systems of linear equations using rank of matrix 2. Determine eigenvalues and eigenvectors and solve eigenvalue problems. 3. Explain the concepts of vector space and subspace, span and basis. 4. Apply principles of matrix algebra to linear transformations and inner product.

Unit No.	Contents	Max. Hrs.
1	**Elementary matrix operations** Introduction to Matrices and Determinants, Solution of Linear Equations, Cramer's rule, Inverse of a Matrix.	6
2	**Matrix Algebra** Rank of a matrix, Gaussian elimination, LU Decomposition (Crout's method), Solving Systems of Linear Equations using the tools of Matrices.	6
3	**Diagonalization of matrix** Eigen Values and Eigen vectors, Linear dependence and independence of Eigen Vectors, Orthogonal Eigen vector, Diagonalization of matrix, Cayley-Hamilton Theorem and Sylvester's Theorem.	7
4	**Vector Space** Vector Space, Subspace, Sum of Sub space, linear combination, Linear dependence and independence, Span and basis, Spanning sets, Generators.	6
5	**Linear Transformation** Linear transformation, Ranges and Kernel (null space) of linear transformation, Inverse of linear transformation, Algebra of linear transformation, Singular and nonsingular linear transformation.	7

Unit No.	Contents	Max. Hrs.
6	**Inner product Spaces** Inner product space and Norms, orthogonal vector, the Gram Schamidt orthogonalization Process , orthogonal compliment, Adjoint of Linear operator, Normal and self adjoint operator, Unitary and orthogonal operator, Bilinear and Quadratic form.	7

Text Books :

1. Advance Engineering Mathematics (9th Edition), Kreyszig. Wiley
2. Higher Engineering Mathematics (40th edition), B.S. Grewal, Publisher: S.Chand & Company Limited
3. Advanced Engineering Mathematics (8th r edition), H.K. Dass
4. Linear Algebra,Hoffman and Kunze, prentice Hall of India, New Delhi
5. Linear Algebra and its Applications, Glbert Strang, Nelson Engineering (2007)

Reference Books :

1. Mathematics for Engineers(19th edition), Chandrika Prasad, John Wiley & Sons.
2. Advanced Mathematics for Engineers (4th edition), Chandrika Prasad.
3. Applied Mathematics for Engineers (3rd edition), L.A. Pipes and Harville, McGraw Hill.
4. Matrix and Linear Algebra, K.B.Datta, Prentice Hall of India.
5. A text book of Engineering Mathematics(Reprint 2008), N.P. Bali & Manish Goyal Laxmi Prakashan

III Semester

CSD2202 - Microprocessors and Microcontrollers

Objective	Course Outcome
The student should be able to 1) To introduce students with the architecture and operation of typical microprocessors and microcontrollers. 2) To familiarize the students with the programming and interfacing of microprocessors and microcontrollers. 3) To provide strong foundation for designing real world applications using microprocessors and microcontrollers. 4) 4. To understand interfacing of on and off chip peripherals with 8051 microcontrollers	**On completion of this course, the student will be able to** 1) Identify a detailed software & hardware structure of the Microprocessor and microcontroller 2) Determine the addressing modes and instruction sets related to programming of 8086 and 8051 3) Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility of a microprocessor and microcontroller. 4) Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO	Identify a detailed software & hardware structure of the Microprocessor and microcontroller	3													
CO	Determine the addressing modes and instruction sets related to programming of 8086 and 8051	3	3					3							
CO	Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility of a microprocessor and microcontroller	3	3	3				3							3
CO	Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.	3	3	3				3							3

Unit No.	Contents	Max. Hrs.
1	8086 architecture- Internal architecture & pin diagram of 8086/8088 microprocessor, Minimum & Maximum mode, even & odd memory banks, Accessing memory & I/O ports, Memory mapping in minimum mode.	6
2	Programming with 8086/8088: Addressing Modes, Instruction set, Instruction encoding format, Timing diagram Assembler directives, 8086 programming examples, String operations, File I/O processing, Far & Near procedures, Macros	5
3	Interfacing with 8086/8088: Memory interfacing, Intel 8255 PPI, Block diagram & interfacing with ADC DAC, Modes & initialization.	5
4	Overview of 8051 Microcontroller family, Introduction to MCS 51 family, Architecture, Memory organization, Internal RAM, Flag Register, Register Banks, SFRs , Functional pin description and various resources of MCS 51. Hardware Overview	5
5	Addressing modes, Instruction set and Assembly language programming Programs using look up table, Bit manipulation, 8051 I/O programming, Delay Programs	6
6	I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming, 8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Advanced microprocessors and peripherals	2nd edition 2006	A.K ray and K.M.Bhurchandani	TMH
2	The 8051 Microcontroller and Embedded systems using assembly & C	2nd edition	Muhammad Ali Mazidi	Pearson Education Asia LPE

Reference Books

SN	Title	Edition	Authors	Publisher
1	The 8051 Microcontrollers, Architecture and programming and Applications		K.Uma Rao, Andhe Pallavi	Pearson,2009
2	Microprocessors and Interfacing: Programming and Hardware	Third edition	Douglas V.Hall	TMH
3	The 8051 microcontroller	3rd edition	Kenneth.J.Ayala	Cengage learning,2010

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

III Semester
CSD2203 -LAB.: Microprocessors and Microcontrollers

Objective	Course Outcome
The student should be able to 1) To introduce students with the architecture and operation of typical microprocessors and microcontrollers. 2) To familiarize the students with the programming and interfacing of microprocessors and microcontrollers. 3) To provide strong foundation for designing real world applications using microprocessors and microcontrollers. 4) 4. To understand interfacing of on and off chip peripherals with 8051 microcontrollers	**On completion of this course, the student will be able to** 1) Identify a detailed software & hardware structure of the Microprocessor and microcontroller 2) Determine the addressing modes and instruction sets related to programming of 8086 and 8051 3) Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility of a microprocessor and microcontroller. 4) Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Identify a detailed software & hardware structure of the Microprocessor and microcontroller	3													
CO2	Determine the addressing modes and instruction sets related to programming of 8086 and 8051	3	3					3							
CO3	Analyze assembly language programs; select appropriate assemble into machine a cross assembler utility of a microprocessor and microcontroller	3	3	3				3							3
CO4	Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.	3	3	3				3							3

List of Practical's

Sr.	Problem Statements
1	Data block transfer using 8086 microprocessor
2	Find the maximum data byte in a block using 8086 microprocessor
3	Count even numbers present in a data block using 8086 microprocessor
4	Convert packed BCD number to its equivalent Hexadecimal number using 8086 microprocessor
5	Convert gray code into binary code using 8086 microprocessor
6	Generate square waveform using DAC using 8051
7	Generate sawtooth waveform using DAC using 8051
8	To find average of numbers using 8051 microcontroller
9	Toggle LED connected to port pin of micro-controller 8051
10	Display BCD no. on seven segment display

III Semester
CSD2204 - Data Structures

Objective	Course Outcome
1) To Study the algorithms for efficiency using Asymptotic Notations. 2) To study and acquire the knowledge of Basic Data Structures. 3) To understand the Data Structure for problem solving.	1) Compute and analyze the algorithms for efficiency using Asymptotic Notations. 2) Understand basic data structures like array, list, stack, queue, tree, graph. 3) Develop knowledge of basic data structures such as arrays, linked lists, 4) Apply appropriate data structures in problem solving. 5) Design application by using data structures and algorithms for real world problems.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Compute and analyze the algorithms for efficiency using Asymptotic Notations	3	3												
CO2	Understand basic data structures like array, list, stack, queue, tree, graph	3													
CO3	Develop knowledge of basic data structures such as arrays, linked lists			3											

CO4	Apply appropriate data structures in problem solving.	**3**		**3**										
CO5	Design application by using data structures and algorithms for real world problems			**3**										

Unit No.	Contents	Max. Hrs.
1	Data structures basics, Mathematical /algorithmic notations & functions, Complexity of algorithms, Sub algorithms. Big oh and theta notations and omega notations, Average, best and worst case analysis String processing: storing strings, character data type, string operations, word processing, and pattern matching algorithms.	5
2	Linear arrays and their representation in memory, traversing linear arrays, inserting & deleting operations, sorting Techniques, Linear search and Binary search algorithms. Multidemensional arrays, Pointer arrays. Record structures and their memory representation. Matrices and sprase matrices.	6
3	Linked lists and their representation in memory, traversing a linked list, searching a linked list. Memory allocation & garbage collection. Insertion deletion opeartions on linked lists. Header linked lists, Two- way linked lists. polynomial representations and manipulations are using linked list, circular linked list, doubly linked list, Generalized list.	7
4	Stacks and their array representation. Arithmetic expressions: Polish notation. Quick sort, an application of stacks, Recursion. Tower of Hanoi problem. Implementation of recursive procedures by stacks, Queues. , Circular queues, Priority Queues, Dequeue .	6
5	Trees, Binary trees & and their representation in memory, Traversing binary trees. Traversal algorithms using stacks, Header nodes : threads. Threaded Binary Trees, Binary search trees, searchng, inserting and deleting in binary trees. Applications, The concept of balancing and its advantages, B-Trees, B+ Trees, AVL Trees. Heap and heapsort. General trees.	6
6	Graphs and digraphs: Representations, Breadth and depth first searches, connected component, spanning trees, shortest path–single source & all pairs , activity networks, topological sort, Hamiltonian path. Graph theory, sequential representations of graphs, Warshalls' algorithm, Linked representation, operations & traversing the graphs. Posets & Topological sorting. hash functions,	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Data Structures using C and C++		Y. Langsam,	Pearson Education
2	Theory & Problems of Data Structures		Seymour Lipschutz	
3	Data Structures using C		Tanenbaum	Pearson Education
Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Data Structures	2nd Edition 2009	Ellis Horowitz, Sartaj Sahni, Dinesh Mehta	CBS Publications
2	An Introduction to Data Structures with Applications		Trembley, Sorenson	

III Semester
CSD2205 - LAB.: Data Structures

Sr. No.	List of Experiment
1	Write a program to perform following operations on Array. a) Traverse b) Insertion c) Deletion
2	Write a program to implement Sorting and Searching Techniques.
3	Program for allocating memory dynamically for single dimensional array and sort it using quick sort and merge sort
4	Write a program to implement following Operations in Linked List a) Traverse b) Insertion c) Deletion
5	Write an application to implement Tower of Hanoi Problem Algorithm.
6	Write an application to implement Abstract data type stack.
7	Write a program to evaluate Post fix expression using stack.
8	Write a program to implement Preorder Traversal of a binary tree.
9	Program to create file for storing details of all the items needed for playing any game of your choice also perform display, insertion of new record at any location, deletion of any record.
10	Write a Program to Perform insertion or search in a specified level of a stack implemented tree- structured symbol table

III SEMESTER
CSD2206 - Computer System Organization

Objective	Course Outcome
1. Study the fundamentals of computer organization and its relevance to classical and modern problems of computer Architecture. 2. Learn how to generate control signals for instructions using different architecture 3. Learn control units operations and its performance issues. 4. Study the different arithmetic operation including the algorithms & implementation for fixed-point and floating-point numbers. 5. Study the hierarchical memory system including cache memories and virtual memory 6. Study the different ways of communicating with I/O devices and standard I/O interfaces and advanced concept of computer architecture.	1. Students will be able to describe fundamentals of computer architecture and organization. 2. Students will be able to write control sequence for instructions. 3. Students will be able to identify control unit operations and understand performances issue in processor and memory. 4. Students will be able to perform arithmetic operations and describe its storage formats. 5. Students will be able to design main memory organization that uses banks for different word size operations and describe the concept of cache mapping techniques. 6. Students will be able to describe the concept of I/O organization and discuss some advanced methods for improving systems performance.

Unit No.	Contents	Max.
1	Basic Structure of Computer Hardware and Software: Functional Units, Basic Operational Concepts, addressing methods and machine program sequencing : Memory Locations , addressing and encoding of information, Main memory operation . Instruction Format, limitations of Short word- length machines, High level language considerations	7
2	Processing Unit: Some fundamental concepts, Single, two, three bus organization, Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instruction, Instruction sequencing, addressing modes. Case study – instruction sets of some common CPUs.	8
3	Hardwired Control : Design Micro-programmed Control: Microinstructions, Grouping of control signals, Micro program sequencing, Micro Instructions with next Address field, Perfecting microinstruction, Emulation, Bit Slices. Case study – design of a simple hypothetical CPU	7
4	Arithmetic: Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction , Arithmetic and Branching conditions, Multiplications of positive numbers, Signed- Operand multiplication, fast Multiplication, Booth's Algorithm, Integer Division, Floating point numbers and operations.	8
5	The main Memory: some basic concepts, semiconductor RAM memories, Memory system consideration, semiconductor ROM memories, Multiple module memories and interleaving, Cache Memory, Mapping techniques, Replacement algorithms, write policies Virtual memories, memory management requirements.	8
6	Computer Peripherals: I/O Devices, I/O device interface, DMA, Interrupt handling Role of interrupts in process state transitions, I/O device interfaces – SCII, USB Introduction to Pipelining, Throughput and speedup, pipeline hazards Introduction to parallel processors.	7

Text Books			
Sr.No.	**Title**	**Authors**	**Publisher**
1	Computer Organization and Design: The Hardware/Software Interface	David A. Patterson and John L. Hennessy	5th Edition Elsevier.
2	Computer Organization and Embedded Systems	Carl Hamacher .	McGraw Hill Higher Education 6th Edition
3	Computer architecture and organization	Carl Hamacher	McGraw Hill Higher Education 4th Edition
Reference Books			
1	Computer Architecture and Organization	John P. Hayes,	WCB/McGraw-Hill 3rd Edition
2	Computer Organization and Architecture: Designing for Performance	by William Stallings,	10th Edition Pearson Education.
	Computer System Design and Architecture	Vincent P. Heuring and Harry F. Jordan,	2nd Edition Pearson Education

III SEMESTER
CSD2207 - Theoretical Foundation of Computer Sciences

Objective	Course Outcome
• To understand the basic properties of formal languages & Finite Automata • To understand basic properties of regular expression and the basic concept of Regular Grammar • To study of different types of grammars and the properties of Context Free Grammar • To understand the basic properties of CFL & Designing of Push Down Automata • To understand the basic properties of Turing machine and study of Recursive Language • To understand the basic properties of concept of undeciadibility, post Correspondence problem & Recursive enumerable language	• After completion of the course students will be able to: • To apply basic properties of formal languages & to design Finite automata. • To analyze & formulate Regular Expression & Regular Grammar. • Understand Context Free Grammar & Construct CFG for the formal language • To apply properties of CFL & design of Push Down Automata • To analyze & design Turing machine & demonstrate basic concept of Recursive Language • To demonstrate the understanding of key notions such as undeciadibility, post Correspondence problem & Recursive enumerable language

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT	To apply basic properties of formal languages & to construct Finite automata.	M	M	H											
IT	To analyze & formulate Regular Expression & Regular Grammar.	M	M												
IT	Understand Context Free Grammar & Construct CFG for the formal language	M	M	H											
IT	To apply properties of CFL & design of Push Down Automata	M	M	H											
IT	To analyze & design Turing machine & demonstrate basic concept of Recursive Language	M	M	H											
IT	To demonstrate the understanding of key notions such as undeciadibility, post Correspondence problem & Recursive enumerable language	M	M												
		M	M	H											

Unit No.	Contents	Max. Hrs.
1	Introduction: Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Finite Automata: Design of Finite Automata, Acceptance of strings and languages, Deterministic Finite Automation , Non-Deterministic Finite Automation, Equivalence between NFA and DFA , NFA with ε-transition, Minimization of FA.	05
2	Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma for regular languages, closure properties of regular sets, properties of regular languages, Chomsky hierarchy of languages, Regular grammars, Right linear and left linear regular grammars, interconversion, Equivalence between regular grammar and FA, Interconversion between RE and RG.	05
3	Context free grammar, Derivation trees (Parse tree), Syntax tree , Ambiguous Grammar, Context Free Language (CFL), Closure properties of CFL, Simplification of CFG, Normal Forms of grammar: Chomsky Normal Form (CNF), Greibach Normal Form (GNF), CYK algorithm.	07
4	Push down automata, definition and model, acceptance of CFL by empty Stack and by final state, Design of PDA for the CFL, equivalence CFG and PDA, Inter conversion, DPDA & NDPDA.	09
5	Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Variants of Turing machines, non deterministic TMs and equivalence with deterministic TMs, context sensitive language (CSG), Linear bounded automata.	08
6	Undecidability: Church-Turing thesis, Undecidable Problems related to Recursive enumerable language and Turing Machine, post correspondence problem (PCP), Universal Turing Machine, The universal and diagonalization languages, reduction between languages and Rice's theorem, Recursive function: Basis functions and operations on them. Bounded minimization, unbounded minimization, preemptive recursive function and μ recursive function.	06

Text Books

Sr. No.	Title	Authors	Publisher
01	T1: Introduction to Automata Theory, Languages and computation	John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman	Pearson Education Asia 2nd edition, 2000
02	T2: Introduction to languages and the Theory of Automata	John C. Martin	Tata McGraw Hill 3rd edition, 2003.

Reference Books

1	R1: Elements of the Theory of Computation	Harry R. Lewis and Christos H. Papadimitriou	Pearson Education Asia
2	R2: Introduction to the Theory of Computation	Michael Sipser	PWS Publishing
3	R3: Theory of Computation	O.G. Kakde	USP 2008

III SEMESTER
CSD2208 - Software Lab

Course Learning Objective	Course Outcomes
1. Understanding data types, data structures, control , and Loop statements in Python. 2. Learn def function definitions, and modules. 3. Learn basic object oriented concepts using Python. 4. Developing applications in Python using customized and built in modules and packages.	After learning the course, the students will be able to 1. Understand the basic data types, built in data structures, control statements and loops and write simple programs in Python 2. To understand the concepts of functions modules and packages and write complex programs using them. 3. To understand defining and handling Python objects and develop classes required for the given application 4. To develop a useful application in Python.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT1---.-	Understand the basic data types, built in data structures, control statements and loops and write simple programs in Python	3													
IT1---.-	To understand the concepts of functions modules and packages and write complex programs using them.	3	1												
IT1---.-	To understand defining and handling Python objects and develop classes required for the given application	3	1												
IT1---.-	To develop an useful application in Python	2	2	2	1	1				2			2	1	1

Contents:

Module 1: Introduction: Build-in Data types: Data type & Variables, Python numbers, Python Strings, Python built in data structures: Lists, Dictionaries, Tuples, Sets, Arrays. Datatype conversion. Statements: Assignment statement, import statement, print statement, input statement, Python Control Statements: if, if – else, elif statements, Loop statements: For, while, continue and break, try and except statement, raise, with statements, case statement.

Module 2: Python Functions, Modules and Packages: The def statement, returning values, parameters, arguments, local variables, global variables and global statement, doc strings for functions, Mathematical Function, Generating Random numbers, File Handling.

Module 3: Python Object and Classes: A simple class, defining methods, member variables, The constructor, calling methods, adding inheritance, class variables, class methods and static methods, Interfaces, New-style classes, Doc strings for classes, Private members, Python Operator Overloading, Python inheritance and polymorphism, Exception Handling, Python Modules.

Module 4: Developing applications in Python using built in and customized modules and packages.

Sr. .	Topics to be Covered	Sample Problem Statement
1.	Demonstration of Build-in Data types: Data type & Variables, Python numbers	Write a Python program to compute the roots of a quadratic equation
2.	Demonstration of Python Lists.	Write a Python program to perform following operations: **i)** Insertion of element in a given list **ii)** Deletion of element from the given list
3.	Demonstration of different Statements: Assignment statement, import statement, print statement, input statement	Write a Python program to find square root of a number
4.	Demonstration of control statements: if, if – else, elif statements	Write a Python program to enter day number (1-7) and print the corresponding day of week name using if else. (e.g 5 then Friday)
5.	Demonstration of Loop statements: For, while, break, continue	Write a Python program to print all prime numbers from 1 to 100 (using nested loops, break and continue)
6.	Demonstration of try and except statement, raise, with statements, case statement	Write a Python program which take character as input and determine about vowels and consonants using case statement.
7.	Demonstration of Python Functions: The def statement, returning values, parameters, arguments	Write a Python program using user defined function to find the sum of following series. 1/1! + 2/2! + 3/3! + ……1/N!
8.	Demonstration of Python Mathematical Function	Write a Python Program to implement some mathematical functions
9.	Demonstration of Python File Handling	Write a Python program to read data from "Input.txt" file using File Input Class and write output to "Output.txt" using File Output class.
10.	Demonstration of Python Object and Classes: A simple class, defining methods, member variables	Write a program to define a class Employee with four data members such as Emp_name, Emp_id, Salary and department_id. Define appropriate methods to initialize and display the values of data members. Also calculate Gross salary of employee based on Basic Salary, TA, DA and HRA of employee
11.	Demonstration Python inheritance	Create a class Account that stores the customer name, account, number and type of account. From this derive the classes Current-acct and Saving-acct to make them more specific to their requirement. Include necessary methods in order to achieve the following tasks: (a) Accept deposit from a customer and update the balance. (b) Display the balance (c) Compute and deposit interest. (d) Permit withdrawals (e) Check the minimum balance, impose penalty, if necessary and update the balance
12.	Demonstration of Python Exception Handling.	Write a program to implement Exception handling in Python.
13	Building Application	Develop some useful application in Python

Nagar Yuwak Shikshan Sanstha's

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(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

4th Semester

(Department of Information Technology)

Computer Science and Design

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

Computer Science and Design

SoE No. CSD-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS	GE	CSD2201	Linear Algebra	**T**	3	1	0	4	4	30	20	50	3 Hours
2	3	PC	IT	CSD2202	Microprocessors and Microcontrollers	**T**	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	IT	CSD2203	Lab:Microprocessors and Microcontrollers	**P**	0	0	2	2	1		60	40	
4	3	PC	IT	CSD2204	Data Structures	**T**	4	0	0	4	4	30	20	50	3 Hours
5	3	PC	IT	CSD2205	Lab:Data Structures	**P**	0	0	2	2	1		60	40	
6	3	PC	IT	CSD2206	Computer System Organization	**T**	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	IT	CSD2207	Theoretical Foundation of Computer Sciences	**T**	3	0	0	3	3	30	20	50	3 Hours
8	3	PC	IT	CSD2208	Software Lab-I	**P**	0	0	4	4	2		60	40	
					TOTAL THIRD SEM		**16**	**1**	**8**	**25**	**21**				
Fourth Semester															
1	4	BS	IT	CSD2251	Discrete Mathematics and Graph Theory	**T**	3	1	0	4	4	30	20	50	3 Hours
2	4	PC	IT	CSD2252	Operating Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	IT	CSD2253	**Lab :** Operating Systems	**P**	0	0	2	2	1		60	40	
4	4	PC	IT	CSD2254	Computer Networks	**T**	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	IT	CSD2255	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	IT	CSD2256	**Lab:**Object Oriented Programming	**P**	0	0	2	2	1		60	40	
7	4	PC	IT	CSD2257	Design and Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	IT	CSD2258	**Lab**.:Design and Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
9	4	PC	IT	CSD2259	Software Lab-II	**P**	0	0	4	4	2		60	40	
					TOTAL FOURTH SEM		**15**	**1**	**10**	**26**	**21**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

List of Audit Course

1	3	HS		GE2121	Environmental studies	**T**	2	0	0	2	0	
2	3	HS		AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0	
3	4	HS		AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE, IIoT, AIML, CSD, AIDS	**A**	3	0	0	3	0	

		June 2022	**1.01**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

IV Semester
CSD2251 – Discrete Mathematics and Graph Theory

Objective	Course Outcome
1. This course will provide the mathematical fundamentals needed to understand computer application. 2. To provide the mathematical concepts necessary in the study of propositional and predicate logic. 3. To discuss the concepts of algebraic systems like semi groups and groups. 4. To use graph theory to analyze the complex structure which helps in writing efficient code.	With the completion of this syllabus students will be able to 1. Identify the importance of statements in deriving valid inferences. 2. Use relations and ordering methods to identify the relationship among the inferences. 3. Select suitable algebraic systems to find solution for real time problems. 4. Find the suitable computing methods and applying graph theory concepts to solve complex problems.

Unit No.	Contents	Max. Hrs.
1	**Mathematical Logic and Set Theory:** Statement and Notation: Negation, Conjunction, Disjunction, Tautologies, Truth Tables, Basic Concepts of Set Theory, Inclusion & equality of set, Power Set, Ordered Pairs and n-tuples, Operations on Sets , mathematical induction. Propositions, Predicate logic.	6
2	**Relations and Functions:** Relations and Ordering, Relation Matrix and Graphs, Partition and Covering of a set, Equivalence relation, Partial order relation, Partially Ordered sets, Functions, Composition of functions, Inverse Functions, Characteristics function of a set.	6
3	**Group Theory:** Groups, Subgroups and Homomorphism, Cosets and Lagrange's theorem, Normal subgroups. Semi groups and Monoids Homomorphism of semigroups and monoids, Sub semi groups and monoids.	7
4	**Rings:** Definitions and Examples, sub ring, Integral domain, ring homomorphism, ideal of ring polynomial.	7
5	**Field and Lattices :** Definitions and Examples, Finite Field, Ordered sets, Hasse Diagrams of partially Ordered sets. Lattices, Bounded Latices, Complements Latices, Definitions and Examples of Finite Field, Ordered sets, Hasse Diagrams of partially Ordered sets. Lattices, Bounded Latices, Complements Latices.	7
6	**Graph Theory:** Basic concepts of graph theory, Basic definitions, Paths and circuits, Reach ability and connectedness, Matrix Representation of graphs, Tree and their representation and operations, Rooted trees, Path lengths in rooted trees, Multi graphs and weighted graphs, and graph isomorphism, shortest paths in weighted graphs, Hypergraphs, transitive closure, Spanning trees, Kruskal's algorithm, Prim's algorithm.	7

Text Books:

1. Discrete Mathematics Structure with application to Computer Science by J. P. Tremblay & R. Manohar ,23rd re-print,2005,Tata McGraw-Hills Publication Company Limited, New Delhi.

2. Discrete Mathematics by Lipschutz Schaums's Outline series,2nd edition,Tata McGraw-Hills Publication Company Limited, New Delhi.

Reference Books:

1. Discrete Mathematical structures :-By Bernard Kolman ,Robert C.Busby, Sharon Ross, 3rd edition,2001,Prentice Hall of India, New Delhi.

IV SEMESTER

CSD2252 – Operating Systems

Course Learning Objective	Course Outcomes
Student will study : 1. To understand the role, components, and designing issues associated with operating systems. 2. To understand processes and threads, CPU scheduling algorithms, and process synchronization mechanisms 3. To comprehend the concepts of memory management including virtual memory. 4. To understand issues related to file system interface and implementation, and disk scheduling.	**After undergoing this course students will be able to** 1. understand the fundamental concepts in Operating Systems (OS) and understand how various hardware features support OS functionality. 2. explain various OS mechanisms and policies for managing system resources. 3. analyze algorithms and techniques for managing various OS resources in a multiprogramming and other environments. 4. evaluate the performance of algorithms for managing various OS resources.

Unit No.	Contents	Max. Hrs.
1	**Introduction to OS:** evolution of OS, basic hardware support necessary for modern operating systems, Layered Structural of OS, Services provided by OS, system calls, Dual mode of operation. Input-output Management : Basics of I/O hardware, Polling, Interrupts and DMA.	(6)
2	**Process management:** introduction, process control block, process states, process context switch, introduction to threads, CPU scheduling, goals of scheduling, Algorithmic evaluation of CPU scheduling algorithms.	(5)
3	**Interposes communication:** process cooperation and synchronization, race condition, critical region, mutual exclusion and implementation, semaphores, classic problems of Synchronization using semaphores.	(6)
4	**File systems : introduction,** Access methods, Directory Structure disk space management and space allocation strategies, disk arm scheduling strategies: FCFS, SSTF, SCAN, CSACN, LOOK, CLOOK, Selecting a disk scheduling algorithm.	(5)
5	**Memory management techniques:** -contiguous allocation, static and dynamic partitioning, and non-contiguous, paging and segmentation, translation look aside buffer (TLB) and overheads.	(5)
6	**Virtual memory:** demand paging, page replacement algorithms, thrashing, working set model. **Deadlocks**: necessary conditions, deadlock detection, deadlock avoidance, deadlock prevention, recovery from deadlock.	(7)

Text Books			
Sr. No.	**Title**	**Authors**	**Publisher**
1	Operating system concepts	8th Edition	Silberchatz & galvin
2	Operating System	5th Edition	William Staling
Reference Books			
1	Modern operating systems	2nd Edition	A.S. Tanenbaum
2	Operating system concepts	2nd Edition	Milan MilenKovic

IV SEMESTER
CSD2253 –Lab: Operating Systems

Objective	Course Outcome
To understand the working of Operating System services, algorithms and mechanism practically .	Students will be able to: 1 Understand the advanced OS commands 2 understand the working of processes and threads and their synchronization practically. 3 Understand various algorithms and techniques used by OS for managing resources through software simulation.

Sr. No	Problem Statements
1	Study of Advanced Linux shell commands (Process management, Memory management, Networking, etc.)
2	Study of Window task manager (about its applications, processes, services, networking, performance etc.)
3	Write a program that illustrates the creation of child process using fork system call. Each child and parent Processes perform different task.
4	Write a multithreaded program to multiply two given matrices.
5	Simulate any two of the following CPU Scheduling Algorithms (One each from preemptive and non-preemptive types) : FCFS, SJF, SRTN, Round Robin, Preemptive priority, Non-preemptive priority
6	Simulate any one of the following Dynamic Memory allocation algorithms First Fit, Best Fit, Worst Fit.
7	Simulate any one of the following Page replacement algorithms: FIFO, LRU, Optimal
8	Write a program to perform Inter-Process-Communication using shared memory OR, pipes OR message queues.
9	Write a program that gives a deadlock and starvation free solution to the Dining philosophers problem using semaphores
10	Write a program to simulate Banker's Deadlock avoidance algorithm.

IV SEMESTER
CSD2254 – Computer Networks

Objective	Course Outcome
Student will study : 1. To understand the modern network architectures from a design and 2. Models perspective. 3. Understand the basic of hardware, software and types of transmission media used in computer networks. 4. Understand the concept of various protocols used in data link layer 5. Understand the Concept of adaptive and no adaptive routing algorithms 6. Understand the concept of Quality of Service provided by the transport layer 7. Understand the concept of knowledge cryptography techniques for network security.	After completion of the course students will be able to: 1. Explain the functions of the different layer of architectures and Models. 2. Demonstrate basic understanding of hardware, software and types of transmission media used in computer networks. 3. Describe the concept of various protocols used in data link layer 4. Demonstrate the knowledge of adaptive and no adaptive routing algorithms 5. Demonstrate the concept of Quality of Service provided by the transport layer 6. Apply basic knowledge cryptography techniques for network security.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
	Explain the functions of the different layer of architectures and Models	**3**													
	Demonstrate basic understanding of hardware, software and types of transmission media used in computer networks		**2**												
	Describe the concept of various protocols used in data link layer		**2**												
	Demonstrate the knowledge of adaptive and no adaptive routing algorithms	**2**	**2**												
	Demonstrate the concept of Quality of Service provided by the transport layer		**2**												
	Apply basic knowledge cryptography techniques for network security	**2**		**2**			**2**								
		2	2	2			2								

Unit No.	Contents	Max. Hrs.
1	The use of computer networks, LAN‟s, MAN‟s, WAN‟s. topologies and their characteristics, wireless networks, protocol hierarchies, design issues for layers, interfaces and services, connection oriented and connectionless services, service primitives relationship of services to protocols. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference model	05
2	Physical layer: theoretical basis for data communication, Guided transmission media, wireless transmission: electromagnetic spectrum, radio transmission, infrared transmission. Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.	05
3	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA	07
4	Network layer: design issues, Classful and classless Internet Addresses, subnet addressing, implementation of subnet with mask, supernetting, Address block and CIDR notation, examples. Routing algorithms, congestion control algorithms, quality of service, internetworking, network layer in Internet: IP protocol, Internet control protocols, OSPF, BGP, Internet multicasting	09
5	**Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm. Performance issues: performance problems in networks, network performance measurement.	08
6	**Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Network security: cryptography, introduction to symmetric and public key algorithms, digital signatures, authentication protocols, e-mail and web security.	06

IV SEMESTER
CSD2255 – Object Oriented Programming

Objective	Course Outcome
Student will : 1. Learn the Concepts of Java programming language 2. Learn Java's syntax, idioms, patterns, and styles to write simple JAVA program. 3. To develop object centric thinking and to use object oriented features of JAVA to write complex programs. 4. Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development 5. Understand How to handle exceptions appropriately. Become familiar with the concept of an I/O stream 6. Learn and Understand development of JAVA applets vs. JAVA applications	After completion of the course students will be able to: 1. Understand basic features of JAVA as an object oriented-programming language. 2. Write, compile, test and run simple Java programs 3. Write object based programs with object oriented features 4. Demonstrate the ability to use simple data structures like arrays in a Java program. Use and explain the difference between a String and a StringBuffer object 5. Demonstrate exceptions that can be recognized and handled by the Java programming language, Understand stream classes, Use it to save and read the data in a file 6. Be able Use Java programming language features to design and create Java applets.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
	Understand basic features of JAVA as an object oriented-programming language.	1	2										2	1	
	Write, compile, test and run simple Java programs	2	3										2	2	
	Write object based programs with object oriented features	3	1										2	1	
	Demonstrate the ability to use simple data structures like arrays in a Java program. Use and explain the difference between a String and a String Buffer object	3	2										2	2	
	Demonstrate exceptions that can be recognized and handled by the Java programming language, Understand stream classes, Use it to save and read the data in a file.	2	2										2	1	
	Be able Use Java programming language features to design and create Java applets.	2	1										2	2	

Unit No.	Contents	Max. Hrs.
1	UNIT I : Introduction to Object oriented programming, Introduction to Java as OOP language: Importance of java, Parts of the java language, Java Environment, Structure Of A Java Program. Building blocks of java, Data types, Variable declarations ,operators and Assignments ,control structures, objects and classes, Declaring Classes and objects, Creating Classes and objects, methods, argument passing, Recursion, this keyword, constructors ,Visibility control	08
2	UNIT II : Java as OOP language, Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances)	07
3	UNIT III : Arrays, Strings Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Wrapper Classes,	08
4	UNIT IV : exception handling mechanism: Fundamentals exception types, uncaught exception, try-catch Block, displaying description of an exception, multiple catch clauses, nested try-catch statements, throw, throws, finally, built in exceptions, creating own exception subclasses,	07
5	UNIT V : Collection Vector and Framework: Introduction to collection framework, Vectors, Array List, Linked list, Hashset, Treeset, Hashmap	07
6	UNIT V I : IO Steam, applets and Thread: Introduction to stream classes, use of stream classes, I/O stream, bytes stream, character stream, pre-defined stream, reading console input, reading character, reading string, writing console output, the print write class, reading & writing files, transient and volatile modifiers, Introduction to applets, applet lifecycle, creating and executing applets, Introduction to multithreading, life cycle of Thread, Runnable interface and Thread class.	08

Text Books			
Sr.No	**Title**	**Authors**	**Publisher**
1	Thinking in Java	Bruce Eckel	Prentice Hall
Reference Books			
1	Java2 Complete Reference	Herbert Schildt	McGraw-Hill
2	Programming with Java	E. Balagurusamy	TATA McGraw-Hill

IV SEMESTER
CSD2256 –LAB. – Object Oriented Programming

Objective	Course Outcome
1. Be able to use the JAVA SDK environment to create, debug and run simple JAVA programs.	1. Design, develop, test, and debug programsusing object oriented principles using java s.

Course Outcomes	Statement	Mapped PO												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT	Design, develop, test, and debug programs using object oriented principles using java														

Sr. No	Experiments Base On
1.	Introduction of JAVA Programming Environment
2.	Data Types and Control Structures
3.	Class and constructor
4.	Overloading
5.	Overriding
6.	Interface
7.	Arrays and String
8.	Exception
9.	Collection
10.	Applet

IV Semester
CSD2257 – Design & Analysis of Algorithms

Objective	Course Outcome
The student should be able to 1. Study asymptotic notations and recurrence relation. Analysis of iterative and recessive algorithms, complexity of algorithms 2. Use of various algorithmic design techniques in problem solving 3. Performance analysis (time and space complexities) of algorithms in best, worst and average cases. 4. How to synthesize and design efficient algorithms for real world problems	**After completion of the course students will be able to** 1. Understand asymptotic analysis of iterative and recursive algorithms, complexity of algorithms 2. Apply important algorithmic design techniques for problem solving 3. Analyze the performance of algorithms 4. Synthesize and design efficient algorithms for real world problems

Unit No.	Contents	Max Hrs.
1	Mathematical foundations, summation of arithmetic and geometric series, recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions.	7
2	Asymptotic notations of analysis of algorithms, analyzing control structures, worst case and average case analysis, amortized analysis, External Sorting, lower bound proof.	6
3	Divide and conquer basic strategy, quick sort, merge sort etc. Greedy method – basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.	7
4	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, optimal binary search trees, Matrix-chain Multiplication, traveling salesman problem.	7
5	Connected components, Branch and bound, Backtracking basic strategy, 8 – Queen's problem, graph coloring, Hamiltonian cycles etc.	7
6	NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP-complete, Cook's Theorem, decision and optimization problems, polynomial reduction	7

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Computer Algorithms	2nd Edition	Horowitz, Sahani, Rajsekharan	Silicon Press
2	Introduction to Algorithm	3rd Edition, 2009	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein	MIT press
3	Fundamentals of Algorithms	1st edition,1995	Brassard, Bratley	Prentice Hall
4	The Algorithm Design Manual	2nd Edition	Steven S. Skiena	Springer

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to the Theory of Computation,	3rd Edition, 2013	Michael Sipser	Cengage Learning
2	Algorithms	1st Edition, 2006	S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani	
3	The art of Computer programming Vol. 3	2nd Edition, 1998	Donald E. Knuth	Addison-Wesley

IV Semester
CSD2258 – Lab- Design & Analysis of Algorithms

Course Learning Objective	Course Outcomes
Students will study : 1. Study of different analysis method 2. Study of different techniques of algorithm like divide and conquer, greedy and dynamic.	Students will be able to: 1. Understand different analysis method and analyze it. 2. Understand different techniques and apply it.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
IT2352.1	Understand different analysis method and analyze it	3													
IT2352.2	Understand different techniques and apply it		3												
IT2352		3	3												

List of Practical's

Sr. No..	Problem Statements
1	Implement and analyze different sorting algorithms.
2	Practical Based on Amortized Analysis
3	Practical Based on Minimum Cost Spanning Tree
4	Practical Based on An Activity Scheduling Problem
5	Practical Based on Single Source Shortest Path
6	Practical Based on Dynamic Programming
7	Practical Based on divide and conquer

IV Semester
CSD2259 – Software Lab-II

Objective	Course Outcome
The student should be able to 1. Understanding data types, data structures, control , and Loop statements in C#. 2. Learn def function definitions, and modules. 3. Learn basic object oriented concepts using C#. 4. Developing applications in C# using customized and built in modules and packages.	**On completion of this course, the student will be able to** 1. Understand the basic data types, built in data structures, control statements and loops and write simple programs in C#. 2. To understand the concepts of functions modules and packages and write complex programs using them. 3. To understand defining and handling C# objects and develop classes 4. To develop a useful application in C#.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO1	PS	P
CO	Understand the basic data types, built in data structures, control statements and loops and write simple programs in C#.	3				3									
CO	To understand the concepts of functions modules and packages and write complex programs using them	3				3									
CO	To understand defining and handling C# objects and develop classes	3				3									
CO	To develop a useful application in C#.		3	3		3				3				3	

List of Practical's

Expt. no.	Name of Experiment / Problem Statement	Topic	CO Mapped
MSPA-1			
1	Implementing Edit Functionality for the Students List	Introduction	CO-1
2	Creating Methods, Handling Exceptions, and Monitoring Applications	Methods	CO-1
3	Extending the Class Enrolment Application Functionality	Inbuilt Application	CO-1
4	Basic types and constructs of Visual C#	Basic Data Type	CO-1
5	Writing the Code for the Grades Prototype Application	Simple Example	CO-1
MSPA-2			
6	Creating Classes and Implementing Type-Safe Collections	Classes	CO-2
7	Adding Data Validation and Type-Safety to the Application	Validation	CO-2
8	Creating a Class Hierarchy by Using Inheritance	Class Hierarchy	CO-2
MSPA-3			
9	Refactoring Common Functionality into the User Class	User Classes	CO-2
10	Reading and Writing Local Data, Accessing a Database	Database Accessing	CO-3
MSPA-4			
11	Implementation of an application for the given problem statement using Python using built in and customized modules and packages.	C# Application Development	CO-4

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Bachelor of Technology

SoE & Syllabus 2021

5th Semester

(Department of Information Technology)

Computer Science and Design

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B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

Computer Science and Design

SoE No. CSD-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE
							L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester															
1	5	HS	IT	CSD2301	Cyber Laws & Professional Ethics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	IT	CSD2302	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	IT	CSD2303	**Lab:** Database Management Systems	**P**	0	0	2	2	1		60	40	
4	5	PC	IT	CSD2304	Principles of Compiler Design	**T**	3	0	0	3	3	30	20	50	3 Hours
5	5	PC	IT	CSD2305	**Lab.:**Principles of Compiler Design	**P**	0	0	2	2	1		60	40	
6	5	PE	IT		**Professional Elective-1**	**T**	3	0	0	3	3	30	20	50	3 Hours
7	5	PE	IT		**Lab : Professional Elective-1**	**P**	0	0	2	2	1		60	40	
8	5	OE	IT		**Open Elective - 1**	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5	OE	IT		**Open Elective - 2**	**T**	3	0	0	3	3	30	20	50	3 Hours
10	5	STR	IT	CSD2306	Seminar	**P**	0	0	2	2	1		100		
					TOTAL FIFTH SEM		**18**	**0**	**8**	**26**	**22**				
Professional Elective 1															
1	5	**PE1**	IT	CSD2310	Digital Image Processing										
	5	**PE1**	IT	CSD2311	**Lab:** Digital Image Processing										
2	5	**PE1**	IT	CSD2312	Machine Learning										
	5	**PE1**	IT	CSD2313	**Lab:** Machine Learning										
3	5	**PE1**	IT	CSD2314	Data Visualization										
	5	**PE1**	IT	CSD2315	**Lab:** Data Visualization										
4	5	**PE1**	IT	CSD2316	Computer Graphics										
	5	**PE1**	IT	CSD2317	**Lab:** Computer Graphics										
5	5	**PE1**	IT	CSD2318	Internet of Things										
	5	**PE1**	IT	CSD2319	**Lab**: Internet of Things										
Open Elective 1 & 2															
1	5	**OE1**	IT	CSD2331	Computer Graphics										
2	5	**OE1**	IT	CSD2332	Multimedia Design										
3	5	**OE2**	IT	CSD2341	Advanced Web Designing										
4	5	**OE2**	IT	CSD2342	Virtual Reality										

Audit Courses															
1	5	HS		AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE, IIoT, AIDS, CSD, AIML	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.01**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

V Semester
CSD2301- Cyber Laws and Professional Ethics

Objectives	Outcomes
➢ To Recognizing the importance and differentiate between engineering and other profession ➢ To Illustrate several Ethical Theories and Issues in Engineering Practice ➢ To understand the background and structure of Constitution ➢ To analyze federalism in the Indian context ➢ To make aware of fundamental rights, duties and directive principles	**Students will be able** – ➢ State the importance of Engineering Ethics and differentiate between engineering and profession ➢ Employ various Ethical Theories and Practice Ethical Engineering ➢ Illustrate background and structure of constitution. ➢ State federalism in the Indian Context ➢ Identify fundamental rights, duties and directive principles enshrined under Constitution of India

Unit No.	Contents	Max. Hrs.
1	**Unit-I: Historical background of Constitution** • Origin of history of Constitution, Concept of Preambles • Meaning of the constitution law and constitutionalism • Parliamentary Form of Government in India – The constitution powers and status of the President of India	6
2	**Unit-II: Federalism** • Salient features of Federalism • Structures and features of Indian Federalism, • Difference between Indian and Federation of other states.	6
3	**Unit-III Fundamental Rights and Directive Principles** • Scheme of the Fundamental rights • The scheme of the Fundamental duties and its legal status • Directive principles of state policy	6
4	**Unit-IV-Professionalism and Codes of Ethics** • Is Engineering a Profession • Difference between Engineering and other professions • Codes of Engineering society • Solving Ethical Problems	6
5	**Unit-V- Ethical Theories** • History of Ethical Thoughts • Ethical Theories(Moral, Utilitarianisms, cost benefit Analysis, duty ethics & right ethics,Corporate morality) • Kohlberg's Stages of moral Development, Piaget,s Theory, Carol Gilligen Theory	6

V Semester
CSD2301- Cyber Laws and Professional Ethics

Unit No.	Contents	Max. Hrs.
6	**Unit-VI- Ethical Issues** • Conflict Problems and Whistle Blowing • Cross -Cultural Issues • Environmental Ethics • Computer Ethics • Ethics and Research • Intellectual Property Rights(IPRs)	6

References/ Text Books for Enrichment:

- G. Austin (2004) Working of a Democratic Constitution of India, New Delhi: Oxford University Press.
- Basu, D.D (2005), An Introduction to the Constitution of India, NewDelhi, Prentice Hall.
- A.G. Noorani(2000): Constitution questions in India: The President, Parliament and the Status, New Delhi: Oxford University Press.
- Singh, M.P & Saxena, R (2008) Indian Politics: Contemporary Issues and Concerns. New Delhi: PHI Learning.
- Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.
- Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

V Semester
CSD2302 - Data Base Management Systems

Objective	Course Outcome
The student should be able to 1. Understand Database management system's basic operations & design process using ER, EER diagram, SQL and with the use of Normalization. 2. Understand Transaction with ACID properties and their implementation. 3. Understand various storage structures, Query Processing and query optimization techniques to build a robust database management system. 4. Understand concurrency control mechanism using various concurrency control protocols.	**On completion of this course, the student will be able to** 1. To obtain sound knowledge in the theory, principles and applications of database management system. 2. Design and develop data model given their specifications and within performance and cost constraints. 3. Acquire and understand new knowledge, use them to develop data centric application and to understand the importance of lifelong learning. 4. Perform experiments in different disciplines of database management system.

Unit No.	Contents	Max. Hrs.
1	Introduction to Database Management System: General File System vs. DBMS, Data Abstraction, Data Independence, Keys, Data Modeling using the Entity Relationship(ER) Model, The enhanced Entity Relationship(EER) model.	8
2	Relational Model: Structure of Relational Databases, The Relational Algebra and Relational Calculus(TRC & DRC) Introduction to SQL Programming: (DDL, DML, Joins, Nested Queries/Sub Queries/Inner Queries) Integrity Constraints.	7
3	Database Design: Functional Dependency and Normalization for Relational Databases, Desirable properties of decomposition.	7
4	Query Processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, Other Operations, Evaluation of Expressions. Query Optimization: Overview, Transformation of Relational Expressions, Estimating Statistics of Expression Results.	8
5	Transaction Processing: Introduction to Transaction Concept, A Simple Transaction Model, Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels.	8
6	Concurrency control Techniques: Lock-Based Protocols, Deadlock Handling, Multiple Granularity, and Timestamp-Based Protocols. Data Control Language: GRANT, REVOKE; Concept of Triggers and Views.	8

V Semester
CSD2302 - Data Base Management Systems

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Database System	5th Edition(2006)	Elmasri & Navathe	
2	Database System Concepts	6th Edition, (2010)	Abraham Silberschatz, Henry F. Korth and S. Sudarsha	McGraw-Hill Education
3	Database Management Systems	Second Edition	Raghu Ramakrishnan, Johannes Gehrke	McGraw-Hill, 2002

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Database in Depth – Relational Theory for Practitioners		C.J. Date	O`Reilly Media, 2005
2	Database design, Application Development and Administration	4th Edition(2008)	Michael Mannino	

V Semester
CSD2303 - – LAB.: Data Base Management Systems

List of Practical's

Sr. No..	Problem Statements
1	Database design using E-R Model for: Payroll processing system, Banking system Library Information System Student Information System, etc.
2	Mapping of E-R model to relational Schema and creation of Tables using DDL (Data DefinitionLanguage).
3	Modification of Database objects using DDL and DML
4	Querying the Database based on various inbuilt functions (Date Function, Numeric Function, Character Function, Conversion Function, Miscellaneous Function, etc.).
5	Querying the Database based on Set, Arithmetic and Logical operator.
6	Implementation of Joins(all types).
7	Queries based on Data Grouping Restricting and sorting.
8	To create and manipulate various database objects of the Table using Views:
9	Querying the Database based on to create triggers for various events such as insertion, updation, etc.
10	Exploring NOSQL Database.

V Semester
CSD2304 - Principles of Compiler Design

Objective	Course Outcome
The student should be able to 1. To study the basic concept of compiler fundamentals & design of lexical analysis 2. To study the different parsing techniques. 3. To study the construction of parsers for different CFG. 4. To study Syntax Directed Translation of different programming language constructs. 5. To study symbol table organization & error detection & recovery 6. To study code optimization & designing of code	**On completion of this course, the student will be able to** 1. Understand different phases of compilation process and lexical analyzer tool "Lex" OR "Flex" 2. Apply parsing techniques to design and implement parsers using YACC /Bison tool 3. Apply syntax directed translation scheme to programming language constructs and analyze errors in lexical and syntactic phase of compiler 4. Apply different optimization techniques in the design of compiler and generate target code Software Lab-II

Unit No.	Contents	Max. Hrs.
1	Introduction to Abstract Model & Grammar , Introduction to Compilation Process, Compilers & Translators, Phase structure of Compiler, Role of Lex, Design of Lexical Analysis.	6
2	Specifying Syntactic Structure of Programming Language using Context Free Grammars, The role of Parser, Top-down Parsing, and Bottom up Parsing, Predictive Parsers, and Recursive Decent Parser	8
3	Construction of efficient LR Parsers (SLR, CLR & LALR), Canonical Collection of set of items and construction of Parsing table, Implementation of LR Parsing table	7
4	Syntax Directed Translation: Intermediate Code, Postfix notation, Parse tree and Syntax Trees, Three address codes, quadruples, triples, Translation of Arithmetic Expression, Boolean expressions, Control Statements. Array references, Procedure Calls, Declarations, Case Statements, Use of Compiler writing tools (Lex/Flex, Yacc /Biason).	8
5	Symbol Tables: Contents, Representing scope information. Error detection and Recovery: Error handling, Lexical-phase, Syntactic phase and semantic phase	6
6	Introduction to Code Optimization, The principle sources of optimization, Loop optimization, The DAG representation, Introductory Data Flow analysis, Introduction to Code Generation: Object programs, Problems in Code Generation, Register allocation and assignment, Code generation from DAG, Peephole optimization.	8

V Semester
CSD2304 - Principles of Compiler Design

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Compilers Principles, Techniques & Tools	2nd Edition	Alfred V. Aho , Ravi Sethi , Jeffrey D.	Addison Wesley.
2	Principles of Compiler Design	2nd Edition	Alfred V. Aho ,Jeffrey D. Ullman	Addison Wesley.

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Compiler Design	4th edition	O.G. Kakde	Laxmi Publication
2	Introduction to Compiling Techniques: First Course Using ANSI C, LEX and YACC	2nd Revised edition Edition	J.P. Bennett	Alfred Waller Ltd

V Semester
CSD2305- : Lab - Principles of Compiler Design

Course Learning Objective	Course Outcomes
Students will study: 1. To study the different phases and passes of compiler design. 2. To write a program using Lex Tool. 3. To write a program using YACC Tool	After completion of the course: 1. Students will be able to understand and apply Lex Tool for the development of program. 2. Students will be able to understand and apply YACC Tool for the development of program.

List of Practical's

Sr. No	Experiments Base On
1	LEX TOOL
2	YACC TOOL

V Semester
CSD2310 - PE1: Digital Image Processing

Objectives	Course Outcome
1. To introduce basic concept of Image processing in the spatial and frequency domain 2. To introduce basics of image representation and description. 3. To introduce the basics of color image processing, image segmentation and morphological operations on images 4. To learn various algorithms for image processing	**On completion of this course, the student will be able to** 1. Understand basic concepts of image processing, in the spatial and frequency domain 2. understand basics of image representation and description. 3. comprehend the basics of color image processing, image segmentation and morphological operations on images 4. understand various algorithms for image processing and apply them on given image data

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand basic concepts of image processing, in the spatial and frequency domain	3	2	3										1	
CO2	understand basics of image representation and description.	3	2	2										1	
CO3	comprehend the basics of color image processing, image segmentation and morphological operations on images	3	2											2	
CO4	understand various algorithms for image processing and apply them on given image data	3	2	2										2	

V Semester
CSD2310 - PE1: Digital Image Processing

Unit	Contents
1	**Introduction**: Fundamental Steps in Image Processing, Elements of DIP systems, Elements of Visual Perception. Fundamentals of Image processing: A Simple Image Model, Sampling and Quantization, Basic Image operations: Subtraction, Averaging, multiplication, etc., Basic Relationships between Pixels
2	**Image Enhancement in the Spatial Domain**: Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Histogram Processing, Local Enhancement, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.
3	**Image Enhancement in the Frequency Domain:** Introduction to the Fourier Transform, Discrete Fourier Transformation, Properties of DFT, Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering
4	**Image Segmentation**: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Hough transform, Thresholding Region-oriented Segmentation.
5	**Image Representation and description**: Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region, Description: Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors
6	**Basics of morphological Image Processing**, **Introduction to colour image processing**: colour models, pseudo colour image processing, introduction to image file formats: TIFF, JPEG, BMP, etc.

Notes: Assignments in TA should be based on Programming on Image Processing concepts learned.

Text Books				
SN	Title	Edition	Authors	Publisher
1	Digital Image Processing	3rd edition	Rafael C. Gonzalez and Richard E. Woods	Prentice Hall, 2007

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Image Processing Principles & Applications	--	TinkuAcharya&Ajoy K. Ray	Willey Inter-Science, 2005

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
CSD2312 - PE1: Machine Learning

Objective	Course Outcome
The student should be able to 1. To introduce basic concepts of machine learning and explain the relative strengths and weaknesses of different machine learning Methods. 2. To understand the different aspects of supervised learning 3. To understand the concepts of unsupervised learning 4. To understand different methods of evaluation of machine learning models	After undergoing the course, student will be able to: 1. Understand various models of supervised and unsupervised learning 2. analyze a problem and identify the machine learning algorithm appropriate for its solution 3. apply supervised learning for the given set of labelled samples and design the model to meet the desired needs 4. apply unsupervised learning for the given set of samples, and design the model to meet the desired needs

Unit No.	Contents	Max. Hrs.
1	**Introduction to machine learning**. What Is Machine Learning, Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Supervised and Unsupervised Learning, Reinforcement Learning, Generalization, Over-fitting, and Under-fitting	(6)
2	**Supervised Learning-1:** k-Nearest Neighbors, linear Models, Naive Bayes Classifiers, Decision Trees	(6)
3.	**Supervised Learning-2:** Kernelized Support Vector Machines, Uncertainty Estimates from Classifiers, The Decision Function, predicting Probabilities, Uncertainty in Multiclass Classification, multivariate classification and regression.	(6)
4	**Unsupervised Learning**: *k*-Means Clustering , Expectation-Maximization Algorithm, Supervised Learning after Clustering , Hierarchical Clustering, Choosing the Number of Clusters	(6)
5	**Design and Analysis of Machine Learning Experiments:** Factors, Response, and Strategy of Experimentation, Randomization, Replication, and Blocking, Guidelines for Machine Learning Experiments , Cross-Validation and Resampling Methods, K-Fold Cross-Validation, Bootstrapping, Measuring Classifier Performance, Hypothesis Testing, Assessing a Classification Algorithm's Performance, Comparing Two Classification Algorithms.	(5)
6	**Advances in Machine Learning**: Combining multiple learners, bagging and boosting, introduction to learning using Neural networks, shallow and deep networks.	(6)

V Semester
CSD2312 - PE1: Machine Learning

SN	Title	Edition	Authors	Publisher
1	Introduction to Machine Learning, Second Edition		Ethem Alpaydın	The MIT Press
2	Introduction to Machine Learning with Python, A Guide for Data Scientists		Andreas C. Müller and Sarah Guido	ORIELLY

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Machine Learning		Tom M. Mitchel	McGraw Hill

V Semester
CSD2313 - PE1: LAB. : Machine Learning

Sr. No..	Problem Statements
1	Experiment on k-Nearest Neighbors, ,
2	Experiment on Naive Bayes Classifiers
3	Experiment on Decision Trees
4	Experiment on Kernelized Support Vector Machines
5	Experiment on *k*-Means Clustering
6	Experiment on Hierarchical Clustering
7	Experiment on K-Fold Cross-Validation
8	Experiment on combining multiple learners
9	Experiment on neural networks using backpropagation algorithm
10	Experiment on deep neural networks

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech SoE and Syllabus 2021-22

(Scheme of Examination w.e.f. 2021-22 onward)

Computer Science and Design

V Semester

CSD2314 - : PE-1: Data Visualization

Objective	Course Outcome
1. To make student aware about various types of data. 2. To familiarize students with the stages of the visualization pipeline, including data modeling, mapping data attributes to graphical attributes, perceptual issues, 3. To know the existing visualization paradigms, techniques, and tools, and 4. To evaluate the effectiveness of visualizations for specific data, task, and user types.	1. To know the history of data visualization and its connection with computer graphics. 2. To know categories of visualization and application areas. 3. To understand the types of transformation the data has undergone to improve the effectiveness of the visualization. 4. To know the methods and algorithms used to map data to graphical depictions 5. To understand the techniques that has been applied to spatial data.

CO	Statement	Mapped PO												PSO	
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P0 10	PO 11	PO 12	PS O1	PS O2
CO1	To know the history of data visualization and its connection with computer graphics.														
CO2	To know categories of visualization and application areas														
CO3	To understand the types of transformation the data has undergone to improve the effectiveness of the visualization														
CO4	To know the methods and algorithms used to map data to graphical depictions														
CO5	To understand the techniques that has been applied to spatial data.														

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
CSD2314 - : PE-1: Data Visualization

Unit No.	Contents	Max. Hrs.
1	Introduction: Introduction to data visualization, what it is and why required, A reasons for using visualization, visualization pipeline and its relationship to other data analysis pipelines, Data foundation, Human Perception and Information Processing,	4
2	Visualization foundations, Visualization Techniques for Spatial Data, Visualization Techniques for Geospatial Data, Visualization Techniques for Time-Oriented Data, Visualization Techniques for Multivariate Data	6
3	Text and Document Visualization, Interaction Concepts, Interaction Techniques	6
4	Designing Effective Visualizations, Comparing and Evaluating Visualization Techniques	6
5	Visualization Systems,	6
6	Research Directions in Visualization	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Data Visualization: A Practical Introduction		Kieran Healy and Kieran Joseph Healy	
2	Data Visualisation: A Handbook for Data Driven Design		Andy Kirk	

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1				
2				

V Semester
CSD2315- PE-1: LAB.:Data Visualization

Sr. No.	List of Experiment
1	Introduction to Data Visualization and installation of tableau.
2	Connect Tableau to various Datasets: Excel and CSV files
3	Create the bar charts, maps and pie charts according to specific data,
4	Create Table Calculations
5	Create Dual Axis Charts
6	Create Area Charts
7	Create Scatterplots
8	Create Treemaps
9	Creating Data Extracts in Tableau

V Semester
CSD2316- : PE-1: Computer Graphics

Course Learning Objective	Course Outcomes
Student will study : 1. To introduce basic concepts of computer graphics. 2. To understand various algorithms of object drawing and various transformation and apply them. 3. To comphend the basic operations on segments, windowing and viewing transformations. 4. Understand some classic 3D graphics algorithms. 5. To understand the basic knowledge of curves and splines. 6. To understand the basic functions of animation.	After completion of the course students will be able to: 1. Understand basics of computer graphics. 2. Apply basic algorithms for line, circle and to solve, apply and list geometric transformation matrices including rotation, translation, scaling and reflection to transform a 2D object. 3. Apply basic algorithms and methods for segments, clipping and viewing transformation. 4. Understand and implement 3D graphics algorithms. 5. To solve and plot curve and splines. 6. Understand various tools and apply to design the animation.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	Understand basics of computer graphics.	H		M						L		L	M		
2	Apply basic algorithms for line, circle and to solve, apply and list geometric transformation matrices including rotation, translation, scaling and reflection to transform a 2D object.	M		H						L		L	M		
3	Apply basic algorithms and methods for segments, clipping and viewing transformation.	M		H						L		L	L		
4	Understand and implement 3D graphics algorithms.	H		M						L		L	H		
5	To solve and plot curve and splines.	H		M						L		L	L		
6	Understand various tools and apply to design the animation.	L		L						H		H	L		
		M		M						L		L	L		

V Semester
CSD2316- : PE-1: Computer Graphics

Unit No.	Contents	Max. Hrs.
1	**UNIT I** : Geometry and line generation: points, lines, pixels, planes and frame buffers, types of display devices: Raster Scan display, Flat Panel, LCD, LED Display, 3D Viewing devices, Virtual Reality Systems.Introduction of GPU.Illumination Models.	8
2	**UNIT II :** DDA and Bresenham's line algorithms, Bresenham's algorithm for circle generation, algorithm for ellipse generation.Algorithms for polygon generation, polygon filling algorithms, NDC (normalized device co-ordinates), pattern filing, 2D transformation: scaling, rotation, translation, rotation about arbitrary point reflection, zooming.	8
3	**UNIT III :** Graphics primitives: displays file, Segment tables, operations on segments, Graphics file formats (jpeg, Tiff, Bmp, etc). Windowing and clipping: Window, view port, viewing transformation, clipping, line and polygon clipping.	8
4	**UNIT IV :** 3D Graphics: 3D primitives, projection, parallel perspective, isometric, viewing transformations, hidden surfaces and line removal, painter's algorithm, Z-buffers, Warnock's algorithm.	8
5	**UNIT V :** Bezier and B-spline, sweeping, method of interpolation, Cubic Splines.	8
6	**UNIT VI :** Animation: Definition & introduction to animation, Basics: Animation target objects, Types, animation timings. Design of an animation sequence, general computer animation functions, raster animation, computer animation language.	8

Textbooks:			
1	Computer Graphics C Version	Second Edition (1997)	Donald Hearn & M. Pauline Baker
2	Computer Graphics Principles and Practice	2nd edition,1996	Foley, Vandam, Feiner and Huges
Reference Books:			
1	Procedural Elements for Computer Graphics	1998	David F. Rogers
2	Computer Graphics, A Programming Approach	2nd edition, 1987	Steven Harrington

V Semester
CSD2318-PE-1: Internet of Things:

Course Objective	Course Outcome
The student will study 1. The students will be able to describe IoT as a Process, its architecture and Management, compare and contrast old and new challenges in IoT 2. The students will be able to Apply various communication protocol and its building blocks in IoT applications. 3. The students will be able to Illustrate relevance of IoT with cloud and Web and analyze various security challenges and also evaluate various control strategies for the same 4. The students will be able to create, Design and Develop various applications based on IoT concepts	On completion of this course, the student will be able to 1. Students will able to describe various communication protocol and its building blocks. 2. Students will able to describe relevance of IoT with cloud and the application areas of IOT. 3. Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor 4. Able to understand building blocks of Internet of Things and characteristics. 5. The students will study and implement IoT project by studying different IoT components, electronic board and their uses.

Unit No.	Contents	Max. Hrs.
1	Introduction to IoT: History of IOT, Concepts, Products and Examples. IOT Paradigm, The Layering concepts of IOT, IOT Communication Model, IOT Architecture, The 6LoWPAN,Domains of IOT, M2M vs IOT, Management of IOT, IOT Platforms, IOT Languages, IOT Physical Systems, Tools for IOT	8 hrs
2	IoT Communication Protocols: Protocol Standardization for IOT, Issues with IOT Standardization, M2M and WSN Protocols, SCADA and RFID Protocols, IEEE 802.15.4, BACNet Protocol, Modbus, KNX, Zigbee Architecture, Unified Data Standards.	8 hrs
3	Web of Things: Web of Things versus Internet of Things, The Two Pillars of the Web, Architecture Standardization for Web of Things, Platform Middleware for Web of Things, Unified Multitier Web of Things Architecture, Web of Things Portals and Business Intelligence	7 hrs
4	Cloud of Things: Grid/SOA and Cloud Computing, Cloud Middleware, Cloud Standards, Cloud Providers & Systems, Mobile Cloud Computing, Cloud of Things Architecture. Models of Implementation, Service Level Agreement (SLA), Examples of Applications.	7 hrs
5	Security Aspects: Security in IOT: Introduction, Purpose, Issues, Challenges. IOT Threats to Individual and Organizations, Challenges to Secure IOT Development, Recommended Security Controls. Cybersecurity and IOT. Layered Security Protections to Defend IOT Assets.	7 hrs
6	IoT Applications: IOT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IOT electronic equipment. Use of Big Data and Visualization in IOT. Role of IOT for Increased Autonomy and Agility in Collaborative Production Environments, Resource Management in the IOT.	7 hrs

V Semester
CSD2318-PE-1: Internet of Things:

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Internet of Things: A Hands-on-Approach		Arshdeep Bahga & Vijay Madisetti	Orient Blackswan Publisher
2	The Internet of Things: Key Applications and Protocols		Olivier Hersent, David Boswarthick & Omar Elloumi	Wiley publication

V Semester
CSD2319-PE-1: LAB. : Internet of Things:

Objective	Course Outcome
Student will study: 1. The students will be able to Illustrate relevance of IoT with cloud and Web and analyze various security challenges and also evaluate various control strategies for the same 2. The students will be able to create, Design and Develop various applications based on IoT concepts	After completion of the course students will be able to: 1. Students will able to describe relevance of IoT with cloud and the application areas of IOT 2. The students will study and implement IoT project by studying different IoT components, electronic board and their uses.

List of Practical's

Sr. No.	Problem Statements
1	Study of Ardunio Kit
2	Study of Raspberry Pi Kit
3	Study of different electronics components
4	Study of different sensors in IoT
5	Case study: Smart Irrigation System using IoT and cloud
6	Case Study: IOT Car Parking System
7	Case Study: IOT Based ICU Patient Monitoring System
8	Case Study: Smart Dustbin With IOT Notifications
9	Project: Designing of Home Automation System
10	Mini Project

V Semester

CSD2331 - OE-1: Computer Graphics

Course Learning Objective	Course Outcomes
Student will study : 1. To introduce basic concepts of computer graphics. 2. To understand various algorithms of object drawing and various transformation and apply them. 3. To comphend the basic operations on segments, windowing and viewing transformations. 4. Understand some classic 3D graphics algorithms. 5. To understand the basic knowledge of curves and splines. 6. To understand the basic functions of animation.	After completion of the course students will be able to: 1. Understand basics of computer graphics. 2. Apply basic algorithms for line, circle and to solve, apply and list geometric transformation matrices including rotation, translation, scaling and reflection to transform a 2D object. 3. Apply basic algorithms and methods for segments, clipping and viewing transformation. 4. Understand and implement 3D graphics algorithms. 5. To solve and plot curve and splines. 6. Understand various tools and apply to design the animation.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	Understand basics of computer graphics.	H		M						L		L	M		
2	Apply basic algorithms for line, circle and to solve, apply and list geometric transformation matrices including rotation, translation, scaling and reflection to transform a 2D object.	M		H						L		L	M		
3	Apply basic algorithms and methods for segments, clipping and viewing transformation.	M		H						L		L	L		
4	Understand and implement 3D graphics algorithms.	H		M						L		L	H		
5	To solve and plot curve and splines.	H		M						L		L	L		
6	Understand various tools and apply to design the animation.	L		L						H		H	L		
		M		M						L		L	L		

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Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
CSD2331 - OE-1: Computer Graphics

Unit No.	Contents	Max. Hrs.
1	Geometry and line generation: points, lines, pixels, planes and frame buffers, types of display devices: Raster Scan display, Flat Panel, LCD, LED Display, 3D Viewing devices, Virtual Reality Systems.Introduction of GPU.Illumination Models.	8 Hrs
2	DDA and Bresenham's line algorithms, Bresenham's algorithm for circle generation, algorithm for ellipse generation.Algorithms for polygon generation, polygon filling algorithms, NDC (normalized device co-ordinates), pattern filing, 2D transformation: scaling, rotation, translation, rotation about arbitrary point reflection, zooming.	8 Hrs
3	Graphics primitives: displays file, Segment tables, operations on segments, Graphics file formats (jpeg, Tiff, Bmp, etc). Windowing and clipping: Window, view port, viewing transformation, clipping, line and polygon clipping.	8 Hrs
4	3D Graphics: 3D primitives, projection, parallel perspective, isometric, viewing transformations, hidden surfaces and line removal, painter's algorithm, Z-buffers, Warnock's algorithm.	8 Hrs
5	Bezier and B-spline, sweeping, method of interpolation, Cubic Splines.	8 Hrs
6	Animation: Definition & introduction to animation, Basics: Animation target objects, Types, animation timings. Design of an animation sequence, general computer animation functions, raster animation, computer animation language.	8 Hrs

Textbooks:			
1	Computer Graphics C Version	Second Edition (1997)	Donald Hearn & M. Pauline Baker
2	Computer Graphics Principles and Practice	2nd edition,1996	Foley, Vandam, Feiner and Huges
Reference Books:			
1	Procedural Elements for Computer Graphics	1998	David F. Rogers
2	Computer Graphics, A Programming Approach	2nd edition, 1987	Steven Harrington

V Semester
CSD2332 - OE-1: Multimedia Design

Objective	Course Outcome
The student should be able to 1. To learn the basics and Fundamentals of Multimedia. 2. The objective of this course is to provide concept about an application, which uses a collection of multiple media sources e.g. text, graphics, images, audio, animation and video. 3. Students will learn about Multimedia, which is a field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.	**On completion of this course, the student will be able to** 1) Define what is multimedia and how it works. 2) Understand multimedia components using various tools and techniques. 3) Discuss about different types of media format and their properties. 4) Justify the right way of manipulating multimedia systems. 5) To analyze the different compression algorithms. 6) To design Multimedia Application.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Define what is multimedia and how it works.	2	2								1			1	
CO2	Understand multimedia components using various tools and techniques.	2	2								1			1	
CO3	Discuss about different types of media format and their properties.	2	2								1			1	
CO4	Justify the right way of manipulating multimedia systems.	2	2								2			1	
C05	To analyze the different compression algorithms.													1	
CO6	To design Multimedia Application	2	2							2	2			1	

V Semester
CSD2332 - OE-1: Multimedia Design

Unit No.	Contents	Max. Hrs.
1	**Introduction to Multimedia:** Definition of Multimedia, Multimedia objects: Text, Graphics, Animation, Audio, images, Video. Definition of HyperText and HyperMedia. Multimedia Applications in Education, Entertainment. Advertising world etc. Components of a Multimedia System, Desirable Features for a Multimedia System, requirements of Multimedia Communication, Applications of multimedia – benefits and problems.	6
2	**Representation of Multimedia Objects:** Representation of Analog Signals, A/D: Sampling and quantization. Text: Font and their representation (bitmap, true type) Graphics: Raster & Vector representation, aliasing problems Image: (bit depth, resolution, color (RGB, CMYK, HSB), introduction to BMP, GIF, TIFF, PNG and JPEG formats) Audio (speech and wideband audio, sampling rate and aliasing, quantisation, introduction to MP3, WMA, WAV, MIDI etc.) Video (frame rate and resolution, interlaced and non-interlaced video, colour planes (YCBCR, YUV), Video broadcast standards (PAL, NTSC, SECAM), HD Video, 3D TV, Video representation: AVI, MPEG, Quick Time, real video (.rm)	6
3	**Concepts of Multimedia Editing:** Digital Audio, Music Sequencing and Notation, Image/Graphics Editing, Video Editing (Linear, Non-linear), Subtitling	5
4	**Introduction to Compression Technology :** Concept of lossy and lossless compression. Concept of rate-distortion characteristics, Basics image compression (JPEG, JPEG 2000), Basics of Audio compression (MP3, MP4), Basics of Video Compression (MPEG, H.264)	5
5	**Multimedia Application Design:** Content design, technical design, visual design, design metaphors, example studies, interactivity	6
6	**Multimedia Authoring and Publishing :** Definition of an Authoring System, uses of an authoring system, Definition and function of Authoring Metaphor, Different Metaphors. Offline Publishing: Flash, Power Point. Online Publishing: HTML5, Dreamweaver	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Fundamentals of Multimedia		Li & Drew	Pearson Education, 2009.
2.	Multimedia Systems		Rajneesh Aggarwal & B. B Tiwari	Excel Publication, New Delhi, 2007.
3.	Multimedia making it work		Tay Vaughan	Tata McGraw-Hill, 2008.

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
CSD2332 - OE-1: Multimedia Design

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Principles of Multimedia		Parekh Ranjan	Tata McGraw-Hill, 2007
2	Introduction to Computer Graphics and Multimedia	Second Edition	Anirban Mukhopadhyay and Arup Chattopadhyay	Vikas Publishing House.

V Semester
CSD2341 - OE-2: Advanced Web Designing

Objective	Course Outcome
The student should be able to 1) Get familiar with basics of HTML, HTML tags, DHTML CSS. 2) Get familiar with client server architecture and able to develop a web application using java technologies. 3) Get familiar with markup languages with their structures and syntax. 4) To get familiarized with JS frame work	**On completion of this course, the student will be able to** 1) Understand the different tags of HTML and Implement interactive web pages using HTML , DHTML and CSS. 2) Understand client server architecture and Develop interactive web pages using java script and client and server side programming. 3) Understand the concept of Markup languages and Make the use of mark up languages in development of web pages. 4) Understand the concepts of Node JS and Angular JS and Develop web applications using Node and Angular JS.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the different tags of HTML and Implement interactive web pages using HTML , DHTML and CSS.														
CO2	Understand client server architecture and Develop interactive web pages using java script and client and server side programming.														
CO3	Understand the concept of Markup languages and Make the use of mark up languages in development of web pages.														
CO4	Understand the concepts of Node JS and Angular JS and Develop web applications using Node and Angular JS.														

V Semester
CSD2341 - OE-2: Advanced Web Designing

Unit No.	Contents	Max. Hrs.
1	Creation of web pages: HTML tags, special characters, images, tables, forms, the hyperlinks, Frames	8
2	Dynamic HTML (DHTML): Introduction, Cascading Style Sheets (CSS), DHTML Document Object Model and Collections [8 Hrs]	8
3	Scripting Languages:- Java Script objects and forms, server side and client side scripting languages	6
4	XML:XML basics, understanding mark-up languages, structures and syntax, valid Vs. Well formed XML, DTD (document type Definitions) classes, Element Type Declaration, Attribute Declarations, Limitations of DTDs, XML processor, Introduction to Schema, Complex Types, Extensible Style sheet Language Transformations (XSLT),Basics of Parsing	7
5	The importance of being asynchronous, Blocking vs. non-blocking code, Server-side JavaScript, What is Node.js?, Why use Node.js?,Features, Process Model, Setup Node.js Development Environment, Node.js Basics, Node.js Module, File System	7
5	The importance of being asynchronous, Blocking vs. non-blocking code, Server-side JavaScript, What is Node.js?, Why use Node.js?,Features, Process Model, Setup Node.js Development Environment, Node.js Basics, Node.js Module, File System	7
6	Introduction to AngularJS, AngularJS Expressions: Numbers, Strings, Objects, Arrays, Expressions using {{ }} and ng-bind. Modules: Creating a module, adding a controller & directive, myApp.js, myCtrl.js, Loading library. Directives: Data Binding, ng-init, ng-repeat, ng-app & ng-model directives, custom directives.2 way binding, Validating User Input, Status, ng-empty, ng-touched, ng-valid, ngpending. Data Binding: Synchronization between model and view. AngularJS Controllers: ng-controller, Controller Methods, External Files.Scope: $scope, understanding the scope, $rootScope	7

Text Books

SN	Title	Edition	Authors	Publisher
1	The Complete Reference HTML and XHTML	5th Edition	Thomas A.Powell	McGraw Hill Pub
2	Learning angular JS		Dayley, Brad Dayley	

Reference Books

SN	Title	Edition	Authors	Publisher
1	Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites	3rd	**Robin Nixon**	O'RELLY

V Semester
CSD2342 - OE2 – Virtual Reality

Objective	Course Outcome
The student should be able to	**On completion of this course, the student will be able to**
1) This course is designed to give historical and modern overviews and perspectives on virtual reality. 2) It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.	1. Describe how VR systems work and list the applications of VR. 2. Understand the design and implementation of the hardware that enables VR systems tobe built. 3. Understand the system of human visionand its implication on perception and rendering. 4 Explain the concepts of motion and tracking in VR systems.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1															
CO2															
CO3															
CO4															

V Semester
CSD2342 - OE2 – Virtual Reality

Unit No.	Contents	Max Hrs
1	**Introduction to Virtual Reality:** Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.	**7**
2	**Representing the Virtual World** Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR	**8**
3	**The Geometry of Virtual Worlds &The Physiology of Human Vision** Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.	**7**
4	**Visual Perception & Rendering** Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates	**7**
5	**Computer Graphics And Geometric Modelling:** Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Colour theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models, Shading algorithms. Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection.	**7**
5	**Computer Graphics And Geometric Modelling:** Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Colour theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models, Shading algorithms. Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection .	**7**
6	**AR / VR Applications:** Introduction, Engineering, Entertainment, Science, Training	**7**

V Semester
CSD2342 - OE2 – Virtual Reality

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Virtual Reality		M. LaValle	Cambridge University Press, 2016
2	,Understanding Virtual Reality", Interface, Application and Design		William R Sherman and Alan B Craig	(The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	3D User Interfaces, Theory and Practice",		Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev	Addison Wesley, USA, 2005.

V Semester
Audit Course
AU2126 : YCCE Communication Aptitude Preparation (YCAP5.1)

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

6th Semester

(Department of Information Technology)

Computer Science and Design

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Information Technology)

Computer Science and Design

SoE No. CSD-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE
							L	T	P	Hrs		MSEs*	TA**	ESE	
Six Semester															
1	6	HS	IT	CSD2351	Management Studies	**T**	3	0	0	3	3	30	20	50	3 Hours
2	6	PC	IT	CSD2352	Software Architecture & Design	**T**	3	0	0	3	3	30	20	50	3 Hours
4	6	PC	IT	CSD2353	Computer Game Design and Programming	**T**	3	0	0	3	3	30	20	50	3 Hours
5	6	PC	IT	CSD2354	Lab: Computer Game Design and Programming	**P**	0	0	2	2	1		60	40	
6	6	PE2	IT		**Professional Elective-II**	**T**	3	0	0	3	3	30	20	50	3 Hours
7	6	PE2	IT		**Professional Elective-II Lab**	**P**	0	0	2	2	1		60	40	
8	6	STR	IT	CSD2355	Design Workshop	**P**	0	0	4	4	2		60	40	
9	6	OE3	IT		**Open Elective-III**	**T**	3	0	0	3	3	30	20	50	3 Hours
10	6	OE4	IT		**Open Elective-IV**	**T**	3	0	0	3	3	30	20	50	3 Hours
					TOTAL SIX SEM		**18**	**0**	**8**	**26**	**22**				

Professional Elective 2					
1	6	**PE2**	IT	CSD2361	Multimedia Design & Processing
	6	**PE2**	IT	CSD2362	**Lab:** Multimedia Design & Processing
2	6	**PE2**	IT	CSD2363	Advanced Web Designing
	6	**PE2**	IT	CSD2364	**Lab**: Advanced Web Designing
3	6	**PE2**	IT	CSD2365	Design Manufacturing and Assembly
	6	**PE2**	IT	CSD2366	**Lab.:** Design Manufacturing and Assembly
4	6	**PE2**	IT	CSD2367	UX &UI Design
	6	**PE2**	IT	CSD2368	**Lab.** UX &UI Design
5	6	**PE2**	IT	CSD2369	Introduction to Deep Learning
	6	**PE2**	IT	CSD2370	**Lab.:** Introduction to Deep Learning
Open Elective -III					
1	6	**OE3**	IT	CSD2381	Computer Graphics
2	6	**OE3**	IT	CSD2382	Multimedia Design
Open Elective- IV					
3	6	**OE4**	IT	CSD2391	Advanced Web Designing
4	6	**OE4**	IT	CSD2392	Virtual Reality

Audit Courses												
1	6	HS		AU2130	YCCE Communication Aptitude Preparation (YCAP6.3) for CT, IT, CSE, IIoT, AIDS, CSD, AIML	**A**	3	0	0	3	0	

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

VI Semester
CSD2351- MANAGEMENT STUDIES

Objectives	Outcomes Students will be able to
1. To introduce the fundamentals and legal provision of management 2. To introduce the Human Resource and Financial practice of Organisation 3. To introduce the Project Management 4. To provide knowledge of Marketing activities of Management	1. Explain the legal provision and function of management 2. Analyze the role of Human Resource and Financial Management in the Organisation 3. Analyze the Project life Cycles 4. Identify tools and techniques for the marketing of goods and services

Unit No.	Contents	Max. Hrs.
1	**Unit – 1 - Principle of Management** Evolution of Management Thought : Scientific and Administrative Theory of Management, Definition and Concept of Management, Functions of Management : Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership.	6
2	**UNIT-2: Legal Aspects of Management** The Indian Contract Act, 1872 – Formation of Valid Contract, Discharge of Contract, Quasi Contract, Indemnity and Guarantee. The Indian Partnership Act, 1932- Essentials of Partnership, The Companies Act – Nature and Definition of Company, Registration and Incorporation, Memorandum and Article of Association, Kinds of companies, Winding up of the Company.	6
3	**UNIT-3: Human Resource Management** Human Resource Management-Meaning and Scope, Principles of HRD, Job Analysis – Job Description and Job Specification, Job Enrichment, Job Rotation, Training and Development – Purpose and Methods, Performance Appraisal- Purpose, Procedure and Techniques, Grievance Redressal Procedure .	6
4	**UNIT-4: Engineering Project Management** Concept, Classification and Characteristics of Project, Project Life Cycle, Project Proposal, Tools and Techniques of Project Management, Network techniques - Introduction and Use of CPM &PERT for planning, SWOT Analysis, Project Risk Analysis, Project Control.	6
5	**UNIT-5: Marketing Management** Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting.	6
6	**UNIT-6: Financial Management** Definition & Functions of Finance department, Sources of finance, Types of capital, Profit maximization vs. Wealth maximization, Functions of Finance Manager in Modern Age, Concept of Risk and Return , Break Even Analysis, Budgets & Budgetary Control, Make or Buy Analysis, Introduction to financial statement – profit and loss A/c and Balance Sheet.	6

Text book and Reference

1. Harold Koontz Ramchandra, Principles of Management, Tata McGrow hills
2. Bare Acts – Indian Contract Act, Indian Partnership Act and Company Law
3. Dr. V.S.P.Rao - Human Resource Management - Text and Cases
4. C.B.Mamoria and S.V.Gankar, A Text book of Human Resource Management,
5. Lock, Gower - Project Management Handbook
6. Ramaswamy V.S. and Namakumari S - Marketing Management: Planning, Implementation and Control (Macmillian, 3rd Edition).
7. Rajan Saxena: Marketing Management, Tata McGraw Hill.
8. Fabozzi - Foundations of Financial Markets and Institutions (Pretice hall, 3rd Ed.)
9. Parameswaran- Fundamentals of Financial Instruments (Wiley India)
10. Bhole L M - Financial Institutions and Markets (Tata McGraw-Hill, 3rd edition, 2003)
11. Khan M Y - Financial Services (Tata Mc Graw Hill, 19)

VI Semester
CSD2352 - Software Architecture & Design

Objective	Course Outcome
The student should be able to 1. To understand the different Software Process Model and Architectural Style for Developing a Software 2. To acquire knowledge of Different Software Testing Techniques 3. To understand the various UML Diagrams 4. To understand different Tools and Techniques for Engineering Practice.	**On completion of this course, the student will be able to** 1. Analyze and evaluate the different software process model and appropriate architectural style while developing a software 2. Understand and Apply the software testing techniques in a variety of ways to test the software. 3. Analyze and design various UML diagram and UML based design and analysis with the help of various diagrams. 4. Demonstrate an ability to use the techniques and tools necessary for engineering practice

Unit No.	Contents:	Max. Hrs.
1	Introduction to Software Engineering .A Generic View of process, and project management, Process model, CMM, Requirement Engineering : Eliciting Requirement ,Developing Use Case ,Analysis Model, Negotiation, Validation , Building the Analysis model : Requirement Analysis ,Analysis Modeling Approaches, Data Modeling	8
2	Design Engineering: Design Concept, Design Model, Pattern Based Software Design, Architectural Design: Software Architecture., Data Design, Architectural style, Architectural design , Mapping Data Flow into a Software Architecture ,Component Level Design , User Interface Analysis and Design ,Interface Analysis, Interface Design steps, Design Evaluation	8
3	Testing Strategies: Strategic Approach, Strategic issues, Strategies for conventional Software, Validation Testing, Testing Tactics: White Box Testing, basic Path testing, Control Structure Testing, Black Box Testing, Object Oriented Testing Method, Testing Method applicable at class Level, Interclass Test Case Design. Metrics: Software Quality.	6
4	Project Management, KPES for project management, Metrics for Process and Projects, Project Estimation, Project Scheduling, Risk Management, Quality Management and Change Management	7
5	Overview of UML, Conceptual Models of the UML, UML and Design Patterns, Applying the UML, UML Diagrams for Payroll processing systems, ATMS, small companies etc	7
6	Advanced Topics in Software Engineering: Case studies based on recent Trends, Reengineering, and CASE tools, client server software Engineering. CORBA	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Software Engineering -A Practitioner's Approach	Seventh Edition	Roger S. Pressman	Pressman
2	Object Oriented Software Engineering	2nd Edition,2005	Lethbridge and Pearson	Pearson Education

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Software Engineering	10th Edition, 2014,	I. Somerville	Oxford University Press
2	An integrated approach to software Engineering'	3rd Edition,1991,	Dr. Pankaj Jalota	Narosa Pub

VI Semester

CSD2353 - Computer Game Design and Programming

Objective	Course Outcome
The student should be able to 1) To be familiar with the workflow for creating 2D video games 2) To be familiar with usage of subcomponents of game engines such as graphics, physics and audio engines 3) be familiar with usage of subcomponents of game engines such as graphics, physics and audio engines. 4) get familiarity with creating game assets such as sprites, tiles, textures and audio	**On completion of this course, the student will be able to** 1) Understand different types/genres of video games and the components thereof. 2) Able to write scripts which control the behavior of different game components. 3) Able to create realistic scenes and environments. 4) Able to design, write and deploy 2D video games 5) Apply hands-on experience with game engines, e.g., Unity.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand different types/genres of video games and the components thereof	3												3	
CO2	Able to write scripts which control the behavior of different game components		3									2		3	
CO3	Able to create realistic scenes and environments			3								2		3	
CO4	Able to design, write and deploy 2D video games			3	3							2		3	
CO5	Apply hands-on experience with game engines, e.g., Unity.	3	3	3	3	3						2		3	

Unit No.	Contents	Max. Hrs.
1	Motivation; Types of games, Different aspects of game design; Different components in a game; Game engines; Geometric primitives, 2D and 3D linear transforms, Homogeneous matrices; Examples of games	6
2	Different image formats; Polygon file formats; Creating sprites; Rigging; Animations using sprite-sheets; Animations using key frames; Animation controllers. Setting up a project, Scene View, Game View, Inspector, Console ,Hierarchy ,GameObjects, Prefabs, Components	6
3	Scenes; Tiles, visual continuity in tiles; Adding objects to scene; Prefabs; Lighting, RGB space, transparency, texture mapping; Collectibles; Navigation and path finding,Input Methods,invoke(),Start() and Awake(), Game Loops,Update(), FixedUpdate() and LateUpdate(),Singletons,Coroutines, Enumerators.	6
4	Physics engines; Gravity simulation; Rigid body interaction; Collisions. Rigidbody Components, Unity Colliders, Physics Materials, Scripting Collision Events	6
5	Layout; Menu system; Visual components; Event system; Skins,Canvas,Buttons,Anchors ,Pivots ,RectTransform vs Transforms,UI Design Concepts	6
6	Audio assets; Different audio formats; Audio mixing.	5

Text Books

SN	Title	Edition	Authors	Publisher
1	Game Programming Patterns	3rd edition	Nystrom Robert	Genever Benning

Reference Books

SN	Title	Edition	Authors	Publisher
1	Unity Game Development Cookbook: Essentials for Every Game	1st Edition	Paris Buttfield-Addison	O'Reilly Media

VI Semester
CSD2354 - LAB.: Computer Game Design and Programming

Objective	Course Outcome
The student should be able to 1. To be familiar with the workflow for creating 2D video games 2. To be familiar with usage of subcomponents of game engines such as graphics, physics and audio engines 3. be familiar with usage of subcomponents of game engines such as graphics, physics and audio engines. 4. get familiarity with creating game assets such as sprites, tiles, textures and audio	**On completion of this course, the student will be able to** 1. Understand different types/genres of video games and the components thereof. 2. Able to write scripts which control the behavior of different game components. 3. Able to create realistic scenes and environments. 4. Able to design, write and deploy 2D video games 5. Apply hands-on experience with game engines, e.g., Unity.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand different types/genres of video games and the components thereof	3												3	
CO2	Able to write scripts which control the behavior of different game components		3									2		3	
CO3	Able to create realistic scenes and environments			3								2		3	
CO4	Able to design, write and deploy 2D video games			3	3							2		3	
CO5	Apply hands-on experience with game engines, e.g., Unity.	3	3	3	3	3						2		3	

List of Practical's

Sr.	Problem Statements
1	Introduction of C#, Variables, If else
2	Program by using Loops, Arrays, Enums
3	Installation of a game engine, e.g., Unity, familiarization of the GUI. Conceptualize the theme for a 2D game
4	Character design, sprites.
5	movement and character control
6	Level design: design of the world in form of tiles along with interactive and collectible objects
7	Design of interaction between the player and the world, optionally using the physics engine.
8	Design of menus and user interaction in mobile platform.
9	Insert audio
10	Project

VI Semester

CSD2361- PE2: Multimedia Design & Processing

Objective	Course Outcome
The student should be able to 1. To introduce Multimedia components and Tools. 2. The objective of this course is to provide a basic knowledge about processing and editing of multimedia content with more emphasis on image processing. 3. The students will be able to understand how to create, edit and modify the multimedia content using different software tools.	**On completion of this course, the student will be able to** 1. To understand concept of multimedia design & processing 2. To analyze the different multimedia design. 3. To apply various operations using Multimedia tool 4. To design user interface and case study on different android applications 5. Expert talk on the recent advancements of media, society and ethics.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	To understand concept of multimedia design & processing	2	2								2				
CO2	To analyze the different multimedia design.	2	2	3							2				
CO3	To apply various operations using Multimedia tool	2	2	3		2					2				
CO4	To design user interface and case study on different android applications	2	2	3		2					2				1
CO5-	Expert talk on the recent advancements of media, society and ethics.	2									3				1

Unit No.	Contents	Max. Hrs.
1	**Design Overview:** Need for design, Human factors, fundamentals of Human perception, Human skill level and behavior, dialogues and tasks, Learning and Learning Modes, Cognitive Domain Learning, Affective and Psychomotor Domain Learning, Multimedia Educational Software Modeling, System Quality, Elements of user Interface.	6
2	**Multimedia Authoring and User Interface**: Multi Media Authoring System and its type, Hypermedia Application Design consideration, User Interface Design, Information Access, Object Display / Playback Issues	6
3	**Human Computer Interface Design:** Information design, interaction and sensorial design, guidelines for user interface design, dialogue design, Cognitive Walkthrough- case studies/ examples – Different Android applications, like Talking Tom, Monkey Trap etc.	5
4	**Multimedia Tool** : Introduction to Multimedia tool – Flash, Creating & Modifying elements, Line tool, fill/attributes, different shapes, text tools & pen tool, Selecting lines fill with arrow tool, selecting shapes, using lasso tool ,performing basic editing tools, selecting & deselecting elements, modifying created objects.	5
5	**Animation Technology:** Definition, History of Animation, Types of Animation – 2D and 3D , Basic principles of animation. Introduction to Multimedia tool – Flash, Creating & Modifying elements, Line tool, fill/attributes, different shapes, text tools & pen tool, Selecting lines fill with arrow tool, selecting shapes, using lasso tool, performing basic editing tools, selecting & deselecting elements, modifying created objects.	6
6	**Animation Design:** i. Introduction & Learning perspective drawing - Drawing for Animation: Gesture Drawing, Action Drawing, Line of action, Dynamic Poses, Action Sketches (Key Poses) ii. 2D Design concepts & Composition. iii. Principles of Animation. iv. Process of 2D Animation film making. v. Editing & Animatics. vi. Input Sound- Sound Effects – Sound Recording. vii. Designing, Developing Characters (Realistic, Exaggerated & Stylized)	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Principles of Multimedia		Parikh	Tata McGraw Hill Education Pvt Ltd , New Delhi
2.	Multimedia Technologies		Rajneesh Aggarwal & B. B Tiwari	Excel Publication, New Delhi, 2007.
3.	Multimedia making it work		Tay Vaughan	Tata McGraw-Hill, 2008.

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Principles of Multimedia		Parekh Ranjan	Tata McGraw-Hill, 2007
2	Introduction to Computer Graphics and Multimedia	Second Edition	Anirban Mukhopadhyay and Arup Chattopadhyay	Vikas Publishing House.

VI Semester
CSD2362-PE2:LAB: Multimedia Design & Processing

List of Practical's

Sr. No.	Problem Statements
1	Installation of various multimedia software like Photoshop/GIMP, Blender, Flash, Director or any open source software
2	Installing and use of various multimedia devices - Scanner - Digital camera, web camera - Mike and speakers Touch screen - Plotter and printers - DVD - Audio CD and Video CD
3	Reading and writing of different format on CD/DVD
4	Transporting audio and video files
5	Using various features of Flash
6	Using various features of Photo-shop/GIMP
7	Using various features of Blender
8	Making multimedia presentations combining, Flash, Photo-shop/GIMP, such as department profile, lesson presentation, games and project presentations.

VI Semester
CSD2363-: PE-2: Advanced Web Designing

Objective	Course Outcome
The student should be able to 1) Get familiar with basics of HTML, HTML tags, DHTML CSS. 2) Get familiar with client server architecture and able to develop a web application using java technologies. 3) Get familiar with markup languages with their structures and syntax. 4) To get familiarized with JS frame work	**On completion of this course, the student will be able to** 1) Understand the different tags of HTML and Implement interactive web pages using HTML , DHTML and CSS. 2) Understand client server architecture and Develop interactive web pages using java script and client and server side programming. 3) Understand the concept of Markup languages and Make the use of mark up languages in development of web pages. 4) Understand the concepts of Node JS and Angular JS and Develop web applications using Node and Angular JS.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	and the different tags of HTML and Implement interactive web pages using HTML , DHTML and CSS.														
CO2	and client server architecture and Develop interactive web pages using java script and client and server side programming.														
CO3	and the concept of Markup languages and Make the use of mark up languages in development of web pages.														
CO4	and the concepts of Node JS and Angular JS and Develop web applications using Node and Angular JS.														

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Unit No.	Contents	Max. Hrs.
1	Creation of web pages: HTML tags, special characters, images, tables, forms, the hyperlinks, Frames	8
2	Dynamic HTML (DHTML): Introduction, Cascading Style Sheets (CSS), DHTML Document Object Model and Collections	8
3	Scripting Languages:- Java Script objects and forms, server side and client side scripting languages	6
4	XML:XML basics, understanding mark-up languages, structures and syntax, valid Vs. Well formed XML, DTD (document type Definitions) classes, Element Type Declaration, Attribute Declarations, Limitations of DTDs, XML processor, Introduction to Schema, Complex Types, Extensible Style sheet Language Transformations (XSLT),Basics of Parsing	7
5	The importance of being asynchronous, Blocking vs. non-blocking code, Server-side JavaScript, What is Node.js?, Why use Node.js?,Features, Process Model, Setup Node.js Development Environment, Node.js Basics, Node.js Module, File System	7
6	Introduction to AngularJS, AngularJS Expressions: Numbers, Strings, Objects, Arrays, Expressions using {{ }} and ng-bind. Modules: Creating a module, adding a controller & directive, myApp.js, myCtrl.js, Loading library. Directives: Data Binding, ng-init, ng-repeat, ng-app & ng-model directives, custom directives.2 way binding, Validating User Input, Status, ng-empty, ng-touched, ng-valid, ngpending. Data Binding: Synchronization between model and view. AngularJS Controllers: ng-controller, Controller Methods, External Files.Scope: $scope, understanding the scope, $rootScope	6

Text Books

Title	Edition	Authors	Publisher
The Complete Reference HTML and XHTML	5th Edition	Thomas A.Powell	McGraw Hill Pub
Learning angular JS		Dayley, Brad Dayley	

Reference Books

SN	Title	Edition	Authors	Publisher
1	Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites	3rd	**Robin Nixon**	O'RELLY

VI Semester
CSD2365- Design for Manufacture and Assembly

Objectives:	Course outcomes:
1. Understand the complex interrelationships between design and manufacturing 2. Explore and understand basic manufacturing processes and the design for manufacturing (DFM) implications of design choices for specific manufacturing processes 3. Use assembly considerations and assembly costs in evaluations 4. Learn modern manufacturing philosophies and practices\ 5. Understand the role of software applications in evaluating designs for manufacturing and assembly costs; understand approaches and practices related to CAD model building and model checking for specific manufacturing processes such as models for sheet metal and models for casts and molds 6. Learn quality related programs in manufacturing	1. Understand that Design for Manufacture and Assembly (DFMA) is an important aspect of product development and promotes early involvement of manufacturing in design 2. Learn a systematic procedure to analyze a proposed design from the point of view of assembly and manufacturing 3. Quantitatively evaluate the impact of design choices on manufacturing cost 4. Get familiar with key concepts in various new manufacturing paradigms and practices related to lean manufacturing

Unit No.	Contents	Max. Hrs.
1	**Unit 1:Introduction to DFMA** History of DFMA, Steps for applying DFMA during product design, Advantages of applying DFMA during product design, Reasons for not implementing DFMA, Introduction to Manufacturing Process: Classification of manufacturing process, Basic manufacturing processes, Mechanical properties of material: Tensile properties, Engineering stress-strain, True stress strain, Compression properties, Shear properties, Introduction to materials and material selection: Classification of engineering materials, Material selection for product design	7
2	**Unit 2: Sand casting** Introduction to sand casting, Typical characteristics of a sand cast part, Design recommendation for sand casting, Investment casting: Introduction, Steps in investment casting, Design consideration of Investment casting, Typical characteristics and applications, Die casting: Introduction to die casting, Advantages of the die casting process, Disadvantages of the die casting process, Applications, Suitable material consideration, General design consideration, Specific design recommendation, Injection moulding: Introduction to injection moulding, Typical characteristics of injection moulded parts, Effect of shrinkage, Suitable materials, Design recommendations, Design for powder metal processing: Introduction to powder metal processing, Typical characteristics and applications, Limitations, Design recommendations.	7

Unit No.	Contents	Max. Hrs.
3	**Unit 3: Design for machining** Introduction to machining, Recommended materials for machinability, Design recommendations, Design for tuning operation: Process description, Typical characteristics and applications, Suitable materials, Design recommendations, Design for machining round holes: Introduction,Suitable materials, Design recommendations, Recommended tolerances, Parts produced by milling: Process description, Characteristics and applications of parts produced on milling machines, Design recommendations for milling, Dimensional factors and tolerances, Parts produced by planning, shaping and slotting: Process description, Design recommendation planning, Design for broached parts: Process description, Typical characteristics of broached parts, Suitable materials for broaching, Design recommendations.	7
4	**Unit 4 Metal Extrusion** Process, Suitable material for extrusion, Design recommendation for metal extrusion, Metal stamping: Process, Characteristics and application of metal stamping, Suitable materials for stamping, Design Recommendations for metal stamping, Fine blanked parts: Fine blanking process, Material suitable for fine blanked parts, Design recommendations for piece parts, Rolled formed section: Process, Design recommendations rolled section, Impact or cold extrusion: Process, Design recommendations for backward extrusion, Forward extrusion: Process, Design recommendations for forward extrusion, Design for Forging: Forging processes, Forging nomenclature, Suitable materials for forging, Design recommendations, Metal injection moulded parts: Process, Materials suitable, Design recommendations for metal injectionmolded parts.	8
5	**Unit 5 Design for cleaning** Introduction to cleaning process, In-process cleaning operations, Cleaning processes and their applications, Design recommendations, Design for polishing and plating: Introduction to Polishing processes, Design recommendations for polishing process, Design for plated surface: Electroplating process, Typical characteristics, Design recommendations for plating, Hot Dip Metallic Coating: Process, Design recommendations for Hot Dip Metallic coating, Thermal sprayed coating: Process, Design recommendations for thermal sprayed coating, Vacuum Metalized surfaces: The process, Typical characteristics and applications, Design recommendations, Design for heat treatment: Introduction to heat treatment, Heat treating process for steel, Applications of heat-treated parts, Design recommendations for heat treatment	8
6	**Unit 6 Introduction to Assembly** The assembly process, Characteristics and applications, Example of common assembly,Economic significance of assembly, General taxonomies of assembly operation and systems,Assembling a product, Design for Assembly: Introduction, Design consideration, Design for Fasteners: Introduction, Design ecommendation for fasteners.	7

VI Semester
CSD2367 - UX &UI Design

Objective	Course Outcome
The student should be able to 1. To study and understand interface design tools, and demonstrate the Interaction between the human and computer components 2. To study and understand the screen designing and its various concepts with design rules 3. To study and understand software tools related to Design process. 4. To understand the interaction devices.	**On completion of this course, the student will be able to** 1. Understand the definition and principles of UI/UX Design in order to design with intention. 2. Achieve a deep understanding of the entire life-cycle of design—the process, purpose, and tools. 3. Learn the basics of HCI (human-computer interaction) and the psychology behind user decision-making. 4. Discover the industry-standard tools and specific project deliverables in UI/UX.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the definition and principles of UI/UX Design in order to design with intention.	3	3	3		3								2	
CO2	Achieve a deep understanding of the entire life-cycle of design—the process, purpose, and tools.	2	2	2		3								2	
CO3	Learn the basics of HCI (human-computer interaction) and the psychology behind user decision-making	3	3	3		2								2	
CO4	Discover the industry-standard tools and specific project deliverables in UI/UX.	2	2	2		2								2	

Unit No.	Contents	Max. Hrs.
1	**INTRODUCTION** Human–Computer Interface – Characteristics Of Graphics Interface –Direct Manipulation Graphical System – Web User Interface –Popularity –Characteristic & Principles.	6
2	**HUMAN COMPUTER INTERACTION** User Interface Design Process – Obstacles –Usability –Human Characteristics In Design – Human Interaction Speed –Business Functions –Requirement Analysis – Direct – Indirect Methods – Basic Business Functions – Design Standards – System Timings – Human Consideration In Screen Design – Structures Of Menus – Functions Of Menus– Contents Of Menu– Formatting – Phrasing The Menu – Selecting Menu Choice– Navigating Menus– Graphical Menus.	5
3	**WINDOWS** Characteristics– Components– Presentation Styles– Types– Managements– Organizations– Operations– Web Systems– Device– Based Controls Characteristics– Screen – Based Controls – Operate Control – Text Boxes– Selection Control– Combination Control– Custom Control– Presentation Control.	5
4	**MULTIMEDIA** Text For Web Pages – Effective Feedback– Guidance & Assistance– Internationalization– Accessibility– Icons– Image– Multimedia – Coloring.	5
5	**WINDOWS LAYOUT– TEST** Prototypes – Kinds Of Tests – Retest – Information Search – Visualization – Hypermedia – WWW– Software Tools.	6
6	**INTRODUCTION TO ACTIVE ELEMENTS OF INTERFACE DESIGN:** Static to Active, Functionality, Speed and Style, Composition and Structure, Buttons, Not Buttons, States and Changes	6

Text Books

SN	Title	Edition	Authors	Publisher
1.	Designing the user interface	3 rd Edition	Ben Shneiderman	Pearson Education Asia, 2004
2	The essential guide to user interface design	-	Wilbert O Galitz	Wiley DreamTech, 2009

Reference Books

SN	Title	Edition	Authors	Publisher
1	The Essential Of User Interface Design", Timings		Alan Cooper,	Wiley – Dream Tech Ltd., (published in 2002)

VI Semester
CSD2368 - Lab. UX &UI Design

Objective	Course Outcome
The student should be able to 1. To study and understand interface design tools, and demonstrate the Interaction between the human and computer components 2. To study and understand the screen designing and its various concepts with design rules 3. To study and understand software tools related to Design process. 4. To understand the interaction devices.	**On completion of this course, the student will be able to** 1. Understand the definition and principles of UI/UX Design in order to design with intention. 2. Achieve a deep understanding of the entire life-cycle of design—the process, purpose, and tools. 3. Learn the basics of HCI (human-computer interaction) and the psychology behind user decision-making. 4. Discover the industry-standard tools and specific project deliverables in UI/UX.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Understand the definition and principles of UI/UX Design in order to design with intention.	3	3	3		3								2	
CO2	Achieve a deep understanding of the entire life-cycle of design—the process, purpose, and tools.	2	2	2		3								2	
CO3	Learn the basics of HCI (human-computer interaction) and the psychology behind user decision-making	3	3	3		2								2	
CO4	Discover the industry-standard tools and specific project deliverables in UI/UX.	2	2	2		2								2	

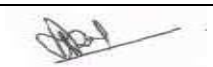
List of Practical's

Sr. No..	Problem Statements
1	PART-1 Lab based o Formal Elements of Interface Design (Introductory Part) (Demonstration of available open source tool for designing)
2	PART-2 Lab based Active Elements of Interface Design • Imagery • Typography
3	PART-2 Lab based Active Elements of Interface Design • Design Before Design • Look and Feel
4	PART-2 Lab based Active Elements of Interface Design • Language as a design tool • Color and Shape
5	PART-2 Lab based Active Elements of Interface Design • Language as a design tool • Color and Shape
6	PART-2 Lab based Active Elements of Interface Design • Icons
7	PART-3 Lab based composing the Elements of Interface Design • Static to Active • Functionality • Buttons
8	PART-3 Lab based composing the Elements of Interface Design • Speed and Style • Composition and Structure
9	PART-3 Lab based composing the Elements of Interface Design Not Buttons • States and Changes
10	Case study based on complete UI/UX Designing on the selected application with the use of open source tool.

VI Semester
CSD2369 - Introduction to Deep Learning

Objective	Course Outcome
• Understand complexity of Deep Learning algorithms and their limitations. • Understand modern notions in data analysis oriented computing; • Be capable of confidently applying common Deep Learning algorithms in practice and implementing their own; • Be capable of performing experiments in Deep Learning using real-world data.	**On completion of this course, the student will be able to** • Comprehend the neural networks as means for computational learning and to analyze the basic network architectures and algorithms for supervised and unsupervised learning. • Recognize the characteristics of deep learning models that are useful to solve real-world problems. • Understand the motivation for different neural network architectures and select the appropriate architecture for a given problem. • Build deep learning models and interpret the results

Unit No.	Contents	Max. Hrs.
1	**Fundamentals of Artificial Neural Networks:** Overview of Artificial Intelligence, Types of AI, Machine Learning, Types of Learning algorithms, relation between AI, ML, and DL, Overview of Neural Network, Types of ANN, Feed forward NN,The McCulloch-Pitts Network, Perceptron, Multi-Layer Perceptron Activation Functions : Sigmoid, ReLU, Leaky ReLU,Hyperbolic, Softmax.	7
2	**Gradient Descent and Backpropagation**: Gradient Descent, Stochastic Gradient Descent, Mini-Batch Gradient Descent, Backpropagation, Momentum based Gradient descent, Nestrov Accelerated Gradient, Some problems in ANN **Optimization and Regularization** : Error functions, Overfitting and Capacity, Cross Validation, Feature Selection, Weight Regularization, L1 & L2 Regularization, Hyper-parameters.	7
3	**Introduction to Convolutional Neural Networks:** Introduction to CNNs, Components of CNN Architecture: Convolutional layer, Pooling/Down-sampling layer, Flattening layer, Fully connected Layer, Receptive fields, Feature Maps, Filters and Activation Maps, Padding, Properties of CNN, Architecture of CNN(LeNet, AlexNet, ZFNet, GoogleNet, VGGNet, ResNet, DenseNet), Applications of CNN.	8
4	**Introduction to Recurrent Neural Networks:** Introduction to RNNs, Challenges with vanishing and exploding gradients, Unfolded RNNs, Seq2Seq RNNs, LSTM, Gated Recurrent Unit(GRU), RNN applications	8
5	**Deep Unsupervised Learning: Autoencoders :** Features, Types (Vanilla, Multilayer, Stacked, Deep, Denoising, Convolutional, Regularized), Variational Autoencoders, Generative Adversarial Networks, Cycle GAN	8
6	**Deep Learning applications**: Object Detection Method using CNN, Region based CNN, Fast R-CNN, Faster RCNN, Region Proposal Network, YOLO , SSD.	8

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Deep Learning		Good fellow, I.,Bengio,Y., and Courville, A.	MIT Press, 2016.

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Pattern Recognition and Machine Learning		Bishop, C. ,M.	Springer, 2006.
2	Neural Network and Deep Learning		Charu C Agarwal	Springer
3	Lecture slides of Prof. Fei Fei Li's, Stanford University, USA. Andrew Ng, Coursera Course on CNN.			

VI Semester
CSD2381- OE-3: Computer Graphics

Course Learning Objective	Course Outcomes
Student will study : 1. To introduce basic concepts of computer graphics. 2. To understand various algorithms of object drawing and various transformation and apply them. 3. To comphend the basic operations on segments, windowing and viewing transformations. 4. Understand some classic 3D graphics algorithms. 5. To understand the basic knowledge of curves and splines. 6. To understand the basic functions of animation.	After completion of the course students will be able to: 1. Understand basics of computer graphics. 2. Apply basic algorithms for line, circle and to solve, apply and list geometric transformation matrices including rotation, translation, scaling and reflection to transform a 2D object. 3. Apply basic algorithms and methods for segments, clipping and viewing transformation. 4. Understand and implement 3D graphics algorithms. 5. To solve and plot curve and splines. 6. Understand various tools and apply to design the animation.

Course Outcomes	Statement	Mapped PO												PSPO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	Understand basics of computer graphics.	H		M						L		L	M		
2	Apply basic algorithms for line, circle and to solve, apply and list geometric transformation matrices including rotation, translation, scaling and reflection to transform a 2D object.	M		H						L		L	M		
3	Apply basic algorithms and methods for segments, clipping and viewing transformation.	M		H						L		L	L		
4	Understand and implement 3D graphics algorithms.	H		M						L		L	H		
5	To solve and plot curve and splines.	H		M						L		L	L		
6	Understand various tools and apply to design the animation.	L		L						H		H	L		
		M		M						L		L	L		

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UNIT I		**[08 Hrs.]**
Geometry and line generation: points, lines, pixels, planes and frame buffers, types of display devices: Raster Scan display, Flat Panel, LCD, LED Display, 3D Viewing devices, Virtual Reality Systems.Introduction of GPU.Illumination Models.		
UNIT II		**[08 Hrs.]**
DDA and Bresenham's line algorithms, Bresenham's algorithm for circle generation, algorithm for ellipse generation.Algorithms for polygon generation, polygon filling algorithms, NDC (normalized device co-ordinates), pattern filing, 2D transformation: scaling, rotation, translation, rotation about arbitrary point reflection, zooming.		
UNIT III		**[08 Hrs.]**
Graphics primitives: displays file, Segment tables, operations on segments, Graphics file formats (jpeg, Tiff, Bmp, etc). Windowing and clipping: Window, view port, viewing transformation, clipping, line and polygon clipping.		
UNIT IV		**[08 Hrs.]**
3D Graphics: 3D primitives, projection, parallel perspective, isometric, viewing transformations, hidden surfaces and line removal, painter's algorithm, Z-buffers, Warnock's algorithm.		
UNIT V		**[08 Hrs.]**
Bezier and B-spline, sweeping, method of interpolation, Cubic Splines.		
UNIT VI		**[08 Hrs.]**
Animation: Definition & introduction to animation, Basics: Animation target objects, Types, animation timings. Design of an animation sequence, general computer animation functions, raster animation, computer animation language.		

Textbooks:			
1	Computer Graphics C Version	Second Edition (1997)	Donald Hearn & M. Pauline Baker
2	Computer Graphics Principles and Practice	2nd edition,1996	Foley, Vandam, Feiner and Huges
Reference Books:			
1	Procedural Elements for Computer Graphics	1998	David F. Rogers
2	Computer Graphics, A Programming Approach	2nd edition, 1987	Steven Harrington

VI Semester

CSD2382- OE-3: Multimedia Design

Objective	Course Outcome
The student should be able to 1. To learn the basics and Fundamentals of Multimedia. 2. The objective of this course is to provide concept about an application, which uses a collection of multiple media sources e.g. text, graphics, images, audio, animation and video. 3. Students will learn about Multimedia, which is a field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.	**On completion of this course, the student will be able to** 1) Define what is multimedia and how it works. 2) Understand multimedia components using various tools and techniques. 3) Discuss about different types of media format and their properties. 4) Justify the right way of manipulating multimedia systems. 5) To analyze the different compression algorithms. 6) To design Multimedia Application.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO	Define what is multimedia and how it works.	2	2								1			1	
CO	Understand multimedia components using various tools and techniques.	2	2								1			1	
CO	Discuss about different types of media format and their properties.	2	2								1			1	
CO	Justify the right way of manipulating multimedia systems.	2	2								2			1	
C05	To analyze the different compression algorithms.													1	
CO	To design Multimedia Application	2	2							2	2			1	

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Unit No.	Contents	Max. Hrs.
1	**Introduction to Multimedia:** Definition of Multimedia, Multimedia objects: Text, Graphics, Animation, Audio, images, Video. Definition of HyperText and HyperMedia. Multimedia Applications in Education, Entertainment. Advertising world etc. Components of a Multimedia System, Desirable Features for a Multimedia System, requirements of Multimedia Communication, Applications of multimedia – benefits and problems.	6
2	**Representation of Multimedia Objects:** Representation of Analog Signals, A/D: Sampling and quantization. Text: Font and their representation (bitmap, true type) Graphics: Raster & Vector representation, aliasing problems Image: (bit depth, resolution, color (RGB, CMYK, HSB), introduction to BMP, GIF, TIFF, PNG and JPEG formats) Audio (speech and wideband audio, sampling rate and aliasing, quantisation, introduction to MP3, WMA, WAV, MIDI etc.) Video (frame rate and resolution, interlaced and non-interlaced video, colour planes (YCBCR, YUV), Video broadcast standards (PAL, NTSC, SECAM), HD Video, 3D TV, Video representation: AVI, MPEG, Quick Time, real video (.rm)	6
3	**Concepts of Multimedia Editing:** Digital Audio, Music Sequencing and Notation, Image/Graphics Editing, Video Editing (Linear, Non-linear), Subtitling	5
4	**Introduction to Compression Technology :** Concept of lossy and lossless compression. Concept of rate-distortion characteristics, Basics image compression (JPEG, JPEG 2000), Basics of Audio compression (MP3, MP4), Basics of Video Compression (MPEG, H.264)	5
5	**Multimedia Application Design:** Content design, technical design, visual design, design metaphors, example studies, interactivity	6
6	**Multimedia Authoring and Publishing :** Definition of an Authoring System, uses of an authoring system, Definition and function of Authoring Metaphor, Different Metaphors. Offline Publishing: Flash, Power Point. Online Publishing: HTML5, Dreamweaver	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Multimedia		Li & Drew	Pearson Education, 2009.
2.	Multimedia Systems		Rajneesh Aggarwal & B. B Tiwari	Excel Publication, New Delhi, 2007.
3.	Multimedia making it work		Tay Vaughan	Tata McGraw-Hill, 2008.

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Principles of Multimedia		Parekh Ranjan	Tata McGraw-Hill, 2007
2	Introduction to Computer Graphics and Multimedia	Second Edition	Anirban Mukhopadhyay and Arup Chattopadhyay	Vikas Publishing House.

VI Semester
CSD2391- OE-4: Advanced Web Designing

Objective	Course Outcome
The student should be able to 1) Get familiar with basics of HTML, HTML tags, DHTML CSS. 2) Get familiar with client server architecture and able to develop a web application using java technologies. 3) Get familiar with markup languages with their structures and syntax. 4) To get familiarized with JS frame work	**On completion of this course, the student will be able to** 1) Understand the different tags of HTML and Implement interactive web pages using HTML , DHTML and CSS. 2) Understand client server architecture and Develop interactive web pages using java script and client and server side programming. 3) Understand the concept of Markup languages and Make the use of mark up languages in development of web pages. 4) Understand the concepts of Node JS and Angular JS and Develop web applications using Node and Angular JS.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	tand the different tags of HTML and Implement interactive web pages using HTML , DHTML and CSS.														
CO2	tand client server architecture and Develop interactive web pages using java script and client and server side programming.														
CO3	tand the concept of Markup languages and Make the use of mark up languages in development of web pages.														
CO4	tand the concepts of Node JS and Angular JS and Develop web applications using Node and Angular JS.														

Unit No.	Contents	Max. Hrs.
1	Creation of web pages: HTML tags, special characters, images, tables, forms, the hyperlinks, Frames	8
2	Dynamic HTML (DHTML): Introduction, Cascading Style Sheets (CSS), DHTML Document Object Model and Collections [8 Hrs]	8
3	Scripting Languages:- Java Script objects and forms, server side and client side scripting languages	6
4	XML:XML basics, understanding mark-up languages, structures and syntax, valid Vs. Well formed XML, DTD (document type Definitions) classes, Element Type Declaration, Attribute Declarations, Limitations of DTDs, XML processor, Introduction to Schema, Complex Types, Extensible Style sheet Language Transformations (XSLT),Basics of Parsing	7
5	The importance of being asynchronous, Blocking vs. non-blocking code, Server-side JavaScript, What is Node.js?, Why use Node.js?,Features, Process Model, Setup Node.js Development Environment, Node.js Basics, Node.js Module, File System	7
5	The importance of being asynchronous, Blocking vs. non-blocking code, Server-side JavaScript, What is Node.js?, Why use Node.js?,Features, Process Model, Setup Node.js Development Environment, Node.js Basics, Node.js Module, File System	
6	Introduction to AngularJS, AngularJS Expressions: Numbers, Strings, Objects, Arrays, Expressions using {{ }} and ng-bind. Modules: Creating a module, adding a controller & directive, myApp.js, myCtrl.js, Loading library. Directives: Data Binding, ng-init, ng-repeat, ng-app & ng-model directives, custom directives.2 way binding, Validating User Input, Status, ng-empty, ng-touched, ng-valid, ngpending. Data Binding: Synchronization between model and view. AngularJS Controllers: ng-controller, Controller Methods, External Files.Scope: $scope, understanding the scope, $rootScope	

Text Books

SN	Title	Edition	Authors	Publisher
1	The Complete Reference HTML and XHTML	5th Edition	Thomas A.Powell	McGraw Hill Pub
2	Learning angular JS		Dayley, Brad Dayley	

Reference Books

SN	Title	Edition	Authors	Publisher
1	Learning PHP, MySQL, JavaScript, and CSS: A Step-by-Step Guide to Creating Dynamic Websites	3rd	**Robin Nixon**	O'RELLY

VI Semester
CSD2392 : OE4 – Virtual Reality

Objective	Course Outcome
The student should be able to 1)This course is designed to give historical and modern overviews and perspectives on virtual reality. 2)It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.	**On completion of this course, the student will be able to** 1. Describe how VR systems work and list the applications of VR. 2.Understand the design and implementation of the hardware that enables VR systems tobe built. 3.Understand the system of human visionand its implication on perception and rendering. ain the concepts of motion and tracking in VR systems.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO															
CO															
CO															
CO															

Unit No.	Contents	Max hrs
1	**Introduction to Virtual Reality:** Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.	**7**
2	**Representing the Virtual World** Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR	**8**
3	**The Geometry of Virtual Worlds &The Physiology of Human Vision** Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.	**7**
4	**Visual Perception & Rendering** Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates	**7**
5	**Computer Graphics And Geometric Modelling:** Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Colour theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models, Shading algorithms. Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection.	**7**
5	**Computer Graphics And Geometric Modelling:** Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, Colour theory, Conversion From 2D to 3D, 3D space curves, 3D boundary representation, Simple 3D modelling, 3D clipping, Illumination models, Reflection models, Shading algorithms. Geometrical Transformations: Introduction, Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection.	**7**
6	**AR / VR Applications:** Introduction, Engineering, Entertainment, Science, Training	**7**

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Virtual Reality		M. LaValle	Cambridge University Press, 2016
2	,Understanding Virtual Reality", Interface, Application and Design		William R Sherman and Alan B Craig	(The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	3D User Interfaces, Theory and Practice",		Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev	Addison Wesley, USA, 2005.

VI Semester
Audit Course
AU2130 : YCCE Communication Aptitude Preparation (YCAP6.3)

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

1st Semester

(Department of Computer Technology)

Artificial Intelligence and Data Science

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

Artificial Intelligence and Data Science

SoE No. ADS-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
First Semester															
1	1	BS	GE	AIDS2101	Calculus, Sequances & Series	**T**	3	0	0	3	3	30	20	50	3 Hours
2	1	BS	GE	AIDS2102	Applied Chemistry	**T**	3	0	0	3	3	30	20	50	3 Hours
3	1	BS	GE	AIDS2103	**Lab.:** Applied Chemistry	**P**	0	0	2	2	1		60	40	
4	1	HS	GE	AIDS2104	Technical Communications	**T**	3	0	0	3	3	30	20	50	3 Hours
5	1	HS	GE	AIDS2105	**Lab.:** Technical Communications	**P**	0	0	2	2	1		60	40	
6	1	PC	CT	AIDS2106	Foundations of Data Science	**T**	3	0	0	3	3	30	20	50	3 Hours
7	1	PC	CT	AIDS2107	**Lab.:** Foundations of Data Science	**P**	0	0	2	2	1		60	40	
8	1	BES	CT	AIDS2108	Computer Programing	**T**	3	0	0	3	3	30	20	50	3 Hours
9	1	BES	CT	AIDS2109	**Lab.:** Computer Programing	**P**	0	0	2	2	1		60	40	
					TOTAL FIRST SEM		**15**	**0**	**8**	**23**	**19**				
List of Audit Course															
1	1	HS	GE	GE2131	Universal Human Value	**T**	2	0	0	0	0				
2	1	HS	GE	AU2121	YCCE Communication Aptitude Preparation (YCAP1)	**A**	3	0	0	3	0				
3	2	HS	GE	AU2122	YCCE Communication Aptitude Preparation (YCAP2)	**A**	3	0	0	3	0				
Second Semester															
1	2	BS	GE	AIDS2151	Probability & Statistics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	2	BS	GE	AIDS2152	Applied Physics	**T**	3	0	0	3	3	30	20	50	3 Hours
3	2	BS	GE	AIDS2153	**Lab.:** Applied Physics	**P**	0	0	2	2	1		60	40	
4	2	HS	GE	AIDS2154	Constitution of India	**T**	3	0	0	3	3	30	20	50	3 Hours
5	2	BES	CT	AIDS2155	Computer Architecture and Organization	**T**	3	0	0	3	3	30	20	50	3 Hours
6	2	PC	CT	AIDS2156	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3 Hours
7	2	PC	CT	AIDS2157	**Lab.:** Object Oriented Programming	**P**	0	0	2	2	1		60	40	
8	2	PC	CT	AIDS2158	Data Structures	**T**	3	0	0	3	3	30	20	50	3 Hours
9	2	PC	CT	AIDS2159	**Lab.:** Data Structures	**P**	0	0	2	2	1		60	40	
10	2	PC	CT	AIDS2160	Software Lab	**P**	0	0	2	2	1		60	40	
					TOTAL SECOND SEM		**18**	**0**	**8**	**26**	**22**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.01**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

I Semester
AIDS2101: Calculus, Sequences and Series

Objective	Course Outcome
1. To give basic knowledge of sequence and Series. 2. To explain the differential calculus and its applications. 3. To extend the concept of integration to double and triple integrals. 4. To teach various methods for solving higher order differential equations and its applications.	Students will be able to 1. Apply the knowledge of differentiation, sequence and series to solve engineering problems. 2. Determine the expansion and derivatives of functions of several variables and use it to find extreme values of functions. 3. Evaluate the improper integrals, multiple integrals and apply it to compute the area and volume of various structures. 4. Solve higher order differential equations and its applications.

Unit No.	Contents	Max. Hrs.
1	**Sequence and Series** Sequence, types of sequence, test of convergence of sequences, Cauchy sequence, infinite series, power series, Alternating series, tests of convergence and absolute convergence of series.	6
2	**Ordinary Differentiation** Successive differentiation; Leibnitz theorem, Taylor's and Maclaurin's series for functions of single variable and its applications.	7
3	**Partial Differentiation** First and higher order derivatives of Functions of several variables, Euler's theorem, Chain Rule, Jacobians, Maxima and minima and saddle point of functions of two variables.	7
4	**Curve Tracing and Improper Integrals** Tracing of curves, Beta, Gamma functions and its applications.	6
5	**Multiple integrals** Elementary double integrals, Change of variables (simple transformations), Coordinate Transformation, Change of order of integration (Cartesian and polar), Elementary triple integrals and Applications to find area, volume.	7
6	**Differential Equations** Higher order differential equations with constant coefficients. Cauchy's and Legendre's homogeneous differential equations, Applications of differential equations	6

Text Books

1. Advance Engineering Mathematics by Erwin Kreyzig,John Wiley and Sons,INC.
2. Engineering Mathematics - by H.K. Dass, 11th revised edition, 2003, S.Chand, Delhi.
3. Advanced Engineering Mathematics - by H.K. Dass, 8th Ed, 2007, S.Chand, Delhi.
4. Engineering Mathematics by Dr. B.S. Grewal
5. Applied Mathematics by P.N.Wartikar and J.N.Wartikar,Pune Vidyarthi Griha Prakashan, Pune

Reference Books

1. G B Thomas and R L Finney: Calculus and Analytical Geometry, 9th ed, Addison-Wesley, 1999.
2. Calculus-by Michael Spivak and Tom Apostol (Vols I and II)
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Prakashan, Reprint 2008.

I Semester
AIDS2102: Applied Chemistry

Objective	Course Outcome
• To impart intensive and extensive knowledge of the subject enriching students to understand the roleof Chemistry in the field of engineering. • To keep students abreast with the latest developments and applications of modern materials. • To gain basic principles, instrumentation and applications of analytical techniques.	(1) Interpret different thermodynamic functions. (L2) (2) Describe basic concepts of electrochemistry and apply the knowledge for energy storage devices. (L3) (3) Illustrate chemical reaction rate and drug molecules synthesis. (L3) (4) Classify advanced engineering materials in technological applications. (L2) (5) Develop analytical and instrumental skills. (L3)

Unit No.	Contents	Max. Hrs.
1	**Energetics**: Introduction, Internal energy, enthalpy, Gibb's free energy, Free energy change and chemical equilibrium. Spontaneous and non-spontaneous processes. I and II law of thermodynamics. Entropy and its significance. Numericals on Internal energy and enthalpy change. Thermodynamic applications to physical and chemical equilibrium.	07
2	**Electrochemistry**: Introduction, metallic and electrolytic conductance, resistance, specific resistance, conductance, specific conductance, equivalent and molar conductance. Variation of conductance with dilution. Electrode and electrode potentials. Nernst Equation. Faraday's laws and Numericals. **Industrial applications**: Electroforming, Electrowinning, Electrolytic refining.	06
3	**Energy storage devices** **Basic concepts**: Primary and secondary battery. Energy density, power density, energy efficiency, cycle life, shelf life. Secondary battery: Ni-metal hydride battery, Lithium-ion battery. **H_2-O_2 Fuel cell**: Principle, working, advantages, disadvantages, applications. Differences between battery and a fuel cell. **Supercapacitors**: Definition, types, characteristics and application.	06
4	**Chemical Kinetics** : Introduction, Rate of reaction and factors influencing rate of reaction, order & molecularity of reaction. Kinetic equations of different orders: Zero Order, First Order, Second Order and numericals.	06
5	**Organic reactions and synthesis of drug molecules**: **Organic reactions**: Introduction to reactions involving substitution, addition, elimination, oxidation, reduction with examples. **Drugs**: Introduction, types of drugs, Synthesis of commonly used drug molecules such as Ibuprofen, Aspirin and Paracetamol. Challenges in chemical synthesis. Applications of Artificial Intelligence in Chemistry.	07

Unit No.	Contents	Max. Hrs.
6	**Advanced Materials :** **Nanomaterials**: Definition of nanomaterials, nano scale. Carbon Nanotubes and types. **Application of Nanomaterials**: Applications of nanomaterials in medicine, environment, and electronics. Nanotechnology for waste reduction and improved energy efficiency. Elementary ideas and applications of Nano biopolymers, Nano fertilizers and Nano ceramics. Threats of Nanomaterials. **Silicon Chips:** Introduction. Physical, chemical, electrical & mechanical properties and applications. **Chemical sensors**: Types and application	07

Text Books:

SN	Title	Edition	Authors	Publisher
1	A Textbook of Engineering Chemistry	Eleventh Edition.	S S. Dara	S.Chand & Co New Delhi
2	Engineering Chemistry	Sixteenth Edition	Jain & Jain	Dhanpat Rai & sons New Delhi.
3	Physical Chemistry	(Eighthedition-2006).	P. W. Atkins	Oxford Publications
4	Engineering Chemistry		B.Sivasankar	Tata McGraw-Hill

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Chemistry in Engineering		Lloyd A.Munro	Prentice-hall
2	Applied chemistry for engineers		T.S.Gyngell	
3	Engineering Chemistry		B.K.Sharma	Krishna Prakashan media private LTD
4	Chemistry of Advanced Materials		CNR Rao	RSC Publications
5	Handbook of Semiconductor Silicon Technology	1st Edition.	William C. O'Mara, Robert B. Herring	Noyes Publications Park Ridge, NJ, USA.

Website / Data sheet:

SN	Title
1	Silicon Chips: What are Computer Chips Made Of? https://www.intel.com/content/www/us/en/history/museum-making-silicon.html
2	What is silicon, and why are computer chips made from it? https://www.extremetech.com/extreme/208501-what-is-silicon-and-why-are-computer-chips- made-from-it

I Semester
AIDS2103: Lab.: Applied Chemistry

Course Outcome: After completion of the laboratory work, student will demonstrate the ability to

CO 2	Describe basic concepts of electrochemistry and apply the knowledge for energystorage devices. (L3)
CO4	Classify advanced engineering materials in technological applications. (L2)
CO 5	Develop analytical and instrumental skills. (L3)

Lab Experiment List:

Expt. No	Name of Experiment (Minimum 4 experiments from Group I & II each and Demonstrations on 2 experiments should be conducted)
	Group I:
1	To determine the strength of a given potassium dichromate solution with N/20 sodium thiosulphate solution.
2	Estimation of Nickel by complexometry.
3	Determination of copper by iodometric titration.
4	Estimation of Fe^{2+} ions by redox titration.
5	Estimation of Fe^{3+} ions by spectrophotometric method.
6	Synthesis of urea formaldehyde resin.
	Group II:
7	Preparation of Printed Circuit Board.
8	Determination of molecular weight of a polymer using Ostwald's viscometer.
9	Determination of ion exchange capacity of a cation exchange resin.
10	Proximate analysis of Coal.
11	Determination of thinner contain in oil paint.
12	Electroplating Copper on Stainless steel.
	Demonstration:
13	Determination of Faradays first law.
14	Determination of Faradays second law.
15	Determination of conductivity of water sample by conductivity meter

I Semester
AIDS2104: Technical Communications

Objective	Course Outcome
1. To Explain the fundamentals of communication 2. To Classify the different speech sounds of English 3. To Apply Different components of oral communication 4. To Draft technical documents	Upon completion of the course, students will have the ability to, 1. Apply different modes for effective communication 2. competently use the phonology of English language 3. Apply nuances of LSRW skills 4. Communicate through different channels

Unit No.	Contents	Max. Hrs.
1	**Basics of Communication** Language as a tool of communication & characteristics of language Process of Communication, Levels of Communication, Flow of Communication, Networks of Communication, Classification of Barriers (Intrapersonal, Interpersonal, Organizational).	6
2	**English Phonetics** Speech Mechanism, Organs of speech, Consonant and Vowels sounds, Worde stress rules	6
3	**Interview Skills** Purpose , expectations of employer and preparation for Interview, Types, Types of Questions & Answering Techniques, Telephonic Interviews – preparation and guidelines, Reading Techniques (Exercise based on Complex Unseen passages	5
4	**Oral Skills** Group Communication- (Purpose, Different types of Group Communication, Organizational GD, GD as a part of selection process), Meeting (purposes, preparation, procedure and minutes of meeting), Listening Skills -definition types and traits	6
5	**Presentation & Visual Communication** Presentation and audience analysis, Organizing content, Nuances of presentation, Visual Communication – Introduction & importance, Role & Psychology of color in visual communication.	6
6	**Technical Written Communication** Memo, Email, Report -Types, Characteristics, prewriting aspects of report and preparing writing aspects of report), Types of paragraphs.	6

Text Books :
1. Technical Communication, Raman & Sharma, Oxford University Press
2. Textbook of English Phonetics for Indian Students, T. Balasubramaniam, Macmillan India Ltd

Reference Books :
1. How to Develop Self – Confidence & Influence People by Public Speaking, Dale Carnegie
2. Communication Skills, Asha Kaul
3. Body Language, Allen Peas
4. Gerson's Gerson – Technical Communication

I Semester
AIDS2105: Lab.: Technical Communications

Objective	Course Outcome
1. To Explain the fundamentals of communication 2. To Classify the different speech sounds of English 3. To Apply Different components of oral communication 4. To Draft technical documents	Upon completion of the course, students will have the ability to, 1. Apply different modes for effective communication 2. competently use the phonology of English language 3. Apply nuances of LSRW skills 4. Communicate through different channels

Sr. No.	List of Experiment
1	Hands on for Consonants and vowel sounds
2	Grooming session for effective use of body language
3	Mock Sessions for Interview
4	Group Discussion
5	Creation of Visual Media – preparing poster boards, advertisements, banners and flyers
6	Official Report writing
7	Official Mail composing
8	Mail Merge
9	Exporting data from excel to Word

Text Books :

1. Technical Communication, Raman & Sharma, Oxford University Press
2. Textbook of English Phonetics for Indian Students, T. Balasubramaniam, Macmillan India Ltd

Reference Books :

1. How to Develop Self – Confidence & Influence People by Public Speaking, Dale Carnegie
2. Communication Skills, Asha Kaul
3. Body Language, Allen Peas
4. Gerson's Gerson – Technical Communication

I Semester
AIDS2106: Foundations of Data Science

Objective	Course Outcome
1. To understand the fundamentals of data analysis of data analysis 2. To understand the data preparation and representation of data for analysis 3. To learn the fundamentals of probability theory and probability distribution 4. To comprehend the application domains of data analysis	1. To interpret the data analysis task 2. To use the statistical techniques to prepare and present the data for analysis 3. To use the probability theory to handle uncertainty in the applications 4. To interpret the applications of data analysis

Unit No.	Contents	Max. Hrs.
1	Introduction to Data Science; role of data scientist, Types of Data, tool boxes for data scientists, introduction to R studio	7
2	Understanding different data sets Introduction to Data analysis, Types of Data analysis, Applications. Technologies involved in the data analysis	7
3	Preparing data for analysis: reading data from files, web, databases, Grouping and Displaying Data to Convey Meaning. Measure of central tendency, dispersion	7
4	Probability theory: basic concepts, applications, types. Bayes theorem	7
5	Probability distribution, Binomial distribution, Poisson distribution, Normal distribution. random variable.	7
6	Application domains of data analysis. Case studies in various application domains.	7

Text Books :

1. Statistics for Management", Richard I. Levin & David S. Rubin, 7th Edition, Pearson Education.

Reference Books :

1. "Practical Statistics for Data Scientists, 50 Essential Concepts", Peter Bruce & Andrew Bruce, O'Reilly Media
2. "An Introduction to Statistical Learning with Applications in R", Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani, Springer Press

I Semester
AIDS2107: Lab.: Foundations of Data Science

Sr. No.	List of Experiment
1	Introduction to R and excel
2	Extraction of data using R
3	Handling and understanding data using R
4	Implementations of conditional statements in R
5	Implementation of Loops in R
6	Introduction to data visualization in R
7	Implementing probability functions
8	Data Handling using Excel
9	Project activity on standard data set

I Semester
AIDS2108: Computer Programing

Course Learning Objective:	Course Outcome
The Students will :- 1. Study overview of Computer System and basics to write an algorithm 2. Study different loop control structures. 3. Study the basic concepts of Functions, Pointers, arrays 4. Study the basics of Strings, Structures, union and File 5. Understand various sorting algorithms	After completion of the course students will be able: 1. Write algorithms & design flowcharts for given problem. 2. Write program using loops and Arrays for fixed size data storage 3. Implement programs using functions and pointers 4. Implement program using Implement program using structures, strings and files 5. Implement sorting algorithms

Unit No.	Contents	Max. Hrs.
1	Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.). Algorithms & Conventions used in writing algorithms, Flowcharts. Overview of Programming Language, sample „C" code, compiler, operating system, running C" programs, Types of programming errors.	06
2	Character set, variables, identifiers & keywords, Data types, Operators, Types of operators and expressions, sizeof() operator, constants and its types, Symbolic constant, typedef statement, Introduction to library functions, basic input/output statements, precedence of operators, write straight line programs, Decision control statements: if, if - else and nested if-else statements, else-if ladder statement, switch-case control statement, Programming Examples.	08
3	Loop Structures: While, do while and for loops, break and continue statement, „goto" statement, C programs based on these loop structures.	07
4	Concept of functions, Modular programming, user defined and library functions, function prototypes, formal parameters, actual parameters, return types, function call- call by value, C programs using functions, Recursive functions, comparing recursion against iteration, C programs using recursive functions, Concepts of pointer.	08
5	Introduction to Arrays, One dimensional array, array manipulation, insertion, deletion of an element, searching techniques- Linear and binary search, sorting techniques - Bubble, insertion and selection sort.Two dimensional array: programs for basic matrix operations-addition, multiplication and transpose, converting a matrix in upper or lower triangular matrix, Array as function arguments.	09

Unit No.	Contents	Max. Hrs.
6	Introduction to strings, string handling functions. Introduction to structures and Union. Concepts of files, Types of files, file opening in various modes, file closing, reading and writing text files, concept of pre-processor directives and macros, Command line Argument.	06

Textbooks:		
T1: The C Programming Language.	J.B.W.Kernighan & D.M.Ritchie	Prentice Hall
T2: Mastering C	K.R.Venugopal & S.R. Prasad	TMH,2007.
T3: Programming in ANSI C	E. Balaguruswamy	Mc Graw Hill Education

Reference Book		
R1:Problem Solving And Program Design In C	Jeri. R. Hanly, Elliot B. Koffman	Pearson Education
R2: Programming with C	Byron Gottfried	Schaum;s Outline Series
R3: How to solve it by computers	R. G. Dromey	Prentice Hall India

I Semester

AIDS2109: Lab. : Computer Programing

Course Learning Objective:	Course Outcomes
The Students will :- 1. Study the different types of basic linux commands to get familiar with Linux environment to run „C" programs. 2. Study different basic 'C' programming language constructs and it's implementations. 3. Study to design programs using different loop control structures. 4. Study the basic concepts of Functions, Pointers and the Modular Programming. 5. Study the concept of different dimensional arrays as a data structures and its applications. 6. Study the basics of Structures and File handling.	After completion of the course students will be able : 1. To implement different types of basic linux commands to get familiar with Linux environment to run „C" programs. 2. To Understand & implement straight line program by using basic „C" programming language constructs. 3. To Design & implement programs using different loop control structures. 4. To Design & implement user defined functions, understand the concept of Pointers & Modular programming. 5. To Understand, analyze different dimensional Arrays as a data structure and designing & implementation of programs. 6. To Understand, analyze the basics of structures, data handling through files and designing & implementation of programs.

Sr.	Problem Statements
1 A	Introduction to Linux Operating system & it's different commands.
1 B	Introduction to Vi editor, Compilation and Execution of a program in Linux
2 A	1) Write a C program to display Your Name, Address and City in different lines. 2) Write a C program to convert centigrade into Fahrenheit. Formula: C= (F-32)/1.8.
2 B	1) Write program using conditional operators to evaluate the following function and print the value of y. y = 2.4x + 3, for x <= 2 y = 3x –5, for x > 2
3	Write a program to implement the following table, which tries to predict if a customer would buy a product. In particular, you need to ask for inputs Age, Gender and City, and print one of the three outputs Yes, No or Cannot Say.

Age	Gender	City	Will Buy?
25-30	M	Chenaai	Yes
33-45	F	Bangalore	Yes
57-80	F	Chennai	No
25-30	F	Hyderabad	No
13-19	M	Bangalore	Yes
16-20	M	Chenaai	No

4	Write a menu driven program to perform following operations. 1) To display maximum number among inputted three number. 2) To display the final prize based on assumption that if total purchase price is above 2500 rs then discount is 25% and if total prize is above 5000 then discount is 30% else 40% discount. 3) To Display percentage of 2nd number to 1st number if two number is entered by the user. 4) Exit.
5	Write a program print weather entered number is Prime or not
6	Write a program to print the sum of exponential series e(x) =1 + x/1! + x^2 / 2! + x^3 / 3! +…….
7	Write a program to print following pyramid **1** **1 2 3** **1 2 3 4 5** **1** 2 3 4 5 6 7
8	i) Write a program in C that will scan a number N and then output the sum of the powers from 1 to N. thus, if the input is 4, the output should be 288. E.g. (1) ^{1} + (2) ^{2} + $(3)^3$ +$(4)^4$ = 1+ 4 + 27 + 256 = 288 [1,2,3,4] Use power function to calculate the power of number. ii) Write a recursive function to print Factorial of a entered number. iii)
9	Write a program to sort an elements using bubble Sort.
10	Produce a multiplication table. Top left hand corner will show 1x1 and bottom right shows 12x12, as below. 1 2 3 4 5 6 7 8 9 10 11 12 2 4 6 8 10 12 14 16 18 20 22 24 3 6 9 12 15 18 21 24 27 30 33 36 4 8 12 16 20 24 28 32 36 40 44 48 5 10 15 20 25 30 35 40 45 50 55 60 6 12 18 24 30 36 42 48 54 60 66 72 7 14 21 28 35 42 49 56 63 70 77 84 8 16 24 32 40 48 56 64 72 80 88 96 9 18 27 36 45 54 63 72 81 90 99 108 10 20 30 40 50 60 70 80 90 100 110 120 11 22 33 44 55 66 77 88 99 110 121 132 12 24 36 48 60 72 84 96 108 120 132 144
11	Write a program To copy one string to another string without using library function
12	Define a structure for a student having name, roll number and marks obtained in six, subjects. Write a program to input the details for 20 students and print the same.
13	Write a program that copies a file to another file. The names of two files should be sent as command line arguments.

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Bachelor of Technology

SoE & Syllabus 2021

2nd Semester

(Department of Computer Technology)

Artificial Intelligence and Data Science

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

Artificial Intelligence and Data Science

SoE No. ADS-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
First Semester															
1	1	BS	GE	AIDS2101	Calculus, Sequances & Series	**T**	3	0	0	3	3	30	20	50	3 Hours
2	1	BS	GE	AIDS2102	Applied Chemistry	**T**	3	0	0	3	3	30	20	50	3 Hours
3	1	BS	GE	AIDS2103	**Lab.:** Applied Chemistry	**P**	0	0	2	2	1		60	40	
4	1	HS	GE	AIDS2104	Technical Communications	**T**	3	0	0	3	3	30	20	50	3 Hours
5	1	HS	GE	AIDS2105	**Lab.:** Technical Communications	**P**	0	0	2	2	1		60	40	
6	1	PC	CT	AIDS2106	Foundations of Data Science	**T**	3	0	0	3	3	30	20	50	3 Hours
7	1	PC	CT	AIDS2107	**Lab.:** Foundations of Data Science	**P**	0	0	2	2	1		60	40	
8	1	BES	CT	AIDS2108	Computer Programing	**T**	3	0	0	3	3	30	20	50	3 Hours
9	1	BES	CT	AIDS2109	**Lab.:** Computer Programing	**P**	0	0	2	2	1		60	40	
					TOTAL FIRST SEM		**15**	**0**	**8**	**23**	**19**				
List of Audit Course															
1	1	HS	GE	GE2131	Universal Human Value	**T**	2	0	0	0	0				
2	1	HS	GE	AU2121	YCCE Communication Aptitude Preparation (YCAP1)	**A**	3	0	0	3	0				
3	2	HS	GE	AU2122	YCCE Communication Aptitude Preparation (YCAP2)	**A**	3	0	0	3	0				
Second Semester															
1	2	BS	GE	AIDS2151	Probability & Statistics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	2	BS	GE	AIDS2152	Applied Physics	**T**	3	0	0	3	3	30	20	50	3 Hours
3	2	BS	GE	AIDS2153	**Lab.:** Applied Physics	**P**	0	0	2	2	1		60	40	
4	2	HS	GE	AIDS2154	Constitution of India	**T**	3	0	0	3	3	30	20	50	3 Hours
5	2	BES	CT	AIDS2155	Computer Architecture and Organization	**T**	3	0	0	3	3	30	20	50	3 Hours
6	2	PC	CT	AIDS2156	Object Oriented Programming	**T**	3	0	0	3	3	30	20	50	3 Hours
7	2	PC	CT	AIDS2157	**Lab.:** Object Oriented Programming	**P**	0	0	2	2	1		60	40	
8	2	PC	CT	AIDS2158	Data Structures	**T**	3	0	0	3	3	30	20	50	3 Hours
9	2	PC	CT	AIDS2159	**Lab.:** Data Structures	**P**	0	0	2	2	1		60	40	
10	2	PC	CT	AIDS2160	Software Lab	**P**	0	0	2	2	1		60	40	
					TOTAL SECOND SEM		**18**	**0**	**8**	**26**	**22**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	**1.01**	**Applicable for AY 2022-23 Onwards**
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**	

II Semester
AIDS2151: Probability & Statistics

Objective	Course Outcome
1. This course provides an indication of the relevance and important of the probability theory in solving practical problems in the field of multidisciplinary engineering applications. 2. To provide undergraduate foundation in both probability distributions and mathematical statistics relevant to engineering problems. 3. To teach mathematical skill sustained from this course to form a suitable base for analytical and theoretical concept encountered in engineering profession.	Students will be able to 1. Identify an appropriate probability distribution for a given discrete or continuous random variable and compute probabilities. 2. Make use of probability distributions to solve real life problems. 3. Apply concepts of sampling theory to find probabilities and estimates parameters of various problems. 4. Inspect scientific data, use proper curve fitting and find correlation, regression of variables.

Unit No.	Contents	Max. Hrs.
1	**Random Variables & Probability Distributions** Conditional probability, Baye's theorem. Random variables: Discrete and Continuous random variables, Probability function and Distribution function, Joint distributions. Independent Random variables, Conditional Distribution.	7
2	**Mathematical Expectation** Mathematical Expectation, Variance & Standard Deviation, Moments, Moment generating function, Skewness and Kurtosis.	7
3	**Special Probability Distributions** Binomial, Geometric, Poisson, Exponential, Normal distributions, Central Limit theorem.	6
4	**Sampling Theory** Population and sample. Statistical inference. Sampling with and without replacement. Population parameters, sample statistics. Sampling distribution of means. Sampling distribution of proportions.	6
5	**Estimation** Unbiased and efficient estimates. Point estimates and interval estimates. Confidence interval for means, Confidence interval for proportions, Confidence interval for differences and sums of mean and proportions.	7
6	**Curve Fitting** Fitting of straight line, $y = a + bx$, a parabola $y = a + bx + cx^2$, exponential curves and power curves by method of least squares; Lines of regression and correlation; Rank correlation.	6

Text Books

1. Advanced Engineering Mathematics - by H.K. Dass, 8th Ed, 2007, S.Chand, Delhi.
2. Engineering Mathematics by Dr. B.S. Grewal
3. The theory and problems of probability and Statistics: M. R. Spiegel, Schaum series. (McGraw Hill)
4. Basic Statistics for Business and economics by E. K.Bowen, M. K.Star (McGraw Hill)

Reference Books

1. A First course in probability by Sheldon Ross, Sixth Edition, Pearson Education.
2. Fundamentals of Mathematical statistics by S. C.Gupta and V.K.Kapoor.
3. Probability and Statistics for Engineering 6th edition, Miller Freund and Johnson.
4. Higher Engineering Mathematics, Dr. V. Ramana , Tata McGraw Hill.

II Semester
AIDS2152: Applied Physics

Objective	Course Outcome
• To understand fundamental principles of engineering physics specifically concern to quantum physics, crystal structure, semiconductor, electron ballistics, Laser and optical fibre and their engineering applications. • To provide problem solving experience and learning of concepts through it in engineering physics, in both the classroom and the laboratory learning environment.	**At the end of Course students are able to** • Explain fundamentals of quantum mechanics and its application to problems dealing with quantum particle. • Develop ability to classify structure of crystal and analyze the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands for device applications. • Illustrate working principle of lasers, ultrasonic waves and its properties for useful applications in the field of industry. • Analyze the motion of charged particle in electric and magnetic fields and its applications to electron optic devices. • Examine the light guiding ability optical fibre through total internal reflection and its application in communication system.

Unit No.	Contents	Max. Hrs.
1	**Unit-I : Quantum Physics [CO1, (PO1, PO2)]** Wave-particle duality, Wave packet, Heisenberg uncertainty principle, Interpretation of wave function, Schrodinger Equations, Application to infinite potential well, Electron Microscope.	9
2	**Unit-II: Crystal structure [CO2, (PO1, PO2)]** Introduction, Space Lattice, Unit cell & symmetry in crystals, Bravais lattices, Calculation of parameters for SC, BCC & FCC lattices, Miller indices, Voids, Braggs law, crystal structure analysis.	8
3	**Unit-III : Semiconductor Physics [CO2, (PO1, PO2)]** Formation of energy bands in solids ; Classification of solids, Energy band diagram of Si/Ge , Intrinsic and extrinsic semiconductors, Conductivity, Law of mass action, Fermi function , Fermi level in intrinsic and extrinsic semiconductors, Dependence of Fermi level on impurity concentration and temperature, Hall effect, Hall sensors.	9
4	**Unit-VI : Laser [CO3, (PO1, PO2)]** Interaction of radiation with matter, Population Inversion and Optical resonance cavity , Three and four level laser, Ruby laser, He-Ne laser, Properties and engineering applications of laser.	9

Unit No.	Contents	Max. Hrs.
5	**Unit-V: Electron Ballistics [CO4, (PO1, PO2)]** Motion of a charged particle in uniform electric and magnetic field, Cross field configuration; Electron refraction, Electron lens, CRO & its applications.	9
6	**Unit-VI :Optical Fibre [CO5, (PO1, PO2)]** Structure of Optical fibre, Total internal reflection, Classification of optical fibres : modes, materials & RI profile diagram, V-number, Attenuation & dispersion, Fibre optic sensors , fibre optic communication system.	8

Text books and Reference Books Recommended :

1. Fundamentals of Physics: D.Halliday , R.Resnick , J.Walker, Wiley India Pvt., Ltd., New Delhi
2. Electonic devices and Circuits by John Allison, Tata McGraw-Hill
3. Introduction to Modern optics by AjoyGhatak,Tata McGraw-Hill
4. Concept of Modern Physics : A.Beiser, Tata McGraw-Hill
5. A concise book of Engineering Physics by S A Band and S A Fadnavis, DasganuPrakashan
6. A Textbook of Engg. Physics: M.N.Avadhanulu , P.G.Kshirsagar, S.Chand and Company
7. Solid state Physics by S.O.Pillai, New Edge International Publishers
8. Solid State Physics by Palansamy, SciTech publishers

II Semester
AIDS2153: Lab.: Applied Physics

Objective	Course Outcome
• To understand and strengthen the theoretical concepts by thorough experimentation. • To learn the proper methods and techniques utilized in gathering experimental data. • To become familiar with the proper use of some basic measuring instruments commonly found in physics laboratories. • To learn how to analyze data and then reach scientific conclusions based on this analysis. • To learn how effectively communicate experimental results in standard scientific way.	• By the end of course students will be able to Perform experiments based on syllabus adopting the proper methodology. • Derive a scientific conclusion on the basis of experimental data.

Minimum Eight experiments are to be performed from the list as given below and One or Two demonstration experiments .

1. A study of cubic space lattices and atomic packing in solids.
2. Determination of amplitude and frequency of sinusoidal signal using C.R.O.
3. Determination of phase angle between sinusoidal signals using C.R.O.
4. Determination of radius of curvature of Plano convex lens using Newton's rings.(BEYOND SYLLABUS)
5. Determination of Band gap in a semiconductor by four probe method.
6. Determination of Band gap in a semiconductor using reverse biased p-n diode.
7. Study of V-I characteristics of diode in FB & RB mode.
8. Determination of Hall coefficient and density of charge carriers using Hall effect.
9. To measure the divergence of laser beam or beam spot size.
10. Determination of Numerical aperture and Acceptance angle of an optical fiber.
11. Measurement of attenuation in optical fiber.
12. Determination of wavelength of laser light using plane transmission grating.

II Semester
AIDS2154: Constitution of India

Objective	Course Outcome
• To enable the student understand the importance of constitution • To understand the structure of executive, legislature and judiciary • To analyze federalism in the Indian context • To understand philosophy of fundamental rights and duties • To understand and evaluate the Indian Political scenario of the emerging challenges.	• Explain the basic concepts of Constitution of India. • Describe the various Fundamental rights • Analyze the Impact of federalism on the State • Explain Industrial Law and Judiciary.

Unit No.	Contents	Max. Hrs.
1	**Origin and Meaning** Origin of history of Constitution, Meaning of the constitution law and constitutionalism, Kingship and Republic States in Ancient India	6
2	**Concept of the Constitution of India** Preamble, The union and its territory, Citizenship	6
3	**Federalism** Salient features of Federalism, Structures and features of Indian Federalism, Panchayat Raj System	6
4	**Fundamental Rights** Scheme of the Fundamental rights, duties, Scheme of the Fundamental Right to Equality, The scheme of the Fundamental Duties and its legal status	7
5	**Legislative Power** Federal structure and distribution of legislative, Financial power between the Union and the States, Parliamentary Form of Government in India – The constitution power and status of the President of India	7
6	**Challenges to Indian Political Systems** The Executive, Directive principles of State Policy, The Union Judiciary	7

Text Books :

1. Dr G.N. Nimbarte, (2018) "Social Science" Sankalp Publication, Vidhya Nagar, Nagpur

Reference Books:

1. G. Austin (2004) Working of a Democratic Constitution of India, New Delhi: Oxford University Press.
2. A.S. Altekar, (2016) State and Government in Ancient India, Motilal Banarsidass Publishing House, New Delhi.
3. Basu, D.D (2005), An Introduction to the Constitution of India, New Delhi, Prentice Hall.
4. A. Vanaik and R. Bharghava (eds) (2010) Understanding Contemporary India: Critical Perspectives, New Delhi: Orient Blackswan.
5. A.G. Noorani (2000): Constitution questions in India: The President, Parliament and the Status, New Delhi: Oxford University Press.
6. Singh, M.P & Saxena, R (2008) Indian Politics: Contemporary Issues and Concerns. New Delhi: PHI Learning.
7. Constitution of India: Dr. B. R. Ambedkar: Government of India.

II Semester
AIDS2155: Computer Architecture and Organization

Objective	Course Outcome
Student will be able: 1. To Understand Internal working of Computer System, its basic principles & execution of machine instructions 2. To Understand basic processor design using Hardwired and microprogrammed control unit. 3. To Know Organization of main memory, cache memory. 4. To Know Various ways in which I/O operations are performed.	**Upon successful completion of the course, the student will be able to:** 1. Relate & Identify the function and design of the various units of computers that process data and store the information. 2. Analyze and write control signal for executing machine instructions for different processors. 3. Explain & Design the organization of memory, memory hierarchy, other peripheral devices, and estimate the cost of computation. 4. Compare among different types of I/O operation

Unit No.	Contents	Max. Hrs.
1	Systems: Digital Systems, Binary Numbers, Binary Codes, Computer Arithmetic Number Base Conversions, Octal and Hexadecimal – conversions. Basic Logic Gates, Universal gates (NAND and NOR gates), other gates (XOR, XNOR gates). Boolean identities, De Morgan's Laws. k-map	7
2	Combinational and sequential circuits: (Simple block diagrams, truth tables and IC packages only required). Flip-flops: RS, clocked RS, JK, D and T flip flops, Master slave flip flops, Registers, latches and Tristate buffers. Basic Memory Organization	7
3	Von-Neuman architecture, Functional units, addressing methods, addresing modes, Execution of complete instructions, Bus organizations, sequencing of Control signals, Processor Design, hard wired control, Microprogrammed Control: Microinstructions, Grouping of control signals, Microprogram sequencing, Micro Instructions with next Address field, perfecting microinstruction.	7
4	Arithmetic (Fixed and Floating point): Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction, Arithmetic and Branching conditions, Multiplications of positive numbers, Signed- Operand multiplication, fast Multiplication, Booth's Algorithm	7
5	Integer Division, Floating point numbers and operations. The Main Memory: Basic concepts, Memory Hierarchy, Speed Size and Cost, Cache Memory, Performance Considerations.	7
6	Pipelining: Basic Concepts, Data Hazards, Instruction Hazards Computer Peripherals: I/O Devices, I/O transfers – program controlled, interrupt driven and DMA, Interrupt handling.	7

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Computer Organization	5th edition	V.Carl Hamacher, Zvonko Vranesic,	McGraw Hill Publications.
2	Computer Architecture & Organization	3rd edition	J.P. Hayes	McGraw Hill Publications
3	Modern Digital Electronics	3rd Edition	R. P. Jain	McGraw Hill

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Computer Organization and Architecture	6th edition	Willaiam Staliing	Pearson Education
2	Computer Architecture: A Quantitative approach	6th edition	John L. Hennessy, David A. Patterson	MK series in computer architecture and design

II Semester
AIDS2156: Object Oriented Programming

Objective	Course Outcome
1. Understand the concept of object-oriented programming and modelling 2. Have an appreciation of the object-oriented programming concepts like reusability of code, inheritance, abstraction, and polymorphism 3. Gain an understanding of addance concepts of object-oriented programming like, generic components I/O stream classes and multithreading 4. Develop an understanding of MVC architecture and how to build the event driven solution of the problem	1. Understand the concept of object-oriented programming and modelling 2. Apply the knowledge of object-oriented programming to solve the given problem 3. Apply the knowledge of advanced concepts of object-oriented programming like I/O stream, generic components and multithreading 4. Formulate the standardized event driven solution for the real life scenarios using object oriented concepts

Unit No.	Contents	Max. Hrs.
1	Introduction to object oriented programming paradigm, procedure oriented programming vs OOP, features of OOP, benefits of OOP, defining class, instantiating a class. UML diagrams to represent class, objects and various relationships.	7
2	Functions in OOP, function overloading, Passing & returning Objects, pointers to members, constructors and its types, Access specifiers and packages. Inheritance, types of inheritance, run time polymorphism, abstract classes, Interface, collection interface	7
3	Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files	7
4	Multithreading, Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations	7
5	MVC architecture, Java web components and its architecture Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images	7
6	Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – Introduction to Swing – layout management – Swing Components – Text Fields, Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows –Menus – Dialog Boxes	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Java Complete Reference	7th	Herbert Schildt	McGraw-Hill
2	Thinking in Java	4th	Bruce Eckel	Prentice Hall

		June 2021	1.00	Applicable for AY 2021-22 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

II Semester
AIDS2157: Lab.: Object Oriented Programming

Sr. No.	Practical based on
1	Implement the concept of Class and its data members and member functions in Java
2	Implement the concept of class constructor and its type in Java.
3	Implement the concept of function overloading in Java
4	Implement the concept of run time polymorphism in Java.
5	Implement the concept of Abstraction in Java.
6	Implement the concept of all types of inheritance in Java.
7	Implement he collection listener to solve the problem in Java
8	Implement the concept of exception in Java.
9	Implement the concept of thread in Java
10	Implement the concept of Files in Java.
11	Implement the concept of generic functions and generic class in Java
12	Implement the concept of applet to prepare a web application in Java
13	Implement the event driven approach to prepare the web application in Java

II Semester

AIDS2158: Data Structures

Objective	Course Outcome
1. To understand various types of linked lists, their structures and operations performed on them. 2. To understand structures and working of advanced data structures like skip list, disjoint set, hash table etc. 3. To understand trees and graph data structures along with its representation methods and various terminologies	**Upon successful completion of the course, the student will be able to:** 1. Implement the concept of linked list, skip lists, disjoint sets data structures for real world problem 2. Use the concepts of advance data structures like skip list, disjoint set, hash table 3. Implement the concept of tree and graph data structures for real world applications.

Unit No.	Contents	Max. Hrs.
1	Overview of arrays and array based algorithms - searching and sorting: merge sort, quick sort, Heaps and heap sort, sparse matrices, time complexity	7
2	Lists - Singly-linked lists, doubly linked lists and circular linked lists. Operations on linked list etc. Applications of lists in polynomial representation	7
3	Introduction to Skip lists, data structures for disjoint set representation, hash table	6
4	Trees, binary trees, binary trees- basic algorithms and various traversals. Binary Search Trees (BSTs) and insertion, deletion in BSTs.	8
5	Height-balanced (AVL) trees, Splay tree, Red-black trees, Multi-way trees-B and B+ and applications	8
6	Graphs – their representation & traversals. Spanning trees, topological sort, shortest path algorithm, all-pairs shortest paths	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Data Structures with C	8th 2013	Seymour Lipschutz	Mc Graw Hill Education
2	Data structures using C	8th 2016	Reema Thareja	Oxford

Reference Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Algorithms	3rd 2015	Thomas Cormen, Charles Leiserson, Ronal Rivest, Clifford Stein	PHI
2	Fundamentals of Data Structures in C++	2nd, 2009	Ellis Horowitz, Sartaj Sahani, Dinesh Mehta	University Press
3	Data Structures and Program Design in C	2nd, 2009	Robert Kruse, Cl Tondo	Pearson Education

II Semester
AIDS2159 : Lab.: Data Structures

Sr. No.	List of Experiment
1	Program to sort an array using Merge sort method
2	Program to search an element in an array
3	Program based on Singly Linked List
4	Program based on operations on doubly linked list
5	Program based on implementing one data structure using another data structure
6	Program based on Binary tree
7	Program based on Binary search tree
8	Program based on Hashing
9	Program for detecting loop in a network

II Semester
AIDS2160: Software Lab

Objective	Course Outcome
1. To make student aware about various programming frameworks of Python 2. To make student familiar with syntax of various data structures and their operations along with control statements in Python 3. To make students comprehend concepts of file handling, classes and objects 4. To make student aware about various packages inbuilt in Python along with their usages	1. Select any framework for python programming as per their understanding 2. Write any python program using various data structures and control statements 3. Write program where file handling and concepts of classes and objects are needed 4. Develop advanced applications using functionalities provided under various packages of python

Sr. No.	List of Experiment
1	Introduction to Python language and Installation of Python write a Python program to implement arithmetic, logical operators
2	Write a program using control structures:Loops, if-else, if-elif etc.
3	Write a program using functions and recursion :list, strings
4	Write a program using dictionary, tuples,sets
5	Write program using array
6	Program using Numpy
7	File handling
8	Study of Pandas dataframes and implement dataframes related operations
9	Program using Matplotlib
10	Project work :Data Extraction to Visualization

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

3rd Semester

(Department of Computer Technology)

Artificial Intelligence and Data Science

28 June 2019

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

Artificial Intelligence and Data Science

SoE No. ADS-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS	CT	AIDS2201	Discrete Maths and Graph Theory	**T**	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CT	AIDS2202	Statistics for Data Science	**T**	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	CT	AIDS2203	Computer Networks	**T**	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	CT	AIDS2204	**Lab.:** Computer Networks	**P**	0	0	2	2	1		60	40	
5	3	PC	CT	AIDS2205	Software Engineering	**T**	3	0	0	3	3	30	20	50	3 Hours
6	3	PC	CT	AIDS2206	**Lab.:** Software Engineering	**P**	0	0	2	2	1		60	40	
7	3	PC	CT	AIDS2207	Operating Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
8	3	PC	CT	AIDS2208	Web Technology	P	0	0	4	4	2		60	40	
9	3	PC	CT	AIDS2209	**Lab2.:** Software	P	0	0	2	2	1		60	40	
					TOTAL THIRD SEM		**15**	**0**	**10**	**25**	**20**				
Fourth Semester															
1	4	BS	GE	AIDS2251	Linear Algebra	**T**	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CT	AIDS2252	Theoretical foundation of Computer Science	**T**	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CT	AIDS2253	Design & Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3 Hours
4	4	PC	CT	AIDS2254	**Lab.:** Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
5	4	PC	CT	AIDS2255	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	CT	AIDS2256	**Lab.:** Database Management Systems	**P**	0	0	2	2	1		60	40	
7	4	PC	CT	AIDS2257	Bayesian Data Analysis	**T**	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	CT	AIDS2258	**Lab3.:** Software	**P**	0	0	2	2	1		60	40	
					TOTAL FOURTH SEM		**15**	**0**	**6**	**21**	**18**				

List of Audit Course

1	3	HS		GE2121	Environmental studies	**T**	2	0	0	2	0				
2	3	HS		AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
3	4	HS		AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE, IIoT, AIML, CSD, AIDS	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

III Semester
AIDS2201: Discrete Maths and Graph Theory

Objective	Course Outcome
1. This course will provide the mathematical fundamentals needed to understand computer application 2. To provide the mathematical concepts necessary in the study of propositional and predicate logic. 3. To discuss the concepts of algebraic systems like semi groups and groups. 4. To use graph theory to analyze the complex structure which helps in writing efficient code.	With the completion of this syllabus students will be able to 1. Identify the importance of statements in deriving valid inferences. 2. Use relations and ordering methods to identify the relationship among the inferences. 3. Select suitable algebraic systems to find solution for real time problems. 4. Find the suitable computing methods and applying graph theory concepts to solve complex problems.

Unit No.	Contents	Max. Hrs.
1	**Mathematical Logic and Set Theory:** Statement and Notation: Negation, Conjunction, Disjunction, Tautologies, Truth Tables, Basic Concepts of Set Theory, Inclusion & equality of set, Power Set, Ordered Pairs and n-tuples, Operations on Sets , mathematical induction. Propositions, Predicate logic.	6
2	**Relations and Functions:** Relations and Ordering, Relation Matrix and Graphs, Partition and Covering of a set, Equivalence relation, Partial order relation, Partially Ordered sets, Functions , Composition of functions, Inverse Functions, Characteristics function of a set.	6
3	**Group Theory:** Groups, Subgroups and Homomorphism, Cosets and Lagrange's theorem, Normal subgroups. Semi groups and Monoids Homomorphism of semigroups and monoids, Sub semi groups and monoids.	7
4	**Rings:** Definitions and Examples, sub ring, Integral domain, ring homomorphism, ideal of ring polynomial.	6
5	**Field and Lattices :** Definitions and Examples, Finite Field, Ordered sets, Hasse Diagrams of partially Ordered sets. Lattices, Bounded Latices, Complements Latices, Definitions and Examples of Finite Field, Ordered sets, Hasse Diagrams of partially Ordered sets. Lattices, Bounded Latices, Complements Latices.	7
6	**Graph Theory:** Basic concepts of graph theory, Basic definitions, Paths and circuits, Reach ability and connectedness, Matrix Representation of graphs, Tree and their representation and operations, Rooted trees, Path lengths in rooted trees, Multi graphs and weighted graphs, and graph isomorphism, shortest paths in weighted graphs, Hypergraphs, transitive closure, Spanning trees, Kruskal's algorithm, Prim's algorithm.	7

Text Books:

1. Discrete Mathematics Structure with application to Computer Science by J. P. Tremblay & R. Manohar ,23rd re-print,2005,Tata McGraw-Hills Publication Company Limited, New Delhi.

2. Discrete Mathematics by Lipschutz Schaums's Outline series,2nd edition,Tata McGraw-Hills Publication Company Limited, New Delhi.

Reference Books:

1. Discrete Mathematical structures :-By Bernard Kolman ,Robert C.Busby, Sharon Ross,3rd edition,2001,Prentice Hall of India, New Delhi.

III Semester
AIDS2202 : Statistics for Data Science

Objective	Course Outcome
1. To introduce the basic statistical formulae and visualization techniques 2. To comprehend the concepts of probability and probability distribution 3. To understand the concepts of sampling, sampling distribution and estimation 4. To understand the concept of hypothesis testing	1. Able to analyze and find the hidden meaning from the given data and visualize the results 2. Able to solve the real-life problem using the probability theory and use it for decision making 3. Able to analyze the samples from the population and solve the problem to get predictive solution using the estimation theory 4. Able to analyze the sample data and use it to test the assumptions made for the population parameter

Unit No.	Contents	Max. Hrs.
1	Introduction: The role of statistics. Numerical and graphical methods for describing and summarizing data.	7
2	Probability: Basic terminology in probability, probability rules, Probabilities under conditions of statistical independence, probabilities under conditions of statistical dependence.	7
3	Probability distribution: What is probability distribution, random variables, use of expected value in decision making, and various probability distributions	7
4	Sampling and Sampling Distribution: introduction to sampling, random sampling, Introduction to sampling distribution. Design of experiment	6
5	Estimation: Introduction, Point estimates, Interval estimates and confidence interval, interval estimates using t distribution, determining the sample size in estimations	6
6	Testing Hypothesis: Introduction, testing hypothesis, One sample test	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Introduction to probability and statistics for engineers and scientist	3rdEdition	Sheldon M. Ross	Elsevier
2	Statistics for Management	7thEdition	Richard I. Levin & David S. Rubin	Pearson Education

		June 2022	1.00	Applicable for AY 2022-23 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Practical Statistics for Data Scientists, 50 Essential Concepts.		Peter Bruce & Andrew Bruce	
2	An Introduction to Statistical Learning with Applications in R		Gareth James,Daniela Witten, Trevor Hastie & Robert Tibshirani	

III Semester
AIDS2203 : Computer Networks

Objective	Course Outcome
1. Understand the importance of layering architecture and classify different types of networks. 2. Study of different protocols at various layers. 3. Study of modern networking tools.	1. Understand design issues of layers and network reference model 2. Solve the given problems related to networking domain. 3. Analyze different networking protocol at various layers 4. Evaluate the performance of network using different tools

Unit No.	Contents	Max. Hrs.
1	Introduction: The uses of computer networks, LAN's, MAN's, WAN's, protocol hierarchies, design issues for layers, interfaces and services, connection oriented and connectionless services, service primitives relationship of services to protocols. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference models, Critique of OSI model & protocols, critique of TCP/IP reference model.	7
2	Transmission Impairments, Transmission Media: Guided, unguided, Architecture of the Internet, Wireless LANs: IEEE 802.11, IEEE 802., The Public Switched Telephone Network, Switching: circuit, packet and message switching, Modems.	7
3	The Data Link Layer: Data link layer design issues- Framing, Error Control, Flow Control, Link Management, Error detection and Correction-Error-Correcting Codes, error-detecting codes, Elementary data link protocols-An Unrestricted simplex Protocol, A simplex stop and wait protocol, A simplex protocol for a noisy channel, Sliding window protocols- A one bit sliding window protocol, Go Back N protocol, Selective Repeat Protocol.	7
4	The Medium Access Sublayer: Static and Dynamic Channel allocation in LAN's and MAN's, Access Protocols-ALOHA, Persistent and Non Persistent CSMA, CSMA/CD, Collision free protocols, Binary countdown, Limited-connection protocol. The adaptive tree walk protocol.	7
5	The Network Layer: Network Layer design issues-services provided to the transport layer, Logical Addressing: classbase and classless, Subnetting and Supernetting, Routing and Routing Algorithms-Flooding, Flow-Based, Distance Vector, Link State, Hierarchical. Congestion Control algorithms- Preallocation of buffers, Packet discarding, Choke packets, Load shedding, Jitter control. Leaky bucket algorithm, token bucket algorithm, IP header format (IPv4, IPv6).	7
6	The Transport Layer: Transport layer design issues-services provided to the session layer, Quality of service, transport service primitives, Elements of transport protocols-Addressing, Establishing and Releasing a connection, Flow control and Buffering, Multiplexing, Crash Recovery. Transmission Control Protocol (TCP). The Application Layer: DNS, SMTP, FTP, TFTP	7

Text Books :
C Computer Networks by Andrew S. Tannenbaum Pearson Education

Reference Books :
Computer Networks: A Top-Down Approach by Behrouz A Forouzan and Firouz Mosharraf McGraw Hill Publication

III Semester
AIDS2204 : Lab. : Computer Networks

Sr. No.	List of Experiment
1	How to bring two computers in the network. Configure TCP/IP to configure Internet on your computer.
2	Use Network Utility Command like ping, ipconfig, netstat, tracert to observe the network details.
3	To implement Hamming Code using C and C++.
4	To implement Dijkstra's Routing algorithm using backtracking approach.
5	Use traffic monitoring tool Wireshark to observe network traffic with packet details.
6	Configure router. Configure network using Cisco Packet Tracer software and show packet transmission from source to destination.
7	Configure network using Distance vector routing protocol in Cisco Packet Tracer
8	Use Openssl command to perform Asymmetric key encryption(RSA) and also implement RSA algorithm.
9	Client server communication using socket programming
10	Advanced Practical: Study of NSG tool

III Semester
AIDS2205 : Software Engineering

Objective	Course Outcome
1. Study software engineering best practices and different strategies applicable for software development, software requirement and its design activity. 2. Explore the various testing types and its strategies. 3. Understand configuration management, version control and change control process of Software development. 4. Understand project management, planning, scheduling, risk management, project and process metrics. 5. Get an overview of open source Software Engineering tool viz. Subversion and understand some concepts such as Re-engineering and Reverse engineering.	Upon successful completion of the course, the student will be able to: 1. Choose appropriate software engineering process model, requirement engineering principles and software designing fundamentals for a given project. 2. Select appropriate testing strategy and apply testing principles for testing a given application. 3. Apply basics of software configuration management, version control and change control in software development. 4. Evaluate cost estimation, effort and severity of software risk for given application. 5. Perform basic operations on Sub-version for software version control.

Unit No.	Contents	Max. Hrs.
1	Introduction to Software Engineering, A Generic View of process, Process models: Water fall Model, RAD Model, Prototyping Model, Component Development Model, Agile Model, Requirement Engineering: Requirement Engineering Task Initialization Eliciting Requirement, Developing Use Case, Analysis Model, Negotiation, Validation	**6**
2	Building the Analysis mode: Requirement Analysis, Analysis Modeling Approaches, Data Modeling Concept, Object Oriented Analysis, Types of Modeling, Design Engineering: Design Concept, Design Model.	**7**
3	Testing Strategies: Strategic Approach, Strategic issues, Strategies for conventional Software, Strategies for Object Oriented Software, Validation Testing, Testing Tactics: White-Box Testing, Basis Path testing: Flow Graph Notation, Independent Pr	**7**
4	Configuration Management: Base lines, Software Configuration items, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting, SCM Standards	**5**
5	Project Management, Metrics for Process and Projects, Project Estimation, Risk Management: Reactive vs. Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection.	**7**
6	Advanced Topics in Software Engineering: Re engineering Computer aided software engineering, Open source SE tools introduction, Example-Subversion: Overview, Typical subversion usage and work flow.	**5**

Text Books :
1. Software Engineering–A Practitioner's Approach (Sixth Edition) by Roger S. Pressman– McGraw Hill.
2. Object Oriented Software Engineering by Leth Bridge, Pearson Edu.

Reference Books :
1.Software Engineering, 9th Edition, Ian Sommerville, University of St Andrews, Scotland, ©2011 , Pearson

III Semester
AIDS2206 : Lab. : Software Engineering

Sr. No.	List of Experiment
1	Introduction to Software Engineering fundamentals, UML and RATIONAL ROSE Interface.
2	To study and create Software Requirement Specification document for given case study
3	To study and draw UML Use Case diagram for the given case study.
4	To study and draw UML Class diagram for given Case Study.
5	To study and draw UML Activity diagram for given Case Study
6	To study and draw UML Sequence Diagram for given Case Study
7	To study and draw State Diagram for given Case Study
8	8 Write a Program to find out the Estimation (cost and effort) by using COCOMO model.
9	To Perform Manual and Automated testing using CASE tool for given Case Study
10	10 To Study and execute Version Control using Subversion

III Semester
AIDS2207 : Operating Systems

Objective	Course Outcome
1. To learn different types of OS & services provided by OS. 2. To understand process management and inter-process communication. 3. To know the deadlock concepts & deadlock avoidance algorithms. 4. To understand the need of memory management. 5. To learn different file system organization.	1. Analyze & compare different OS & its services. 2. Apply & analyze CPU scheduling algorithm & also find different ways to synchronize the process. 3. Use different methods to handle deadlock. 4. Apply various memory management techniques. 5. Compare various disk scheduling algorithms based on their performances.

Unit No.	Contents	Max. Hrs.
1	Introduction, services provided by OS, functions of OS, system calls. Process management-introduction, process control block, process states, process context switch, threads: user level and kernel level.	**7**
2	CPU scheduling, goals of scheduling, CPU scheduling algorithms: FCFS, SJF, SRTF, RR, Priority based.I nter-process communication: process cooperation and synchronization, race condition, critical section, mutual exclusion and implementation, semaphores, classical inter-process communication problems.	**8**
3	Deadlocks: System Model, deadlock characterization-necessary conditions, resource allocation graph (RAG), methods for handling deadlock-deadlock avoidance, deadlock detection, deadlock prevention, recovery from deadlock.	**7**
4	Memory management techniques-contiguous and non-contiguous, paging and segmentation, translation look aside buffer (TLB) and overheads.	**6**
5	Virtual memory and demand paging, page faults, page replacement algorithms, thrashing and working set model	**6**
6	File systems-introduction, disk space management and space allocation strategies, directory structures, disk caching, disk arm scheduling strategies: FCFS, SSTF, SCAN, CSACN, LOOK, CLOOK, File Organization: Sequential, Index, Index Sequential	**6**

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Operating system concepts	5th Edition	A. Silberchatz and P.Galvin	Addison Wesley Longman Inc.
2	Operating system Principles	7th Edition	A. Silberchatz and P.Galvi	John Wiley & Sons Inc.

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Modern operating systems	2ndedition	A.S. Tanenbaum	Prentice Hall of India publication.
2	Operating System	5th Edition	William Stalling	Pearson Education publication.

III Semester
AIDS2208 : Web Technology

Objective	Course Outcome
1. Introduction to internet technology 2. Study of basic of web page designing and validations 3. Introduction to the concepts of data storage using XML 4. learn the advance technique for designing the interactive web page	After successful completion of the course students will be able to: 1. Illustrate various internet technologies 2. Design the web pages using some basic techniques 3. Implement the XML technology to store the data 4. Develop the interactive web pages using the advanced technique

S.N	List of Practical
1.	[A] Introduction to internet (overview of internet, email, www, broadband, FTP) [B] Study and implement basic HTML Tags
2.	Create a web form by using form tags in HTML(use any example)
3.	Develop and demonstrate the usage of inline, internal and external style sheet using CSS.
4.	Introduction to XML. Program to demonstrate the use of External and Internal DTD. (Write an XML file which will display the Book information which includes the following: 1) Title of the book 2) Author Name 3) ISBN number 4) Publisher name 5) Edition 6) Price)
5.	Write a program in JavaScript to perform arithmetic operations.
6.	Write a Program in JavaScript To create Dialogue Boxes.
7.	Write a program in JavaScript to demonstrate the use of While and For Loop.
8.	Write a program in JavaScript to demonstrate the use of Conditional Statements and Functions.
9.	Write JavaScript to validate the following fields of the Registration page. 1. **First Name** (Name should contains alphabets and the length should not be less than 6 characters). 2. **Password** (Password should not be less than 6 characters length). 3. **E-mail id** (should not contain any invalid and must follow the standard pattern name@domain.com) 4. **Mobile Number** (Phone number should contain 10 digits only). 5. **Last Name and Address** (should not be Empty).
10.	**Mini project:** Submission of Website with Report.

III Semester
AIDS2209 : Lab2.: Software

Sr. No.	List of Experiment
1	Implement basic functionality of R
2	Implement data import and export functionality in R
3	Implement R functions to calculate basic statistics of data source
4	Apply the basic visualization techniques in R to understand data
5	Apply some advanced visualization techniques in R to analyze the data
6	Solve the problems using probability distributions in R
7	Using a case study compare various probability distributions
8	Analyze the data using sampling technique
9	Analyze the data to find out estimated value
10	Analyze the data using hypothesis testing

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

4th Semester

(Department of Computer Technology)

Artificial Intelligence and Data Science

28 June 2019

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Technology)

Artificial Intelligence and Data Science

SoE No. ADS-203.1

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS	CT	AIDS2201	Discrete Maths and Graph Theory	**T**	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CT	AIDS2202	Statistics for Data Science	**T**	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	CT	AIDS2203	Computer Networks	**T**	3	0	0	3	3	30	20	50	3 Hours
4	3	PC	CT	AIDS2204	**Lab.:** Computer Networks	**P**	0	0	2	2	1		60	40	
5	3	PC	CT	AIDS2205	Software Engineering	**T**	3	0	0	3	3	30	20	50	3 Hours
6	3	PC	CT	AIDS2206	**Lab.:** Software Engineering	**P**	0	0	2	2	1		60	40	
7	3	PC	CT	AIDS2207	Operating Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
8	3	PC	CT	AIDS2208	Web Technology	P	0	0	4	4	2		60	40	
9	3	PC	CT	AIDS2209	**Lab2.:** Software	P	0	0	2	2	1		60	40	
					TOTAL THIRD SEM		**15**	**0**	**10**	**25**	**20**				
Fourth Semester															
1	4	BS	GE	AIDS2251	Linear Algebra	**T**	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CT	AIDS2252	Theoretical foundation of Computer Science	**T**	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CT	AIDS2253	Design & Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3 Hours
4	4	PC	CT	AIDS2254	**Lab.:** Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
5	4	PC	CT	AIDS2255	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
6	4	PC	CT	AIDS2256	**Lab.:** Database Management Systems	**P**	0	0	2	2	1		60	40	
7	4	PC	CT	AIDS2257	Bayesian Data Analysis	**T**	3	0	0	3	3	30	20	50	3 Hours
8	4	PC	CT	AIDS2258	**Lab3.:** Software	**P**	0	0	2	2	1		60	40	
					TOTAL FOURTH SEM		**15**	**0**	**6**	**21**	**18**				

List of Audit Course

1	3	HS		GE2121	Environmental studies	**T**	2	0	0	2	0				
2	3	HS		AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0				
3	4	HS		AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE, IIoT, AIML, CSD, AIDS	**A**	3	0	0	3	0				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

IV Semester
AIDS2251: Linear Algebra

Objective	Course Outcome
1. To provide mathematical knowledge required to analyze problems encountered in engineering. 2. The students are acquainted with the solution of system of linear equation, eigen values and eigen vectors. 3. To apply principles of matrix algebra to linear transformations and inner products. 4. Student can apply this course in many areas of engineering such as computer graphics, cryptography, wire-less communication, signal processing, robotics and animation.	After completion of the course, the student will be able to 1. Solve systems of linear equations using rank of matrix 2. Determine eigenvalues and eigenvectors and solve eigenvalue problems. 3. Explain the concepts of vector space and subspace, span and basis. 4. Apply principles of matrix algebra to linear transformations and inner product.

Unit No.	Contents	Max. Hrs.
1	**Elementary matrix operations** Introduction to Matrices and Determinants, Solution of Linear Equations, Cramer's rule, Inverse of a Matrix.	**6**
2	**Matrix Algebra** Rank of a matrix, Gaussian elimination, LU Decomposition (Crout's method), Solving Systems of Linear Equations using the tools of Matrices.	**6**
3	**Diagonalization of matrix** Eigen Values and Eigen vectors, Linear dependence and independence of Eigen Vectors, Orthogonal Eigen vector, Diagonalization of matrix, Cayley-Hamilton Theorem and Sylvester's Theorem.	**7**
4	**Vector Space** Vector Space, Subspace, Sum of Sub space, linear combination, Linear dependence and independence, Span and basis, Spanning sets, Generators.	**6**
5	**Linear Transformation** Linear transformation, Ranges and Kernel (null space) of linear transformation, Inverse of linear transformation, Algebra of linear transformation, Singular and nonsingular linear transformation.	**7**
6	**Inner product Spaces** Inner product space and Norms, orthogonal vector, the Gram Schamidt orthogonalization Process , orthogonal compliment, Adjoint of Linear operator, Normal and self adjoint operator, Unitary and orthogonal operator, Bilinear and Quadratic form.	**7**

Text Books :

1. Advance Engineering Mathematics (9th Edition), Kreyszig. Wiley
2. Higher Engineering Mathematics (40th edition), B.S. Grewal, Publisher: S.Chand & Company Limited
3. Linear Algebra,Hoffman and Kunze, prentice Hall of India, New Delhi
4. Linear Algebra and its Applications, Glbert Strang, Nelson Engineering (2007)

Reference Books :

1. Linear Algebra, 3rded: Schaum outline series , Seymour Lipschutz et al.
2. An introduction to linear algebra, Affiliated East West Press, New Delhi P.G. Bhattacharya, S.K. Jain and S.R., V. Krishnamoorthy et al.
3. First course in Linear Algebra, Wiley Eastern Ltd., New Delhi, Nagpaul.
4. Matrix and Linear Algebra, K.B.Datta, Prentice Hall of India.

IV Semester
AIDS2252: Theoretical foundation of Computer Science

Objective	Course Outcome
1. To understand the basic properties of formal languages and Finite Automata, regular expression and Regular Grammar. 2. To study of different types of grammars and the properties of Context Free Grammar 3. To understand the basic properties of CFL and Designing of Push Down Automata 4. To understand the basic properties of Turing machine and study of Recursive Language, undecidability, post Correspondence problem and Recursive enumerable language	1. Apply basic properties of formal languages and to design finite automata for regular expression and Regular Grammar. 2. Construct context free grammar for various languages. 3. Solve various problems of push down automata for context free language 4. Design Turing Machines for given any computational problem.

Unit No.	Contents	Max. Hrs.
1	Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Design of Finite State Machines, Acceptance of strings and languages, Non Deterministic Finite Automation, Deterministic Finite Automation, Equivalence between NFA and DFA, NFA with ε-transition, Minimization of FA.	8
2	Regular Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets (Proofs not required), Regular grammars, Right linear and left linear regular grammars, inter-conversion between LLG & RLG, Equivalence between regular grammar and F.A., Inter-conversion between RE and RG.	7
3	Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal form, Greibach normal form.	7
4	Push Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Inter-conversion, Closure of properties of CFL, DPDA & NDPDA.	6
5	Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Church‟s hypothesis, Chomsky hierarchy of language, Linear bounded automata and context sensitive language, Universal Turing Machin	6
6	Un-decidability Problems related to Recursive enumerable language and Turing Machine, post correspondence problem. Recursive function Theory –Basis functions and operations on them. Bounded minimization preemptive μ recursive function unbounded minimization and recursive function	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Automata Theory, Languages, and computation	3rd Edition	Hopcroft J.E., Rajeev Motwani, Jeffrey D. Ullman	Pearson Education
2	Introduction to languages and the Theory of Computation	3rd Edition	John C.Martin	Mc Graw Hill

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to the Theory of Computation	2nd Edition	Michael Sipser	GALE CENGAGE Learning
2	Theory of Computation	1st Edition	Dr. O. G. Kakde	Laxmi Publication

IV Semester
AIDS2253: Design & Analysis of Algorithms

Objective	Course Outcome
1. To introduce basic algorithmic techniques, time requirements of an algorithm and mathematical techniques used in analysis of algorithms 2. Learn analysis of algorithms for a wide variety of foundational problems occurring in computer science applications with discussions on complexity and NP-completeness.	1. Students should be able to design some algorithms 2. Analyze their performance with respect to selected evaluation parameters

Unit No.	Contents	Max. Hrs.
1	Mathematical foundations, summation of arithmetic and geometric series, □n, □n2, bound summations using integration, Analysis of algorithms, analyzing control structures, worst case and average case analysis, Asymptotic notations, Analysis of sorting algorithms such as selection sort, insertion sort, bubble sort, heap sort, external Sorting, lower bound proof.	6
2	Recursive functions and recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions, elementary and advanced data structures with operations on them and their time complexity, Amortized analysis.	7
3	Divide and conquer basic strategy, binary search, quick sort, merge sort, Fast Fourier Transform etc. Greedy method –basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.	7
4	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem.	6
5	Basic Traversal and Search Techniques, breadth first search, connected components, Backtracking basic strategy, 8 – Queen‟s problem, graph colouring, Hamiltonian cycles etc.	6
6	NP-hard and NP-complete problems, basic concepts, non deterministic algorithms, NP-hard and NP- complete, Cook‟s Theorem, decision and optimization problems, polynomial reduction.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Computer Algorithms	Third	Horowitz, Sahani, Rajsekharan	Galgotia Publications Pvt. Ltd.
2	Introduction to Algorithms	Third	Thomas H. Cormen	Prentice Hall of India.

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Fundamentals of Algorithms	Second	Brassard and Bratley	Prentice Hall

IV Semester
AIDS2254: Lab. : Design & Analysis of Algorithms

Sr. No.	List of Experiment
1	Write a program for insertion sort and display its time complexity for different number of inputs.
2	Write a program for heap sort and compare its time complexity with insertion sort for different number of inputs.
3	Write a program for merge sort and display its time complexity for different number of inputs.
4	Write a program for quick sort and compare its time complexity with merge sort for different number of inputs.
5	Write a program for fractional knapsack problem using greedy strategy and analyse its time complexity for different number of inputs.
6	Write a program for job sequencing with deadline problem using greedy strategyand analyse its time complexity for different number of inputs.
7	Write a program for travelling salesman problem using dynamic programmingand analyse its time complexity for different number of inputs.
8	Write a program for all pair shortest path using dynamic programming and analyse its time complexity for different number of inputs.
9	Write a program for 8 queen's problem using backtracking
10	Write a program for graph coloring problem using backtracking

IV Semester
AIDS2255: Database Management Systems

Objective	Course Outcome
1. To learn different database system concepts 2. To learn the designing of Entity Relationship Diagram. 3. To know relational data model, relational algebra & SQL Queries. 4. To understand relational database design. 5. To know about data integrity issues	Upon successful completion of the course, the student will be able to: 1. Analyze & compare different levels of abstraction & data independence. 2. Design Entity Relationship Diagram for any scenario. 3. Solve queries based on relational algebra & SQL. 4. Identify functional dependencies & normalize the database and apply ACID properties. 5. Analyze transaction management, various concurrency control protocols and crash recovery methods.

Unit No.	Contents	Max. Hrs.
1	**Introduction to Database Management System:** General File System and Database system Concepts and Architecture, Data Models, Schemas and Instances, Abstraction & Different Levels of Data Abstraction, Data Independence: Logical & Physical Independence.	8
2	**Entity-Relationship Model**: Entities and Entity Sets, Relationships and Relationship Sets, Attributes, Mapping Constraints, Keys, Entity Relationship Diagram, Reducing E-R Diagrams to Tables, Generalization, Aggregation, Design of an E-R Database Scheme	6
3	**SQL:** Data definition language (DDL), Data Manipulation Language (DML), Basic structure of SQL Queries, Set operations, Null Values, Nested subqueries, views, modification of database, transaction, Joins. **Advanced SQL:** SQL data types & schemas, Integrity Constraints, Domain Constraints, Assertions, triggers, Advanced SQL Features.	8
4	**Relational Data Model**: Structure of Relational Databases **Relational Algebra**: Structure of relational databases, Fundamental Relational-Algebra Operations, Additional relational algebra operations, extended relational algebra operations, modification of the databases	6
5	**Relational Database Design**: Pitfalls in Relational Database Design, Functional Dependencies, Normalization using Functional Dependencies, Alternative Approaches to Database design. **Transaction Management**: ACID Properties, Implementation of ACID Properties, Database processes to support ACID Properties, Schedules, and Testing of Serializability.	6

Unit No.	Contents	Max. Hrs.
6	**Concurrency Control**: Lock-based Protocols, Timestamp Based Protocols, Validation Techniques, Multiple Granularity, Multi version Timestamp Protocol, Transaction isolation levels, Read consistency. **Crash Recovery**: Failure Classification, Log Based Recovery, Buffer Management, Checkpoints, Shadow Paging.	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Database System Concepts	6th Edition	Korth, Silberschatz	McGraw-Hill publication
2	Fundamentals of Database Systems	5th Edition	Elmasri, Navathe & Gupta	Pearson Education.

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Database Systems	3rd Edition	Connolly	Pearson Education
2	Database Systems	6th Edition	S. K. Singh,	Pearson Education

IV Semester
AIDS2256: Lab.: Database Management Systems

Sr. No.	List of Experiment
1	Study of My-SQL
2	Designing of an ER Diagram.
3	Designing of Database Schema based on ER diagram
4	Implementation of different DDL commands
5	Implementation of Constraints: Referential Constraints, Domain Constraints
6	Implementation of different DML Commands
7	Study and Implement Inner join
8	Study and Implement Outer Join
9	Consider the schema for Movie Database:ACTOR (Act_id, Act_Name, Act_Gender)DIRECTOR (Dir_id, Dir_Name, Dir_Phone)MOVIES (Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)MOVIE_CAST (Act_id, Mov_id, Role)RATING (Mov_id, Rev_Stars) Write SQL queries to 1.List the titles of all movies directed by 'Hitchcock'. 2.Find the movie names where one or more actors acted in two or more movies. 3.List all actors who acted in a movie before 2000 and also in a movie after2015 (use JOIN operation). 4.Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5.Update rating of all movies directed by 'Steven Spielberg' to 5

IV Semester
AIDS2257: Bayesian Data Analysis

Objective	Course Outcome
Students will be able to 1. Understand the fundamental theories of Bayesian statistics 2. Understand the concept of inferences from data using various probability models 3. Comprehend various model checking techniques. 4. Discuss various predictive error measures for model comparison	Students will be able to 1. Demonstrate the fundamental theories of Bayesian statistics 2. Construct a probability model for computing the posterior distribution 3. Examine the model using model checking techniques 4. Estimate the predictive model accuracy and expand in the direction of improvement

Unit No.	Contents	Max. Hrs.
1	Fundamentals of Bayesian Inference : The three steps of Bayesian data analysis, General notation for statistical inference , Bayesian inference, probability as a measure of uncertainty	6
2	Single Parameter Models : Estimating a probability from binomial data, Posterior as compromise between data and prior information, Summarizing posterior inference, Informative prior distributions, Normal distribution with known variance, Other standard single-parameter models, informative prior distribution, Noninformative prior distributions.	7
3	Multiparameter model : Averaging over 'nuisance parameters', Normal data with a noninformative prior distribution, Normal data with a conjugate prior distribution, Multinomial model for categorical data, Multivariate normal model with known variance, Multivariate normal with unknown mean and variance	7
4	Hierarchical models : Constructing a parameterized prior distribution, Exchangeability and hierarchical models, Bayesian analysis of conjugate hierarchical models, Normal model with exchangeable parameters, Hierarchical modeling applied to a meta-analysis	7
5	Model checking : The place of model checking in applied Bayesian statistics, Posterior predictive checking , Graphical posterior predictive checks, Model checking for the educational testing example	7
6	Evaluating, comparing, and expanding models : Measures of predictive accuracy, Information criteria and cross-validation, Model comparison based on predictive performance, Model comparison using Bayes factors, Continuous model expansion. Application domains	7

Text Books :

1. Gelman, A., Carlin, J. B., Stern, H. S., Rubin, D. B. (2013) Bayesian Data Analysis, Third Edition, Chapman & Hall/CRC.

Reference Books :

1. R. Christensen, W. Johnson, A. Branscum, T. E. Hanson (2010) Bayesian Ideas and Data Analysis: An Introduction for Scientists and Statisticians, CRC Press.

IV Semester
AIDS2258: Lab3.: Software

Objective	Course Outcome
1. To understand the syntax of various data structures along with their operations 2. To comprehend concepts of file handling and object oriented programming 3. To make students aware about various programming frameworks and libraries of Python 4. To understand the functionalities provided under various packages required to build any web-based application	1. Write a python program to apply various data structures concept 2. Apply the concept of file handling and object-oriented programming in python 3. Select the required framework and appropriate libraries to write a program in python 4. Develop web-based application using functionalities provided under various packages

Sr. No.	List of Experiment	CO
1	Revision to Python language: Lists, Dictionary, Sets, Tuples, Numpy. write a Python program using: Lists comprehension, Dictionary comprehension	CO1
2	Write a program using: File handling	CO2
3	Write a program using: Exception Handling	CO2
4	Write a program using: Enumeration, Lambda Function	CO2
5	Write program using: Decorators	CO2
6	Write a program using object-oriented concept	CO2
7	Module reference: statistics, Random, Math	CO3
8	Study of Pandas data frames and implement data frames related operations	CO3
9	Program using: Matplotlib	CO3
10	Project work: GUI creation in Python (Flask framework)	CO4

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

1st Semester

(Department of Computer Science & Engineering

(CSE)Artificial Intelligence & Machine Learning

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. AML-203.1

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Science & Engineering)

CSE (AIML)

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
First Semester															
1	1	BS	GE	AIML2101	Calculus, Sequeces and Series	**T**	3	0	0	3	3	30	20	50	3 Hours
2	1	HS	GE	AIML2102	Technical Communication	**T**	3	0	0	3	3	30	20	50	3 Hours
3	1	HS	GE	AIML2103	**Lab:** Technical Communication	**P**	0	0	2	2	1		60	40	
4	2	BES	CSE	AIML2104	Computer Workshop	**P**	0	0	2	4	2		60	40	
5	1	BES	CSE	AIML2105	Programming for Problem Solving	**T**	3	0	0	3	3	30	20	50	3 Hours
6	1	BES	CSE	AIML2106	Lab: Programming for Problem Solving	**P**	0	0	2	2	1		60	40	
7	1	BS	GE	AIML2107	Applied Chemistry	**T**	3	0	0	3	3	30	20	50	3 Hours
8	1	BS	GE	AIML2108	**Lab.:** Applied Chemistry	**P**	0	0	2	2	1		60	40	
					TOTAL FIRST SEM		**12**	**0**	**8**	**22**	**17**				
List of Audit Course															
1	1	HS	GE	GE2131	Universal Human Value	**T**	2	0	0	0	0				
2	1	HS	GE	AU2121	YCCE Communication Aptitude Preparation (YCAP1)	**A**	3	0	0	3	0				
3	2	HS	GE	AU2122	YCCE Communication Aptitude Preparation (YCAP2)	**A**	3	0	0	3	0				
Second Semester															
1	2	BS	GE	AIML2151	Probability and Statistics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	2	BS	GE	AIML2152	Applied Physics	**T**	3	0	0	3	3	30	20	50	3 Hours
3	2	BS	GE	AIML2153	**Lab:** Applied Physics	**P**	0	0	2	2	1		60	40	
4	2	BES	EE	AIML2154	Digital Electronics	**T**	3	0	0	3	3	30	20	50	3 Hours
5	2	BES	EE	AIML2155	**Lab:** Digital Electronics	**P**	0	0	2	2	1		60	40	
6	2	BES	CSE	AIML2156	Object Oriented Programming	T	3	0	0	3	3	30	20	50	3 Hours
7	2	BES	CSE	AIML2157	**Lab:** Object Oriented Programming	P	0	0	2	2	1		60	40	
8	2	BES	CSE	AIML2158	Web Technology Lab	**P**	0	0	0	2	2		60	40	
9	2	HS	GE	AIML2159	Constitution of India	**T**	3	0	0	3	3	30	20	50	3 Hours
					TOTAL SECOND SEM		**15**	**0**	**6**	**23**	**20**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

I Semester
AIML2101: Calculus, Sequences and Series

Objective	Course Outcome
The student should be able to 1) To give basic knowledge of sequence and Series. 2) To explain differential calculus and its applications. 3) To extend the concept of integration to double and triple integrals. 4) To teach various methods for solving higher order differential equations and its applications.	**On completion of this course, the student will be able to** 1) Apply the knowledge of differentiation, sequence and series to solve engineering problems. 2) Determine the expansion and derivatives of functions of several variables and use it to find extreme values of functions. 3) Evaluate the improper integrals, multiple integrals and apply it to compute the area and volume of various structures. 4) Solve higher order differential equations and its applications.

Unit No.	Contents	Max. Hrs.
1	**Sequence and Series** Sequence, types of sequence, test of convergence of sequences, Cauchy sequence, infinite series, power series, Alternating series, tests of convergence and absolute convergence of series.	6
2	**Ordinary Differentiation** Successive differentiation; Leibnitz theorem, Taylor's and Maclaurin's series for functions of single variable and its applications.	7
3	**Partial Differentiation** First and higher order derivatives of Functions of several variables, Euler's theorem, Chain Rule, Jacobians, Maxima and minima and saddle point of functions of two variables.	7
4	**Curve Tracing and Improper Integrals** Tracing of curves, Beta, Gamma functions and its applications.	6
5	**Multiple integrals** Elementary double integrals, Change of variables (simple transformations), Coordinate Transformation, Change of order of integration (Cartesian and polar), Elementary triple integrals and Applications to find area, volume.	7
6	**Differential Equations** Higher order differential equations with constant coefficients. Cauchy's and Legendre's homogeneous differential equations, Applications of differential equations	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics by	6th	Erwin Kreyzig,	John Wiley and Sons,INC.
2	Engineering Mathematics	11th revised edition, 2003	H.K. Dass	S.Chand, Delhi.

SN	Title	Edition	Authors	Publisher
3	Advanced Engineering Mathematics	8th Ed, 2007	H.K. Dass	S.Chand, Delhi.
4	Engineering Mathematics	43rd edition	Dr. B.S. Grewal	
5	Applied Mathematics	4th Edition	P.N.Wartikar and J.N.Wartikar,,Pune	Vidyarthi Griha Prakashan, Pune

Reference Books

SN	Title	Edition	Authors	Publisher
1	Calculus and Analytical Geometry,	9th ed,	G B Thomas and R L Finney:	Addison-Wesley, 1999.
2	Calculus	(Vols I and II)	Michael Spivak and Tom Apostol	
3	A text book of Engineering Mathematics	10th	N.P. Bali and Manish Goyal,	

I Semester
AIML2102: Technical Communication

Objective	Course Outcome
The student should be able to 1) To Explain the fundamentals of communication 2) To Classify the different speech sounds of English 3) To Apply Different components of oral communication 4) To Draft technical documents	**On completion of this course, the student will be able to** 1) Apply different modes for effective communication 2) competently use the phonology of English language 3) Apply nuances of LSRW skills 4) Communicate through different channels

Unit No.	Contents	Max. Hrs.
1	**Basics of Communication** Language as a tool of communication & characteristics of language Process of Communication, Levels of Communication, Flow of Communication, Networks of Communication, Classification of Barriers (Intrapersonal, Interpersonal, Organizational).	6
2	English Phonetics Speech Mechanism, Organs of speech, Consonant and Vowels sounds, Word stress rules	6
3	Interview Skills Purpose , expectations of employer and preparation for Interview, Types, Types of Questions & Answering Techniques, Telephonic Interviews – preparation and guidelines, Reading Techniques (Exercise based on Complex Unseen passages	5
4	Oral Skills Group Communication- (Purpose, Different types of Group Communication, Organizational GD, GD as a part of selection process), Meeting (purposes, preparation, procedure and minutes of meeting), Listening Skills -definition types and traits	6
5	Presentation & Visual Communication Presentation and audience analysis, Organizing content, Nuances of presentation, Visual Communication – Introduction & importance, Role & Psychology of color in visual communication.	6
6	Technical Written Communication Memo, Email, Report -Types, Characteristics, prewriting aspects of report and preparing writing aspects of report), Types of paragraphs.	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Technical Communication	3rd Edition	Raman &Sharma	Oxford University Press.
2	Textbook of English Phonetics for Indian Students	3rd Edition	T. Balasubramaniam	Macmillan India Ltd.

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	How to Develop Self – Confidence & Influence People by Public Speaking	1st Edition	Dale Carnegie	Simon & schuster
2	Communication Skills,	2nd Edition	Asha Kaul	PHL learning
3	Body Language,	1st Edition	Allen Peas	Sheldon prss
4	Technical Communication	January 2003	Gerson's Gerson –	Longman publishing group

I Semester
AIML2103: Lab.: Technical Communication

Sr.No	List of Experiment	Max. Hrs.
1	Hands on for Consonants and vowel sounds	6
2	Identifying the pragmatic meaning of the text	6
3	Mock Sessions for Mock Sessions for Interview	5
4	Grooming session for effective use of body language	6
5	Visual Media – preparing poster boards, advertising product	6
6	Group Discussion	6

Text Books:

SN	Title	Edition	Authors	Publisher
1	Technical Communication	3rd Edition	Raman & Sharma,	Oxford University Press
2	Textbook of English Phonetics for Indian Students	3rd Edition	T. Balasubramaniam,	Macmillan India Ltd

Reference Books:

SN	Title	Edition	Authors
1	How to Develop Self – Confidence & Influence People by Public Speaking	1st Edition	Dale Carnegie
2	Communication Skills	2nd Edition	Asha Kaul
3	Body Language	1st Edition	Allen Peas
4.	Technical Communication	January 2003	Gerson'sGerson

I Semester
AIML2104: Lab.: Computer Workshop

Objective	Course Outcome
The student should be able to 1) To impart basic knowledge of Computer Hardware and Networking Components. 2) To impart operational knowledge of Linux/UNIX System features and Shell commands 3) To introduce useful software tools such as Excel and JASON format	**On completion of this course, the student will be able to** 1) To understand the Computer Hardware and networking components and their interconnection 2) To work with Linux/UNIX System using shell commands 3) To learn to use software tools such as Excel, JASON format, etc.

List of Practical's

Sr.No.	Problem Statements
1	Study of Personal Computer Hardware: Assembling a Personal Computer PC Hardware Components Study of BIOS and its working
2	Introduction to Networking Networking Devices Communication Channels Networking Topologies Types of Computer Networks
3	Introduction to LINUX/UNIX Operating System with its important features and directory structure
4	Introduction to Linux shell commands with pipes and redirection
5	Introduction to JSON format and its applications
6	Introduction to Mind Maps using tools such as Mindmeister
7	Working with Excel and creating useful work sheets

I Semester
AIML2105: Programming for Problem Solving

Objective	Course Outcome
The student should be able to 1) To impart basic knowledge of Computer Systems and Computer programming 2) To inculcate problem solving ability using various C language features	**On completion of this course, the student will be able to** 1) To understand the basics of computer system components and operation, basics of algorithms and flowcharts 2) To design & develop programs using conditional statements and loops. 3) To design & develop user defined functions, understand the concept of modular programming and pointers. 4) To understand and analyze single and multi-dimensional arrays as a data structure and its use in problem solving. 5) To understand the basics of Strings, Structures, Unions, and File handling and its use for problem solving. 6) To understand the given problem statement and write programs to solve real-life problems.

Unit No.	Contents	Max. Hrs.
1	**Computer System Basics:** Introduction to components of a computer system (disks, memory, processor), how program is executed, understanding of concepts such as operating system, compilers, source and object programs, etc. Introduction to algorithms and flowcharts. **Basic building blocks of C:** Character set, variables, identifiers & keywords, Data types, Operators: arithmetic, logical and relational operators, precedence of operators	6
2	Expressions, sizeof() operator, constants, typedef statement, basic input/output statements and functions (scanf, printf, getch, putch, gets, puts), Introduction to library functions, writing straight line programs.Decision control statements: if, if - else and nested if-else statements, else-if ladder statement, switch-case control statement.	6
3	**Loop Structures:** While, do while and for loops, break and continue statement, "goto" statement, real life programming examples based on these loop structures, bitwise operators, real life programming examples.	6
4	**Modular programming:** Concept of functions, user defined functions, function prototypes, formal parameters, actual parameters, return types, call by value , C programs using functions, Recursive functions, comparing recursion against iteration, C programs using recursive functions, Concepts of a pointer, call by reference, types of programming errors, real life programming examples	7

Unit No.	Contents	Max. Hrs.
5	**Arrays:** One dimensional array, array manipulation, insertion, deletion of an element, searching techniques- Linear and binary search, sorting techniques – Bubble sort , and selection sort. Two-dimensional arrays: matrix representation, programs for basic matrix operations such as addition, multiplication and transpose, Array as function arguments. Strings: string representation and string handling functions, real life programming examples	7
6	Structure and Union, Concepts of files, Types of files, file opening in various modes, file opening and closing, fseek(), reading and writing text files, concept of pre-processor directives and macros, command line arguments, real life programming examples	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Mastering C	2nd	K.R.Venugopal & S.R. Prasad	TMH,2007.
2	Programming in ANSI C	8th reprint	E. Balaguruswamy	Mc Graw Hill Education
3	The C Programming Language.	2nd	J.B.W.Kernighan & D.M.Ritchie	Prentice Hall

Reference Books

SN	Title	Edition	Authors	Publisher
1	Problem Solving And Program Design In C	8th	Jeri. R. Hanly, Elliot B. Koffman	Pearson Education
2	Programming with C	4th	Byron Gottfried	Schaum;s Outline Series
3	How to solve it by computers	1st -2006	R. G. Dromey	Prentice Hall India

I Semester
AIML2106: Lab.: Programming for Problem Solving

Objective	Course Outcome
The student should be able to 1) To write, compile and execute C programs. 2) To inculcate problem solving ability using various C language features	**On completion of this course, the student will be able to** 1) To develop and run C programs on Linux system 2) To develop programs using conditional statements and loops. 3) To develop user defined functions required to solve a given problem 4) To understand and use single and multi-dimensional arrays as a data structure for problem solving. 5) To understand the basics of Strings, Structures, Unions, and File handling and its use for problem solving. 6) To understand the given problem statement of a real-life problem and write a program to solve it.

List of Practical's

<table>
<tr><th>Sr. No..</th><th>Problem Statements</th></tr>
<tr><td>1</td><td>Introduction to Linux Operating system & its different commands.</td></tr>
<tr><td>2</td><td>Introduction to editor, Compilation and Execution of a program in Linux</td></tr>
<tr><td>3</td><td>a) Write a C program to display Your Name, Address and City in different lines.
b) Write a C program to convert centigrade into Fahrenheit. Formula: C= (F-32)/1.8.</td></tr>
<tr><td>4</td><td>Write program using conditional operators to evaluate the following function and print the value of y. y = 2.4x + 3, for x <= 2 y = 3x –5, for x > 2</td></tr>
<tr><td>5</td><td>Write a program to implement the following table, which tries to predict if a customer would buy a product. In particular, you need to ask for inputs Age, Gender and City, and print one of the three outputs Yes, No or Cannot Say.
<table>
<tr><th>Age</th><th>Gender</th><th>City</th><th>Will Buy?</th></tr>
<tr><td>25-30</td><td>M</td><td>Chennai</td><td>Yes</td></tr>
<tr><td>33-45</td><td>F</td><td>Bangalore</td><td>Yes</td></tr>
<tr><td>57-80</td><td>F</td><td>Chennai</td><td>No</td></tr>
<tr><td>25-30</td><td>F</td><td>Hyderabad</td><td>No</td></tr>
<tr><td>13-19</td><td>M</td><td>Bangalore</td><td>Yes</td></tr>
<tr><td>16-20</td><td>M</td><td>Chennai</td><td>No</td></tr>
</table></td></tr>
</table>

Sr. No.	Problem Statements
6	Write a menu driven program to perform following operations. 1) To display maximum number among inputted three number. 2) To display the final prize based on assumption that if total purchase price is above 2500 rs then discount is 25% and if total prize is above 5000 then discount is 30% else 40% discount. 3) To Display percentage of 2nd number to 1st number if two numbers is entered by the user. 4) Exit.
7	Write a program print whether entered number is Prime or not
8	Write a program to print the sum of exponential series e(x) =1 + x/1! + x2 / 2! + x3 / 3! +…….
9	Write a program to print the given number pyramid
10	Write a program in C that will scan a number N and then output the sum of the powers from 1 to N. thus, if the input is 4, the output should be 288. E.g. (1) ^{1} + (2) ^{2} + (3)^3 +(4)^4 = 1+ 4 + 27 + 256 = 288 [1,2,3,4] Write a recursive function to print Factorial of a entered number. Use power function to calculate the power of number. Write a recursive function to print Factorial of a entered number.

I Semester
AIML2107: Applied Chemistry

Objective	Course Outcome
The student should be able to 1) To impart intensive and extensive knowledge of the subject enriching students to understand the role of Chemistry in the field of engineering. 2) To keep students abreast with the latest developments and applications of modern materials. 3) To gain basic principles, instrumentation and applications of analytical techniques.	**On completion of this course, the student will be able to** (1) Interpret different thermodynamic functions. (L2) (2) Describe basic concepts of electrochemistry and apply the knowledge for energy storage devices. (L3) (3) Illustrate chemical reaction rate (L3) (4) Classify advanced engineering materials in technological applications. (L2) (5) Develop analytical and instrumental skills. (L3)

Unit No.	Contents	Max. Hrs.
1	**Energetics**: Introduction, Internal energy, enthalpy, Gibb's free energy, Free energy change and chemical equilibrium. Spontaneous and non-spontaneous processes. I and II law of thermodynamics. Entropy and its significance. Numericals on Internal energy and enthalpy change. Thermodynamic applications to physical and chemical equilibrium.	07
2	**Electrochemistry**: Introduction, metallic and electrolytic conductance, resistance, specific resistance, conductance, specific conductance, equivalent and molar conductance. Variation of conductance with dilution. Electrode and electrode potentials. Nernst Equation. Faraday's laws and Numericals.**Industrial applications**: Electroforming, Electrowinning, Electrolytic refining.	06
3	**Energy Storage Devices** **Basic concepts**: Primary and secondary battery. Energy density, power density, energy efficiency, cycle life, shelf life.Secondary battery: Ni-metal hydride battery, Lithium-ion battery. **H_2-O_2 Fuel cell**: Principle, working, advantages, disadvantages, applications. Differences between battery and a fuel cell.**Supercapacitors**: Definition, types, characteristics and application.	06
4	**Chemical Kinetics** : Introduction, Rate of reaction and factors influencing rate of reaction, order & molecularity of reaction.Kinetic equations of different orders: Zero Order, First Order, Second Order and numericals.	06
5	**Spectroscopic Techniques and Applications** Fundamentals of spectroscopy, types of spectroscopy, aim of spectroscopy. **UV-Visible spectroscopy**: Basic principle, Lamberts Beers law, applications. **IR spectroscopy**: Introduction and Application **NMR**: Basic principle, chemical shift, Application Fundamentals of X-Ray Diffractions (XRD) spectroscopy	07

Unit No.	Contents	Max. Hrs.
6	**Advanced Materials :** **Nanomaterials**: Definition of nanomaterials, nano scale. Carbon Nanotubes and types. **Application of Nanomaterials**: Applications of nanomaterials in medicine, environment, and electronics. Nanotechnology for waste reduction and improved energy efficiency. Elementary ideas and applications of Nano biopolymers, Nano fertilizers and Nano ceramics. Threats of Nanomaterials. **Silicon Chips:** Introduction. Physical, chemical, electrical & mechanical properties. Applications. **Chemical sensors**: Types and application	07

Text Books

SN	Title	Edition	Authors	Publisher
1	A Textbook of Engineering Chemistry	Eleventh Edition.	S S. Dara	S.Chand & Co New Delhi
2	Engineering Chemistry	Sixteenth Edition	Jain & Jain	Dhanpat Rai & sons New Delhi.
3	Physical Chemistry	(Eighthedition-2006).	P. W. Atkins	Oxford Publications
4	Engineering Chemistry	First edition	B.Sivasankar	Tata McGraw-Hill

Reference Books

SN	Title	Edition	Authors	Publisher
1	Chemistry in Engineering	First edition	Lloyd A.Munro	Prentice-hall
2	Applied chemistry for engineers	First edition	T.S.Gyngell	Edward Arnold and Co
3	Engineering Chemistry	First edition	B.K.Sharma	Krishna Prakashan media private LTD
4	Chemistry of Advanced Materials	First edition	CNR Rao	RSC Publications
5	Handbook of Semiconductor Silicon Technology	First edition	William C. O'Mara, Robert B. Herring	Noyes Publications Park Ridge, NJ, USA.
6	Fundamentals of Molecular Spectroscopy	First edition	C.N. Banwell	McGraw hill education

Website / Data sheet:

SN	Title
1	Silicon Chips: What are Computer Chips Made Of? https://www.intel.com/content/www/us/en/history/museum-making-silicon.html
2	What is silicon, and why are computer chips made from it? https://www.extremetech.com/extreme/208501-what-is-silicon-and-why-are-computer-chips- made-from-it

I Semester
AIML2108: Lab.: Applied Chemistry

Objective	Course Outcome
The student should be able to Develop analytical ability Integrate chemistry fundamentals with practical applications	**On completion of this course, the student will be able to** 1) Describe basic concepts of electrochemistry and apply the knowledge for energy storage devices. (L3) 2) Classify advanced engineering materials in technological applications. (L2) 3) Develop analytical and instrumental skills. (L3).

List of Practical's

Sr. No.	Problem Statements
	Name of Experiment (Minimum 4 experiments from Group I & II each andDemonstrations on 2 experiments should be conducted)
	Group I:
1	To determine the strength of a given potassium dichromate solution with N/20 sodium thiosulphate solution
2	Estimation of NICKEL by complexometry
3	Determination of copper by iodometric titration
4	Estimation of Fe2+ ions by redox titration
5	Estimation of Fe3+ ions by spectrophotometric method
6	Synthesis of urea formaldehyde resin.
	Group II:
7	Preparation of Printed Circuit Board.
8	Determination of molecular weight of a olymer using Ostwald's viscometer
9	Determination ofion exchangecapacity of a cation exchange resin
10	Proximate analysis of coal.
11	Determination of thinner contain in oil paint
12	Electroplating Copper on Stainless steel.
	Demonstration:
13	Determination of Faradays first law.
14	Determination of Faradays second law.
15	Determination of conductivity of water sample by conductivity meter

I Semester
GE2131: Universal Human Value (Audit Course)

Objective	Course Outcome
The student should be able to 1) To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' 2) To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity 3) To highlight plausible implications of Holistic understanding in terms of ethical human conduct.	**On completion of this course, the student will be able to** 1) Experiential validation through the way to verify right or wrong. 2) Practice living in harmony with natural acceptance 3) Understand the importance of relationships.

Unit No.	Contents	Max. Hrs.
1	**Course Introduction** **Need, Basic Guidelines, Content and Process for Value Education** • Understanding the need, basic guidelines, content and process for Value Education • Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration • Continuous Happiness and Prosperity- A look at basic Human Aspirations	6
2	**Understanding Harmony in the Human Being - Harmony in Myself!** • Understanding human being as a co-existence of the sentient 'I' and the material 'Body' • Understanding the needs of Self ('I') and 'Body' • Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) • Understanding the characteristics and activities of 'I' and harmony in 'I'	6
3	**Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** • Understanding Harmony in the family – the basic unit of human interaction • Understanding values in human-human relationship; meaning of Nyaya and program for its fulfilment to ensure Ubhay-tript; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship • Understanding the meaning of Vishwas; Difference between intention and competence • Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship • Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sahasttva as comprehensive Human Goals • Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! • Practice Exercises and Case Studies will be taken up in Practice Sessions	5

Unit No.	Contents	Max. Hrs.
4	**Understanding Harmony in the Nature and Existence - Whole existence as Co-existence** • Understanding the harmony in the Nature • Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature • Understanding Existence as Co-existence (Sah-asttva) of mutually interacting units in all-pervasive space • Holistic perception of harmony at all levels of existence • Practice Exercises and Case Studies will be taken up in Practice Session	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	**The primary resource material for teaching this course consists of text book** A foundation course in Human Values and professional Ethics, Excel books,	1st Edition 2011	R.R Gaur, R Sangal, G P Bagaria	Excel books, New Delhi, 2010

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	**The teacher's manual** A foundation course in Human Values and professional Ethics, Excel books,	1st Edition 2011	R.R Gaur, R Sangal, G P Bagaria	Excel books, New Delhi, 2010

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

2nd Semester

(Department of Computer Science & Engineering

(CSE)Artificial Intelligence & Machine Learning

After BoS27#

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. AML-203.1

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Science & Engineering)

CSE (AIML)

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
First Semester															
1	1	BS	GE	AIML2101	Calculus, Sequeces and Series	**T**	3	0	0	3	3	30	20	50	3 Hours
2	1	HS	GE	AIML2102	Technical Communication	**T**	3	0	0	3	3	30	20	50	3 Hours
3	1	HS	GE	AIML2103	**Lab:** Technical Communication	**P**	0	0	2	2	1		60	40	
4	2	BES	CSE	AIML2104	Computer Workshop	**P**	0	0	2	4	2		60	40	
5	1	BES	CSE	AIML2105	Programming for Problem Solving	**T**	3	0	0	3	3	30	20	50	3 Hours
6	1	BES	CSE	AIML2106	Lab: Programming for Problem Solving	**P**	0	0	2	2	1		60	40	
7	1	BS	GE	AIML2107	Applied Chemistry	**T**	3	0	0	3	3	30	20	50	3 Hours
8	1	BS	GE	AIML2108	**Lab.:** Applied Chemistry	**P**	0	0	2	2	1		60	40	
					TOTAL FIRST SEM		**12**	**0**	**8**	**22**	**17**				
List of Audit Course															
1	1	HS	GE	GE2131	Universal Human Value	**T**	2	0	0	0	0				
2	1	HS	GE	AU2121	YCCE Communication Aptitude Preparation (YCAP1)	**A**	3	0	0	3	0				
3	2	HS	GE	AU2122	YCCE Communication Aptitude Preparation (YCAP2)	**A**	3	0	0	3	0				
Second Semester															
1	2	BS	GE	AIML2151	Probability and Statistics	**T**	3	0	0	3	3	30	20	50	3 Hours
2	2	BS	GE	AIML2152	Applied Physics	**T**	3	0	0	3	3	30	20	50	3 Hours
3	2	BS	GE	AIML2153	**Lab:** Applied Physics	**P**	0	0	2	2	1		60	40	
4	2	BES	EE	AIML2154	Digital Electronics	**T**	3	0	0	3	3	30	20	50	3 Hours
5	2	BES	EE	AIML2155	**Lab:** Digital Electronics	**P**	0	0	2	2	1		60	40	
6	2	BES	CSE	AIML2156	Object Oriented Programming	T	3	0	0	3	3	30	20	50	3 Hours
7	2	BES	CSE	AIML2157	**Lab:** Object Oriented Programming	P	0	0	2	2	1		60	40	
8	2	BES	CSE	AIML2158	Web Technology Lab	**P**	0	0	0	2	2		60	40	
9	2	HS	GE	AIML2159	Constitution of India	**T**	3	0	0	3	3	30	20	50	3 Hours
					TOTAL SECOND SEM		**15**	**0**	**6**	**23**	**20**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

II Semester
AIML2151 : Probability and Statistics

Objective	Course Outcome
The student should be able to 1. This course provides an indication of the relevance and important of the probability theory in solving practical problems in the field of multidisciplinary engineering applications. 2. To provide undergraduate foundation in both probability distributions and mathematical statistics relevant to engineering problems. 3. To teach mathematical skill sustained from this course to form a suitable base for analytical and theoretical concept encountered in engineering profession.	**On completion of this course, the student will be able to** 1. Identify an appropriate probability distribution for a given discrete or continuous random variable and compute probabilities. 2. Make use of probability distributions to solve real life problems. 3. Apply concepts of sampling theory to find probabilities and estimates parameters of various problems. 4. Inspect scientific data, use proper curve fitting and find correlation, regression of variables.

Unit No.	Contents	Max. Hrs.
1	**Random Variables & Probability Distributions** Conditional probability, Baye's theorem. Random variables: Discrete and Continuous random variables, Probability function and Distribution function, Joint distributions. Independent Random variables, Conditional Distribution.	7
2	**Mathematical Expectation** Mathematical Expectation, Variance & Standard Deviation, Moments, Moment generating function, Skewness and Kurtosis.	7
3	**Special Probability Distributions** Binomial, Geometric, Poisson, Exponential, Normal distributions, Central Limit theorem.	6
4	**Sampling Theory** Population and sample. Statistical inference. Sampling with and without replacement. Population parameters, sample statistics. Sampling distribution of means. Sampling distribution of proportions.	6
5	**Estimation** Unbiased and efficient estimates. Point estimates and interval estimates. Confidence interval for means, Confidence interval for proportions, Confidence interval for differences and sums of mean and proportions.	7
6	**Curve Fitting** Fitting of straight line, $y = a + bx$, a parabola $y = a + bx + cx^2$, exponential curves and power curves by method of least squares; Lines of regression and correlation; Rank correlation.	6

Text Books:

SN	Title	Edition	Authors	Publisher
1	The theory and problems of probability and Statistics	5rd edition	M. R. Spiegel	Schaum series. (McGraw Hill)
2	Basic Statistics for Business and economics	3rd edition	E. K.Bowen, M. K.Star	McGraw Hill
3	Engineering Mathematics	43rd edition	Dr. B. S. Grewal	Khanna Publisher
4	Probability and Statistics	2nd edition	Michael J. Evans and Jeffrey S. Rosenthal	

Reference Books:

SN	Title	Edition	Authors	Publisher
1	A First course in probability	Sixth Edition	Sheldon Ross	Pearson Education
2	Fundamentals of Mathematical statistics	3rd Edition	S. C.Gupta and V.K.Kapoor	Sultan Chand and Sons
3	Probability and Statistics for Engineering	6th edition	Miller Freund and Johnson.	Richard A. Johnson

II Semester
AIML2152 : Applied Physics

Objective	Course Outcome
The student should be able to 1) To know the fundamental principles of Applied engineering physics specifically concern to quantum physics, crystal structure, band theory of solids, Laser, Optical fibre, electron ballistics, electron optic devices and their engineering applications. 2) To provide problem solving experience and learning of concepts through it in Applied engineering physics, in both, the classroom and the laboratory learning environment	**On completion of this course, the student will be able to** 1) Co-relate fundamentals of quantum mechanics to solve problems dealing with quantum particle. 2) Assess the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands. 3) Illustrate working principle of lasers and optical fibres for their use in the field of industry. 4) Identify the requirements of sensor material for technological application. 5) Analyze the motion in electric field and magnetic field and its applications to electron optic devices.

Unit	Content	Hours
1	**QUANTUM PHYSICS** Wave-particle duality, Electron Diffraction, Wave packet, Heisenberg uncertainty principle, thought experiment, Significance, Applications.	6
2	**BASICS OF QUANTUM COMPUTING** Introduction of complex numbers, operators, eigen values, eigen functions. Wave function and itsprobability interpretation, Schrodinger Equation, Particle in infinite and finite potential well, quantum tunneling, Introduction to Bits and Qubits.	7
3	**BAND THEORY OF SOLIDS** Formation of energy bands in solids, Classification and energy band diagrams, Structure of semiconductor with band diagram, Intrinsic and extrinsic semiconductors,Law of mass action, Carrier transport, conductivity, Hall Effect.	7
4	**OPTICAL RADIATIONS & COMMUNICATION** Interaction of radiation with matter, Population Inversion and Optical resonance cavity, diode laser, Properties and engineering applications of laser. Optical Fibre: Principle, structure and classification, Acceptance angle, Numerical aperture, Losses.	7

Unit	Content	Hours
5	**SENSORS** Introduction, classification of sensors, performance characteristics, selection criteria, Requirement of sensor material, Role of sensors in industry, Examples: thermal, optical, pressure and acoustic sensors.	6
6	**ELECTRON BALLISTICS AND OPTICS** Motion of a charged particle in uniform electric and magnetic field, Cross field configuration; Electron refraction, Electron lens, CRO.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	A Textbook of Engg. Physics	Revised	M.N.Avadhanulu , P.G.Kshirsagar	S.Chand and Company
2	Electronic Engineering Materials and Devices	TMH edition, 10th	John Allision	reprint Tata McGraw Hill

Reference Books

SN	Title	Edition	Authors	Publisher
1	Fundamentals of Physics	10th	David Halliday, Robert Resnick and Jerle Walker,	John-Wiley India John Wiley & Sons Inc
2	Text Book of Optics	Revised	Brijlal and Subramanyam	S. Chand and Company
3	Laser	2 nd	M. N. Avadhanulu	S. Chand and Company
4	Concept of Modern Physics	6th	A.Beiser	Tata McGraw-Hill
5	LASERS: Theory and Applications:.	2nd	Thyagarajan K and Ghatak	A.K Macmillan Publication
6	Solid state Physics	9th	S.O.Pillai	New Edge International Publishers
7	Solid State Physics	8th	Palanisamy	SciTech Publishers
8	Solid State Physics	8th	C. Kittel	Willey Publication
9	Engineering Physics	1st	B.K.Pandey,S.Chaturvedi	Cengage Learning
10	Engineering Physics	2nd	H.K.Malik, A.K.Singh	Tata McGraw-Hill

II Semester
AIML2153 : Lab.: Applied Physics

Course Outcome
On completion of this course, the student will be able to
CO2- Assess the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands.
CO3- Illustrate working principle of lasers and its properties for useful applications in the field of industry.
CO4-Identify the requirements of sensor material for technological application.
CO5-Analyze the motion in electric field and magnetic field and its applications to electron optic devices.

List of Practical's

Expt.	Name of Experiment	CO	PO
1	Determination of Hall coefficient and density of charge carriers using Hall effect.	CO2	PO1,PO2
2	Determination of amplitude and frequency of sinusoidal signal using C.R.O.	CO 5	PO1,PO2
3	The study of V-I characteristics of a semiconductor diode (germanium and silicon) in forward and reverse bias mode.	CO 2	PO1,PO2
4	Determination of Band gap in a semiconductor by four probe method.	CO 2	PO1,PO2
5	To measure the phase shift introduced by a phase shift network using Dual beam CRO.	CO 5	PO1,PO2
6	Determination of wavelength of laser using diffraction grating.	CO 3	PO1,PO2
7	Determination of Band gap in a semiconductor using reverse biased p-n diode .	CO 2	PO1,PO2
8	Determination of divergence of laser beam.	CO 3	PO1,PO2
9	Determination of Acceptance angle and numerical aperture of a given optical fiber	CO 4	PO1,PO2
10	Dependence of Hall coefficient on temperature.	CO 2	PO1,PO2
11	Determination of attenuation of a given optical fibre.	CO 4	PO1,PO2
12	Study of magnetic field sensing by varying the gap between pole pieces of electromagnet.	CO 4	PO1,PO2
13	Determination of the velocity of Ultrasonic waves in a non –electrolytic liquid by ultrasonic interferometer	CO 4	PO1,PO2
	Demonstration Experiment		
14	Determination of the velocity of Ultrasonic waves in a non –electrolytic liquid by ultrasonic interferometer		

II Semester
AIML2154 : Digital Electronics

Objective	Course Outcome
➢ Develop a strong foundation of digitalelectronics. ➢ Understand concepts of combinational andsequential circuits. ➢ Analyze the synchronous and asynchronouslogic circuits.	Students will be able to: 1) Simplify combination logic circuits using Boolean algebra. 2) Understand and demonstrate the various codes and illustrate their addition substraction. 3) Simply and exhibit the methods to solve logical functions using K- map and Quine Mc-Cluskey methods and apply it to implement combinational logic circuits. 4) Design and analyze Synchronous and Asynchronous sequentialCircuits.

Unit No.	Contents	Max. Hrs.
1	Number system and codes :Binary: octal, hexadecimal and decimal Number systems and their inter conversion, BCD numbers (8421-2421), gray code, excess–3 code, ASCII codes. Binary addition and subtraction, signed and unsigned binary numbers, 1's and 2's complement representation.	6
2	Boolean Algebra: Basic logic circuits: Logic gates (AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR and their truth tables,), Universal Gates, Laws of Boolean algebra, De-Morgan's theorem. Introduction to Logic Family.	6
3	Minimization Techniques: Min term, Max term, POS, SOP, K-Map, Simplification by Boolean theorems, don't care condition.	6
4	Combinational Logic: The Half adder, the full adder, subtractor circuit. Multiplxer de-multiplexer, decorder, BCD to seven segment Decorder, encoders	6
5	Sequential Circuits: Flip flop, set-reset laches, R-S flip-flop, D-flip flop, J-K Flip-flop, Master slave Flip flop, T flip-flop, excitation table of flip-flops.	7
6	Registers & Counters: Serial in/Serial out shift register, Serial in/parallel out shift register, parallel in/ parallel out shift register, parallel in/Serial out shift register, Bi-directional register, Synchronous/Asynchronous counter, Structure of RAM.	7

TEXT BOOKS

1. Modern Digital Electronics , RP Jain, Tata McGraw Hill, 3rd Edition
2. M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 PearsonEducation (Singapore) Pvt. Ltd., New Delhi, 2003.
3. Donald P.Leach and Albert Paul Malvino, Digital Principles and Applications, 6thEdition,TMH, 2003.
4. Anandkumar- fundamental of digital circuit. 3rd edition. PHI

Reference Books:

1) Fundamentals of Logic Design, C.H.Roth, Public Work & Services, 3rd edition 2007.
2) Engg Approach to Digital Design, Fletcher, Prentice Hall of India 1993.
3) Digital Circuits & Microprocessors, Hebert Taub, Mc Graw Hill, 1988.

II Semester
AIML2155 : Lab: Digital Electronics

Objective	Course Outcome
➢ Develop a strongfoundation of digital Electronics. ➢ Understand concepts of combinational and sequential circuits. ➢ Design and develop combinational andsequential circuits	Students will be able to: 1. Simplify combination logic circuits using Boolean algebra and exhibit the methods to solve logical functions using K-map and Quine-Mc-Clauskey methods. 2. Understand and apply the concept of combinational logic circuits in various digital systems. 3. Understand and demonstrate the various codes and illustrate concept of logic family with their characteristics. 4. Understand the working of Flip-flops and its use to design Synchronous counters and Design and demonstrate finite state machines.

List of Practical's

Sr. No..	Problem Statements
1.	Introduction to LogicAid software and commands. Verifications of functions using Logic Aid and comparing the results with manual results.
2.	Introduction to Bread Board and Verify Truth Tables of basic Logic gates using Bread Board.
	On Experimental Kit (Hardware) / Virtual Lab: An Initiative of Ministry of Human Resource Development Under the National Mission onEducation through ICT
3.	Construction of half/ full adder using XOR and NAND gates and verification of its operation.
4.	Verify Binary to Gray and Gray to Binary conversion using NAND gates only.
5.	Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates.
6.	Verify the truth table of D-flip-flops and JK- flip-flops.
7	Design and verify the 2- Bit Synchronous up Counter.
	Using SPICE
8	Introduction to SPICE Digital model and commands. Verify Truth Tables of basic Logic gates &Universal Gates **using SPICE.**
9	Design & verify Truth Table of Half adder & Full adder circuits **using SPICE.**
10	Design & verify Truth Table of 4:1 Multiplexer & 1: 4 Demultiplexer circuits **using SPICE.**

II Semester
AIML2156 : Object Oriented Programming

Objective	Course Outcome
The student should be able to 1. Learn the Concepts of Java programming language 2. Learn Java's syntax, idioms, patterns, and styles to write simple JAVA program. 3. To develop object centric thinking and to use object oriented features of JAVA to write complex programs. 4. Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development	**On completion of this course, the student will be able to:** 1. Demonstrate the understanding of Object oriented concepts. 2. Apply the programming language JAVA efficiently in object oriented software development 3. Able to analyze problem statement and identify appropriate objects and methods 4. Design and implement small programs using classes 5. Design, develop, test, and debug programs using object oriented principles of java

Unit No.	Contents	Max. Hrs.
1	Introduction to object oriented programming paradigm, procedure oriented programming vs OOP, features of OOP, benefits of OOP, defining class, instantiating a class. Declaring Classes and objects, Creating Classes and objects, methods, argument passing, Recursion, this keyword, constructors ,Visibility control	8
2	Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances)	7
3	Arrays, Strings Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Wrapper Classes,	8
4	exception handling mechanism: Fundamentals exception types, uncaught exception,try-catch Block, displaying description of an exception, multiple catch clauses, nested try-catch statements, throw, throws, finally, built in exceptions, creating own exception subclasses,	7
5	Collection Vector and Framework: Introduction to collection framework, Vectors, Array List, Linked list, Hashset, Treeset, Hashmap	7
6	IO Steam, applets and Thread: Introduction to stream classes, use of stream classes,I/O stream, bytes stream, character stream, predefined stream, reading console input, reading character, reading string, writing console output, the print write class, reading & writing files, transient and volatile modifiers, Introduction to applets, applet life cycle, creating and executing applets, Introduction to multithreading, life cycle of Thread, Runnable interface and Thread class.	8

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Thinking in Java	4th	Bruce Eckel	Prentice Hall

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Java Complete Reference	7th	Herbert Schildt	McGraw-Hill
2	Programming with Java	6th	E. Balagurusamy	TATA McGraw-Hill

II Semester
AIML2157 : Lab.: Object Oriented Programming

List of Practical's

Sr. No..	Problem Statements
1	Implement the concept of Class and its data members and member functions in Java
2	Implement the concept of function overloading in Java
3	Implement the concept of class constructor and its type in Java
4	Implement the concept of Abstraction in Java
5	Implement the concept of all types of inheritance in Java
6	Implement the collection listener to solve the problem in Java
7	Implement the concept of run time polymorphism in Java
8	Implement the concept of Files using command line arguments in Java
9	Implement the concept of exception in Java
10	Implement the concept of applet to prepare a web application in Java

II Semester
AIML2158 : Web Technology Lab

Objective	Course Outcome
The student should be able to 1) To introduce with the internet technology 2) To study the basic of web page designing 3) To introduce the validations in the web page 4) To introduce the concepts of data storage using XML 5) To learn the advance technique for designing the interactive web page	**On completion of this course, the student will be able to** 1) Understand various internet technologies 2) To design the web pages using some basic techniques 3) To design and implement the interactive web pages 4) To use the XML technology to store the data 5) To design and develop the interactive web pages using the advanced technique

List of Practical's

Sr.No.	Problem Statements
1	Introduction to internet (Overview of Internet, Email, WWW, Broad Band and FTP)
2	Study and implement basic HTML Tags.
3	Create web forms by using form tags in HTML. (Use any example)
4	Program to demonstrate the use of java Script in while and for loops.
5	Program to demonstrate the use of java Script in conditional statements and functions.
6	Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.
7	Introduction to XML program to demonstrate the use of External and Internal DTD.
8	Create a web form which will accept two numbers as input and perform operation depending on value selected from dropdown list control.
9	To create a web form to demonstrate the use of ASP.NET Web controls- Radio Button Control, Image Control and Link Button Control

II Semester
AIML2159 : Constitution of India

Objective	Course Outcome
The student should be able to 1) To enable the student understand the importance of constitution 2) To understand the structure of executive, legislature and judiciary 3) To analyze federalism in the Indian context 4) To understand philosophy of fundamental rights and duties 5) To understand and evaluate the Indian Political scenario of the emerging challenges.	**On completion of this course, the student will be able to** 1) Explain the basic concepts of Constitution of India. 2) Describe the various Fundamental rights 3) Analyze the Impact of federalism on the State 4) Explain Industrial Law and Judiciary.

Unit No.	Contents	Max. Hrs.
1	**Origin and Meaning** Origin of history of Constitution, Meaning of the constitution law and constitutionalism, Kingship and Republic States in Ancient India	6
2	**Concept of the Constitution of India** Preamble, The union and its territory, Citizenship	6
3	**Federalism** Salient features of Federalism, Structures and features of Indian Federalism, Panchayat Raj System	6
4	**Fundamental Rights** Scheme of the Fundamental rights, duties, Scheme of the Fundamental Right to Equality, The scheme of the Fundamental Duties and its legal status	7

Unit No.	Contents	Max. Hrs.
5	**Legislative Power** Federal structure and distribution of legislative, Financial power between the Union and the States, Parliamentary Form of Government in India – The constitution power and status of the President of India	7
6	**Challenges to Indian Political Systems** The Executive, Directive principles of State Policy, The Union Judiciary	7

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	"Social Science"	1st Edition	Dr G.N. Nimbarte, (2018)	Sankalp Publication, Vidhya Nagar, Nagpur

Sn	Title	Edition	Authors	Publisher
1	Constitution of India	1st Edition	Dr. B. R. Ambedkar	Government of India, Ministry of Law and Justice
2	An Introduction to the Constitution of India	24th Edition	Basu, D.D (2005)	New Delhi, Prentice Hall
3	Working of a Democratic Constitution of India	2nd Edition	G. Austin (2004)	New Delhi: Oxford University Press.
4	State and Government in Ancient India	7th Edition	A.S. Altekar (2016)	Motilal Banarsidass Publishing House, New Delhi.
5	Understanding Contemporary India: Critical Perspectives,	1st Edition	A. Vanaik and R. Bharghava (eds) (2010)	New Delhi: Orient Blackswan.

Nagar Yuwak Shikshan Sanstha's

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Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

3rd Semester

(Department of Computer Science & Engineering

(CSE)Artificial Intelligence & Machine Learning

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. AML-203.1

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Science & Engineering)

CSE (AIML)

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS		AIML2201	Distrete Mathematics and Graph theory	**T**	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CSE	AIML2202	Formal Language & Automata Theory	**T**	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	CSE	AIML2203	**Lab:** Formal Language & Automata Theory	**P**	0	0	2	2	1		60	40	
4	3	PC	CSE	AIML2204	Data Structures	**T**	3	0	0	3	3	30	20	50	3 Hours
5	3	PC	CSE	AIML2205	**Lab:** Data Structures	**P**	0	0	2	2	1		60	40	
6	3	PC	CSE	AIML2206	Computer Architecture & Organisation	T	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	CSE	AIML2207	**Lab:** Software	**P**	0	0	2	2	2		60	40	
					TOTAL THIRD SEM		**12**	**0**	**6**	**18**	**16**				
Fourth Semester															
1	4	BS	GE	AIML2251	Linear Algebra	**T**	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CSE	AIML2252	Operating Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CSE	AIML2253	**Lab:** Operating Systems	**P**	0	0	2	2	1		60	40	
4	4	PC	CSE	AIML2254	Software Engineering	**T**	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	CSE	AIML2255	**Lab:** Software Engineering	**P**	0	0	2	2	1		60	40	
6	4	PC	CSE	AIML2256	Design & Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	CSE	AIML2257	**Lab:** Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
8	4	PC	CSE	AIML2258	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
9	4	PC	CSE	AIML2259	**Lab:** Database Management Systems	**P**	0	0	2	2	1		60	40	
					TOTAL FOURTH SEM		**15**	**0**	**8**	**23**	**19**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

List of Audit Course

1	3	HS		GE2121	Env Studies for EL,ETC,CT,CSE-AIML	**T**	2	0	0	2	0	
2	3	HS		AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0	
3	4	HS		AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE, IIoT, AIML, CSD, AIDS	**A**	3	0	0	3	0	

		June 2022	1.01
Chairperson	**Dean (Acad. Matters)**	**Date of Release**	**Version**

Applicable for AY 2022-23 Onwards

III Semester

AIML2201 - Discrete Mathematics and Graph theory

Objective	Course Outcome
1. This course will provide the mathematical fundamentals needed to understand computer application. 2. To provide the mathematical concepts necessary in the study of propositional and predicate logic. 3. To discuss the concepts of algebraic systems like sem groups and groups. 4. To use graph theory to analyze the complex structure which helps in writing efficient code.	With the completion of this syllabus students will be able to 1. Identify the importance of statements in deriving valid inferences. 2. Use relations and ordering methods to identify the relationship among the inferences. 3. Select suitable algebraic systems to find solution for real time problems. 4. Find the suitable computing methods and applying graph theory concepts to solve complex problems

Unit No.	Contents	Max. Hrs.
1	**Mathematical Logic and Set Theory:** Statement and Notation: Negation, Conjunction, Disjunction, Tautologies, Truth Tables, Basic Concepts of Set Theory, Inclusion & equality of set, Power Set, Ordered Pairs and n-tuples, Operations on Sets , mathematical induction. Propositions, Predicate logic.	6
2	**Relations and Functions:** Relations and Ordering, Relation Matrix and Graphs, Partition and Covering of a set, Equivalence relation, Partial order relation, Partially Ordered sets, Functions , Composition of functions, Inverse Functions, Characteristics function of a set.	6
3	**Group Theory:** Groups, Subgroups and Homomorphism, Cosets and Lagrange's theorem, Normal subgroups. Semi groups and Monoids Homomorphism of semigroups and monoids, Sub semi groups and monoids.	7
4	**Rings:** Definitions and Examples, sub ring, Integral domain, ring homomorphism, ideal of ring polynomial.	7

5	**Field and Lattices :** Definitions and Examples, Finite Field, Ordered sets, Hasse Diagrams of partially Ordered sets. Lattices, Bounded Latices, Complements Latices, Definitions and Examples of Finite Field, Ordered sets, Hasse Diagrams of partially Ordered sets. Lattices, Bounded Latices, Complements Latices.	7
6	**Graph Theory:** Basic concepts of graph theory, Basic definitions, Paths and circuits, Reachability and connectedness, Matrix Representation of graphs, Tree and their representation and operations, Rooted trees, Path lengths in rooted trees, Multi graphs and weighted graphs, and graph isomorphism, shortest paths in weighted graphs, Hypergraphs, transitive closure, Spanning trees, Kruskal's algorithm, Prim's algorithm.	7

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Discrete Mathematics Structure with application to Computer Science	1st edition	J. P. Tremblay & R. Manohar	Tata McGraw-Hills Publication Company Limited
2	Discrete Mathematics	2nd edition	Lipschutz Schaums	Tata McGraw-Hills Publication Company Limited

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Mathematical structures	3rd edition	Kolman ,Robert C.Busby, Sharon Ross	Prentice Hall of India

III Semester

AIML2202 - Formal Language & Automata Theory

Objectives	Outcomes
1. To understand the basic properties of formal languages and Finite Automata, regular expression and Regular Grammar. 2. To study of different types of grammars and the properties of Context Free Grammar 3. To understand the basic properties of CFL and Designing of Push Down Automata 4. To understand the basic properties of Turing machine and study of Recursive Language, decidability, post Correspondence problem and Recursive enumerable language.	1. Apply basic properties of formal languages and to design finite automata for regular expression and Regular Grammar. 2. Construct context free grammar for various languages. 3. Solve various problems of push down automata for context free language 4. Design Turing Machines for given any computational problem.

Unit No.	Contents	Max. Hrs.
1	Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Design of Finite State Machines, Acceptance of strings and languages, Non Deterministic Finite Automata, Deterministic Finite Automata, Equivalence between NFA and DFA, NFA with ε-transition, Minimization of FA.	8
2	Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets (Proofs not required), Regular grammars, Right linear and left linear regular grammars, inter-conversion between LLG & RLG, Equivalence between regular grammar and F.A., Inter-conversion between RE and RG.	7
3	Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal form, Greibach normal form.	7
4	Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Inter-conversion, Closure properties of CFL, DPDA & NDPDA.	6
5	Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive Language, Recursive enumerable language, , Properties of Recursive enumerable language, Church's hypothesis, Chomsky hierarchy of language, Linear bounded automata , context sensitive language, Universal Turing Machine	6
6	Un-decidability Problems related to Recursive enumerable language and Turing Machine, post correspondence problem. Recursive function Theory –Basis functions and operations on them. Bounded minimization preemptive μ recursive function ,unbounded minimization and recursive function	6

Text Books:

SNo	Title	Edition	Authors	Publisher
1	Introduction to Automata Theory, Languages, and computation	3rd Edition	Hopcroft J.E., Rajeev Motwani, Jeffrey D. Ullman	Pearson Education
2	Introduction to languages and the Theory of Computation	3rd Edition	John C.Martin	Mc Graw Hill

Reference Books:

SNo	Title	Edition	Authors	Publisher
1	Introduction to the Theory of Computation	2nd Edition	Michael Sipser	GALE CENGAGE Learning
2	Theory of Computation	1st Edition	Dr. O. G. Kakde	Laxmi Publication

III Semester

AIML2203 - Lab: Formal Language & Automata Theory

Sr. No.	List of Experiment
1	Study of JFLAP tool.
2	Study of other FLAT tools.
3	Design NFA for a string starting with '0' over the alphabet Σ = {0,1} using JFLAP.
4	Using JFLAP, construct NFA for a string ending with 'b' over the alphabet Σ = {a,b}.
5	Construct a DFA for a string containing '00' over the alphabet Σ = {0,1} using any tool.
6	Construct a DFA for a string having second last symbol as 'a' over the alphabet Σ = {a,b} using JFLAP.
7	Build a PDA for a palindrome of even length over the alphabet Σ = {0, 1}.
8	Build a PDA for a palindrome of odd length over the alphabet Σ = {a, b}.
9	Enter the following CFG into JFLAP S → T T S → U T → 0T T → T0 T → # U → 0U00 U → #
10	Design a Turing Machine that concatenates the following strings on the input tape '...□001□110□100□'.

III Semester

AIML2204: Data Structures

Objective	Course Outcome
1. To make students familiar with arrays, operations on arrays and structures 2. To make student understand concept of abstract data types like stacks and queues, linked list 3. To make student understand trees and graphs and operations on it 4. To create thinking ability needed for implementation of programming logic with proper use of memory	1. To understand fundamental concepts in data structures 2. To apply and analyse algorithms for performing operations on data structures 3. To evaluate the performance of data structures and its applications. 4. Simulate the algorithms for performing operations on data structures.

Unit No.	Contents	**Max. Hrs.**
1	Introduction to data structures- Need of data structures, Types of data structures, recursion, Arrays, sorting – Bubble sort , Insertion sort, Selection sort, Merge sort, Quick sort and searching techniques- Linear Search and Binary Search, Hashing: Direct-address tables, Hash tables, open addressing, Perfect Hashing	7
2	Stacks and queues: The stack as an ADT, Representation, Stack operation, Application. Queue: The Queue as an ADT, Representation, Queue operation, Circular and Priority queue, Applications of stacks and queues	6
3	Linked Lists: Linked list as an ADT, Singly-linked lists, doubly linked lists and circular linked lists. Operations on linked list etc., Linked stacks and Queues, Applications of lists in polynomial representation, multi-precision arithmetic.	6
4	Binary Trees: Binary trees, binary trees- basic algorithms and various traversals. Binary Search Trees (BSTs) and insertion, deletion in BSTs. Heaps and heap sort	6
5	Balanced trees: Height-balanced (AVL) trees, Splay tree, Red-black trees, Multi-way trees-B and B+ and applications	6
6	Graphs: Representation & traversals: Spanning trees, topological sort, shortest path algorithm, all-pairs shortest paths	7

Text books:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Data Structures & Program Design in C	Robert Kruse, G. L. Tondo and B. Leung	latest edition	Person
2	"Fundamentals of Data Structures in C",	Horowitz, S. Sahni, S. Anderson-freed,	latest edition	University Press,
3	"Data Structures Using C and C++"	Y. Langsam, M. J. Augenstein and A. M. Tannenbaum,	latest edition	Prentice Hall India,

Reference books:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Fundamentals of Data Structures in C++	2nd, 2009	Ellis Horowitz, Sartaj Sahani, Dinesh Mehta	University Press
2	Data Structures with C	Latest	Seymour Lipschutz	Tata McGraw Hill

III Semester

AIML2205 - Lab: Data Structures

Sr. No.	List of Experiment
1	Program based on searching- linear , binary search
2	Program based on sorting- quick sort / merge sort
3	Program based on stacks creation and operations on it
4	Program based on queue creation and operations on it
5	Program based on single linked list creation and operations on it
6	Program based on double linked list creation and operations on it
7	Program based on Binary tree : creation and traversal
8	Program based on Binary search tree : creation and searching
9	Program based on graphs :creation and traversal
10	Program based on graph: Prims/ Kruskal algorithm for finding minimum cost spanning tree

III Semester

AIML2206: Computer Architecture and Organisation

Objective	Course Outcome
1. Understand basics of computer architecture, its components with peripheral devices, instruction set architecture 2. To introduce essentials of assembly language programming. 3. To introduce the students to inner working of CPU and its design based on hardwired and microprogrammed control unit 4. To deliver the knowledge of information representation within computers memory, and to know the hardware implementations of arithmetic operations on integers and floating point numbers 5. To study the function of each element of a memory hierarchy in view of its effects on overall system performance. 6. Learn the concepts of interrupts, I/o modules, DMA, and pipelining	On completion of the course, student will be able to 1. Understand and demonstrate the basic computer architecture concepts related to the working of processors, memory systems, and input output systems. 2. Differentiate among various addressing modes and develop ability to write assembly language programs. 3. Comprehend information representation in computer and perform arithmetic operations using algorithms suitable for hardware implementation. 4. Explain and compare techniques for improving the performance of a computer system components like CPU, main memory, input/output system and pipelining.

Unit No.	Contents	Max. Hrs.
1	Basic Structure of Computer Hardware and Software: Functional Units, Basic Operational Concepts, Bus Structures, Software, processor clock and basic performance evaluation, number systems, and arithmetic operations, Memory Locations, addressing and encoding of information, instruction and instruction sequencing, branching, condition codes, zero, one and two address instructions, RISC vs CISC computers.	6
2	Addressing modes, Stacks, and Subroutines, Processing Unit: Some fundamental concepts, Execution of a complete instruction, One, two, and three bus organization, Sequencing of control Signals, Assembly language programming.	6
3	Processor Design, hardwired control, Microprogrammed Control: Microinstructions, Grouping of control signals, Microprogram sequencing, Micro Instructions with next Address field, prefetching microinstructions.	7

4	Arithmetic (Fixed and Floating point): Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction, Arithmetic and Branching conditions, Multiplications of positive numbers, Signed- Operand multiplication, Booth's Algorithm , fast Multiplication, Integer Division algorithms, Floating point numbers and operations, IEEE floating point standards	7
5	The Main Memory: Basic concepts, Memory Hierarchy, semiconductor RAM memories, Static RAM vs Dynamic RAM, semiconductor ROM memories, DDRAM, Memory system considerations, Speed , Size and Cost. Cache Memory: cache memory mapping techniques, secondary storage devices, HDD vs SSD, Performance Considerations.	6
6	Computer Peripherals, I/O modules and I/O Devices, I/O transfers: program controlled, memory mapped and I/o mapped I/O, Interrupt handling and Interrupt driven I/O, DMA. Pipelining: Basic Concepts, Data Hazards and Instruction Hazards. Introduction to GPU and GPU Computing.	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Computer Organization	5th edition	V. Carl Hamacher, ZvonkoVranesic,	McGraw Hill Publications.
2	Computer Architecture: A Quantitative approach	6th edition	John L. Hennessy, David A. Patterson	MK series in computer architecture and design

Reference Books

SN	Title	Edition	Authors	Publisher
1	Computer Organization and Architecture	6th edition	WillaiamStaliing	Pearson Education
2	Computer Architecture & Organization	3rd edition	J.P. Hayes	McGraw Hill Publications

III Semester

AIML2207 - Lab: Software

Objective	Course Outcome
• Understanding data types, data structures, control and Loop statements in Python. • Learn def function definitions, and modules. • Learn basic object-oriented concepts using Python. • Developing applications in Python using customized and built in modules and packages.	After learning the course, the students will be able to 1. Understand the basic data types, built in data structures, control statements and loops and write simple programs in Python 2. understand the concepts of functions, modules and packages and write complex programs using them. 3. understand defining and handling Python objects and develop classes required for the given application 4. develop a useful application in Python.

Unit No.	Contents	Max. Hrs.
1	Introduction: Build-in Data types: Data type & Variables,, Python Strings, Python built in data structures: Lists, Dictionaries, Tuples, Sets, Arrays. Datatype conversion. Statements: Assignment statement, import statement, print statement, input statement, Python Control Statements: if, if – else, statements, Loop statements: For, while, continue and break, try and except statement, raise, with statements.	4
2	Python Functions, Modules and Packages: The def statement, returning values, parameters, arguments, local variables, global variables and global statement, doc strings for functions, Mathematical Function, Generating Random numbers, File Handling.	3
3	Python Object and Classes: defining classes and creating classes, member variables, Doc strings for classes, Private members, Python Operator Overloading, Python inheritance and polymorphism, Exception Handling, Python Modules and packages.	2
4	Developing applications in Python using built in and customized modules and packages.	1

Books:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1.	Learn Python Programming	Fabrizio Romano, Heinrich Kruger	Third Edition, 2020	PACKT Publishing
2.	Introduction to Computation and Programming Using Python	John V. Guttag	Second Edition,2016	PHI EEE(MIT Press)

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A' Grade by NAAC with a score of 3.25)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

4th Semester

(Department of Computer Science & Engineering

(CSE)Artificial Intelligence & Machine Learning

28 June 2019

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. AML-203.1

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2022-23 onward)

(Department of Computer Science & Engineering)

CSE (AIML)

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Third Semester															
1	3	BS		AIML2201	Distrete Mathematics and Graph theory	**T**	3	0	0	3	3	30	20	50	3 Hours
2	3	PC	CSE	AIML2202	Formal Language & Automata Theory	**T**	3	0	0	3	3	30	20	50	3 Hours
3	3	PC	CSE	AIML2203	**Lab:** Formal Language & Automata Theory	**P**	0	0	2	2	1		60	40	
4	3	PC	CSE	AIML2204	Data Structures	**T**	3	0	0	3	3	30	20	50	3 Hours
5	3	PC	CSE	AIML2205	**Lab:** Data Structures	**P**	0	0	2	2	1		60	40	
6	3	PC	CSE	AIML2206	Computer Architecture & Organisation	T	3	0	0	3	3	30	20	50	3 Hours
7	3	PC	CSE	AIML2207	**Lab:** Software	**P**	0	0	2	2	2		60	40	
					TOTAL THIRD SEM		**12**	**0**	**6**	**18**	**16**				
Fourth Semester															
1	4	BS	GE	AIML2251	Linear Algebra	**T**	3	0	0	3	3	30	20	50	3 Hours
2	4	PC	CSE	AIML2252	Operating Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
3	4	PC	CSE	AIML2253	**Lab:** Operating Systems	**P**	0	0	2	2	1		60	40	
4	4	PC	CSE	AIML2254	Software Engineering	**T**	3	0	0	3	3	30	20	50	3 Hours
5	4	PC	CSE	AIML2255	**Lab:** Software Engineering	**P**	0	0	2	2	1		60	40	
6	4	PC	CSE	AIML2256	Design & Analysis of Algorithms	**T**	3	0	0	3	3	30	20	50	3 Hours
7	4	PC	CSE	AIML2257	**Lab:** Design & Analysis of Algorithms	**P**	0	0	2	2	1		60	40	
8	4	PC	CSE	AIML2258	Database Management Systems	**T**	3	0	0	3	3	30	20	50	3 Hours
9	4	PC	CSE	AIML2259	**Lab:** Database Management Systems	**P**	0	0	2	2	1		60	40	
					TOTAL FOURTH SEM		**15**	**0**	**8**	**23**	**19**				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

List of Audit Course

1	3	HS		GE2121	Env Studies for EL,ETC,CT,CSE-AIML	**T**	2	0	0	2	0	
2	3	HS		AU2123	YCCE Communication Aptitude Preparation (YCAP3)	**A**	3	0	0	3	0	
3	4	HS		AU2124	YCCE Communication Aptitude Preparation (YCAP4.1) for CV,ME,CT,IT,CSE, IIoT, AIML, CSD, AIDS	**A**	3	0	0	3	0	

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Applicable for AY 2022-23 Onwards

IV Semester

AIML2251 – Linear Algebra

Objective	Course Outcome
1. To provide mathematical knowledge required to analyze problems encountered in engineering. 2. The students are acquainted with the solution of system of linear equation, eigen values and eigen vectors. 3. To apply principles of matrix algebra to linear transformations and inner products. 4. Student can apply this course in many areas of engineering such as computer graphics, cryptography, wire-less communication, signal processing, robotics and animation.	After completion of the course, the student will be able to 1. Solve systems of linear equations using rank of matrix 2. Determine eigenvalues and eigenvectors and solve eigenvalue problems. 3. Explain the concepts of vector space and subspace, span and basis. 4. Apply principles of matrix algebra to linear transformations and inner product.

Unit No.	Contents	Max. Hrs.
1	**Elementary matrix operations** Introduction to Matrices and Determinants, Solution of Linear Equations, Cramer's rule, Inverse of a Matrix.	6
2	**Matrix Algebra** Rank of a matrix, Gaussian elimination, LU Decomposition (Crout's method), Solving Systems of Linear Equations using the tools of Matrices.	6
3	**Diagonalization of matrix** Eigen Values and Eigen vectors, Linear dependence and independence of Eigen Vectors, Orthogonal Eigen vector, Diagonalization of matrix, Cayley-Hamilton Theorem and Sylvester's Theorem.	7
4	**Vector Space** Vector Space, Subspace, Sum of Sub space, linear combination, Linear dependence and independence, Span and basis, Spanning sets, Generators.	6
5	**Linear Transformation** Linear transformation, Ranges and Kernel (null space) of linear transformation, Inverse of linear transformation, Algebra of linear transformation, Singular and nonsingular linear transformation.	7

6	**Inner product Spaces** Inner product space and Norms, orthogonal vector, the Gram Schamidt orthogonalization Process , orthogonal compliment, Adjoint of Linear operator, Normal and self adjoint operator, Unitary and orthogonal operator, Bilinear and Quadratic form.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Advance Engineering Mathematics	9th Edition (September 2009)	Kreyszig.	Wiley
2	Higher Engineering Mathematics	40th edition, (2010)	B.S. Grewal	Khanna Publishers (2006)
3	Advanced Engineering Mathematics	8th revised edition, 2007	H.K. Dass	Publisher: S.Chand and Company Limited
4	Linear Algebra,		Hoffman and Kunze	prentice Hall of India, New Delhi
5	Linear Algebra and its Applications		GlbertStrang	Nelson Engineering (2007)

Reference Books

SN	Title	Edition	Authors	Publisher
1	Mathematics for Engineers	19th edition, (2007)	Chandrika Prasad.	JohnWiley & Sons
2	Advanced Mathematics for Engineers	4th edition, (2006)	Chandrika Prasad	JohnWiley & Sons
3	Applied Mathematics for Engineers	3rd edition, (1970)	L.A. Pipes and Harville	McGraw Hill
4	Matrix and Linear Algebra,	Latest edition	K.B.Datta:	prentice Hall of India, New Delhi
5	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	LaxmiPrakashan

IV Semester

AIML2252– Operating Systems

Objective	Course Outcome
1. To understand the role, components, and designing issues associated with operating systems. 2. To understand processes and threads, CPU scheduling algorithms, and process synchronization mechanisms 3. To comprehend the concepts of memory management including virtual memory. 4. To understand issues related to file system interface and implementation, and disk scheduling.	After undergoing this course student will be able to 1. Understand the fundamental concepts in Operating Systems (OS) and understand how various hardware features support OS functionality. 2. Explain various OS mechanisms and policies for managing system resources. 3. Analyse algorithms and techniques for managing various OS resources in a multiprogramming and other environments. 4. Evaluate the performance of algorithms for managing various OS resources.

Unit No.	Contents	Max. Hrs.
1	Introduction to OS**:** evolution of OS, basic hardware support necessary for modern operating systems, Layered Structural of OS, process concept, process state transitions , Services provided by OS, system calls, privileged instructions, Dual mode of operation, I/O bound and CPU bound processes, concept of multiprogramming and multiprocessing.	5
2	Process management: process control block, process context switch, process versus threads, CPU scheduling, goals of scheduling, CPU scheduling algorithms, Algorithmic evaluation of CPU scheduling algorithms, multi-queue scheduling, multithreading	6
3	Interprocess communication and Synchronization: Operations on processes, Interprocess communication, process cooperation and synchronization, race condition, critical region, mutual exclusion and implementation, semaphores, classic problems of Synchronization using semaphores, other synchronization constructs.	8
4	Memory management techniques: -contiguous allocation, static and dynamic partitioning, non-contiguous allocation, paging, translation look aside buffer (TLB) and overheads, segmentation.	6
5	Virtual memory: demand paging, page replacement algorithms, thrashing, and working set model. Deadlocks: necessary conditions, deadlock detection, deadlock avoidance, deadlock prevention, recovery from deadlock.	7
6	File systems: introduction, Access methods, Directory Structure disk space management and space allocation strategies, disk arm scheduling strategies: FCFS, SSTF, SCAN, CSACN, LOOK, CLOOK, Selecting a disk scheduling algorithm.	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Operating system Principles	9th Edition	A. Silberchatz and P.Galvin	John Wiley & Sons Inc.
2	Operating Systems Internals and Design Principles	2nd	William Staling	Pearson

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Operating Systems: A Design-Oriented Approach	-	Charles Crowley	McGraw Hill
2	Operating system concepts and Design	2nd	Milan MilenKovic	Tata McGraw Hill

IV Semester

AIML2253–Lab: Operating Systems

Sr. No.	List of Experiment
1	Study of Window task manger(Exploring various tabs: application, processes, services, networking, performance)
2	Study of Advanced Linux shell commands (Process management, memory management, networking, etc.)
3	Write a program that illustrates the creation of child process using fork system call. Each child and parent Processes perform different task.
4	Write a multithreaded program to multiply two given matrices.
5	Simulate: a) Any preemptive CPU Scheduling Algorithm b) Any Non-preemptive CPU Scheduling Algorithm
6	Write a program to perform Inter-Process-Communication using shared memory or, pipes or message queues.
7	Write a program that solves two process Producer-Consumer problem with bounded buffer using semaphores. OR Write a program that gives a deadlock and starvation free solution to the Dining Philosohers problem using semaphores.
8	Simulate: a) First Fit(Static Memory allocation algorithm) and b) Worst Fit(Dynamic Memory allocation algorithm)
9	Simulate any one of the following page replacement algorithms: FIFO, LRU, Optimal
10	Write a program to simulate Banker's Deadlock avoidance algorithm.

IV Semester

AIML2254– Software Engineering

Objective	Course Outcome
1. Study software engineering best practices and different strategies applicable for software development, software requirement and its design activity. 2. Explore the various testing types and it strategies. 3. Understand configuration management, version control and change control process of Software development. 4. Understand project management, planning, scheduling, risk management, project and process metrics. 5. Get an overview of open source Software Engineering tool viz. Subversion and understand some concepts such as Re-engineering and Reverse engineering.	**Upon successful completion of the course, the student will be able to:** 1. Choose appropriate software engineering process model, requirement engineering principles and software designing fundamentals for a given project. (CO1) 2. Select appropriate testing strategy and apply testing principles for testing a given application. (CO2) 3. Apply basics of software configuration management, version control and change control in software development. (CO3) 4. Evaluate cost estimation, effort and severity of software risk for given application. (CO4) 5. Perform basic operations on Sub-version for software version control. (CO5)

Unit No.	Contents	Max. Hrs.
1	Introduction to Software Engineering, A Generic View of process, Process models: Water fall Model RAD Model, Prototyping Model, Component Development Model, Agile Model, Requirement Engineering: Requirement Engineering Task Initialization Eliciting Requirement, Developing Use Case Analysis Model, Negotiation, Validation	6
2	Building the Analysis mode: Requirement Analysis, Analysis Modeling Approaches, Data Modeling Concept, Object Oriented Analysis, Types of Modeling, Design Engineering: Design Concept, Design Model.	7
3	Testing Strategies : Strategic Approach, Strategic issues, Strategies for conventional Software Strategies for Object Oriented Software, Validation Testing, Testing Tactics: White-Box Testing, Basis Path testing: Flow Graph Notation, Independent Program Paths, Control Structure Testing, Black Box Testing, Introduction to object oriented testing.	7
4	Configuration Management: Base lines, Software Configuration items, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting, SCM Standards.	5
5	Project Management, Metrics for Process and Projects, Project Estimation, Risk Management Reactive vs. Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection.	7
6	Advanced Topics in Software Engineering: Re engineering Computer aided software engineering, Open source SE tools introduction, Example-Subversion: Overview, Typical subversion usage and work flow.	5

TEXT BOOKS:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Software Engineering–A Practitioner's Approach	Roger S. Pressman	6th	McGraw Hill
2	Software Engineering,	Ian Sommerville,	9th	Pearson

Reference books:

Sr. No	Title	Authors	Edition (Year of Publication)	Publisher
1	Object Oriented Software Engineering	Leth Bridge	6th	TATA McGraw Hill

IV Semester

AIML2255–Lab: Software Engineering

Sr. No.	List of Experiment
1	Introduction to software engineering fundamentals UML, RATIONAL ROSE Interface/ *Star UML (open Source*)
2	To study and create Software Requirement Specification document for given case study
3	To study and draw UML Use Case diagram for the given case study.
4	To study and draw UML Class diagram for given Case Study.
5	To study and draw UML Activity diagram for given Case Study.
6	To study and draw UML Sequence Diagram for given Case Study.
7	To study and draw State Diagram for given Case Study.
8	Write a Program to find out the Estimation (cost and effort) by using COCOMO OR http://vlabs.iitkgp.ernet.in/se/2/
9	To Perform Manual and Automated testing using CASE tool using Sample To perform manual and Automated testing using USE- CASE tool using sample GUI OR *http://vlabs.iitkgp.ernet.in/se/10/*
10	To Study and execute Version Control using Subversion

IV Semester

AIML2256 – Design & Analysis of Algorithms

Objective	Course Outcome
1. To introduce basic algorithmic techniques, time requirements of an algorithm and mathematical techniques used in analysis of algorithms 2. Learn analysis of algorithms for a wide variety of foundational problems occurring in computer science applications with discussions on complexity and NP-completeness.	After completion of the course, student will be able to: CO1 : Remember the concepts of algorithms, CO2 : Understand time requirements of an algorithm and mathematical techniques used in analysis of algorithms. CO3 : Analyze the Complexities of different algorithms for a wide variety of foundational problems occurring in computer science applications. CO4 : Apply the knowledge of different algorithms with discussions on complexity. CO5 : Evaluate the knowledge of algorithms with Complexity and NP-completeness.

Unit No.	Contents	Max. Hrs.
1	Mathematical foundations, summation of arithmetic and geometric series, Σn, Σn2, bound summations using integration, Analysis of algorithms, analyzing control structures, worst case and average case analysis, Asymptotic notations, Analysis of sorting algorithms such as selection sort, insertion sort, bubble sort, heap sort, external Sorting, lower bound proof.	6
2	Recursive functions and recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions, elementary and advanced data structures with operations on them and their time complexity, Amortized analysis.	7
3	Divide and conquer basic strategy, binary search, quick sort, merge sort, Fast Fourier Transform etc. Greedy method –basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.	7
4	Dynamic Programming basic strategy, multistage graphs, all pair shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem, Matrix Chain Multiplication, Longest Common Subsequent.	6
5	Basic Traversal and Search Techniques, breadth first search, connected components, Backtracking basic strategy, 8 – Queen‟s problem, graph colouring, Hamiltonian cycles etc.	6
6	NP-hard and NP-complete problems basic concepts, non-deterministic algorithms, NP-hard and NP-complete, Cook‟s Theorem, decision and optimization problems, polynomial reduction.	6

Text Books:

Sr. No.	Title	Author	Edition	Publisher
1	Computer Algorithms	Horowitz, Sahani, Rajsekharan	Third	Galgotia Publications Pvt. Ltd.
2	Introduction to Algorithms	Thomas H. Cormen	Third	Prentice Hall of India.
3	Algorithm design	Klienberg and Tardos	Latest	Pearson

Reference Book:

Sr. No.	Title	Author	Edition	Publisher
1	Fundamentals of Algorithms	Brassard and Bratley	second	Prentice Hall

IV Semester

AIML2257– Lab: Design & Analysis of Algorithms

Sr. No.	List of Experiment
1	To Compute and Analyze its time complexity of various sorting algorithm. • Bubble sort • Insertion sort • Selection Sort
2	To implement and compute time complexity of given problem using Divide and Conquer algorithm. • Merge sort • Quick sort • Binary Search
3	To implement and compute time complexity of Job sequencing problem using Greedy Method for different number of inputs.
4	To implement and compute time complexity of Knapsack Problem using Greedy Method for different number of inputs.
5	To implement and compute time complexity of Dijikstra Problem using Greedy programming for different number of inputs.
6	To implement the given problem using minimum cost spanning trees. • Kruskal Algorithm • Prim Algorithm
7	To implement and compute time complexity of All Pair Shortest Path using dynamic programming for different number of inputs.
8	To implement and compute time complexity of Travelling Salesman Problem using dynamic programming for different number of inputs.
9	To implement and compute time complexity of 8 Queens's problem using backtracking for different number of inputs.
10	To implement and compute time complexity of Graph coloring problem using backtracking for different number of inputs.

IV Semester

AIML2258– Database Management Systems

Objective	Course Outcome
1. To learn different database system concepts 2. To learn the designing of Entity Relationship Diagram. 3. To know relational data model, relational algebra & SQL Queries. 4. To understand relational database design. To know about data integrity issues	Upon successful completion of the course, the student will be able to: 1: Understand & compare different levels of abstraction & data independence. 2: Design Entity Relationship Diagram for any scenario & normalize the database 3: Solve queries based on relational algebra & SQL. 4: Analyze transaction management, various concurrency control protocols and crash recovery methods.

Unit No.	Contents	Max. Hrs.
1	**Introduction to Database Management System:** General File System and Database system Concepts and Architecture, Data Models, Schemas and Instances, Abstraction & Different Levels of Data Abstraction, Data Independence: Logical & Physical Independence.	6
2	**SQL:** Data definition language (DDL), Data Manipulation Language (DML), Basic structure of SQL Queries, Set operations, Null Values, Nested subqueries, views, Joins,SQL data types & schemas, Integrity Constraints, Domain Constraints, Assertions, triggers, PL/SQL. , jdbc connectivity **No SQL databases**: Features of NoSQL databases, Types of NoSQL databases	8
3	**Entity-Relationship Model**: Entities and Entity Sets, Relationships and Relationship Sets, Attributes, Mapping Constraints, Keys, Entity Relationship Diagram, Reducing E-R Diagrams to Tables, Generalization, Aggregation, Design of an E-R Database Scheme	5
4	**Relational Database Design**: Structure of Relational Databases, Pitfalls in Relational Database Design, Functional Dependencies, Normalization using Functional Dependencies, Alternative Approaches to Database design. **Relational Algebra**: Structure of relational databases, Fundamental Relational-Algebra Operations, Additional relational algebra operations.	6
5	**Indexing and Hashing**: Basic of query processing; Indices: Concepts, B+ trees and B -tree index file; Static and dynamic hashing.	6
6	**Transactions:** basic concepts, States, Concurrent execution, Serializability, Recoverability, isolation; **Concurrency control:** Timestamps and locking protocols, Validation based protocols, deadlock handling; Recovery: Log-based recovery, Shadow-paging.	6

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Database System Concepts	6th Edition	Korth, Silberschatz	McGraw-Hill publication
2	Fundamentals of Database Systems	5th Edition	Elmasri, Navathe & Gupta	Pearson Education.

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	SQL & PL / SQL for Oracle 11g Black Book Kindle Edition	3rd Edition	Dr. P.S. Deshpande	Dreamtech Press
2	Database Systems	3rd Edition	Connolly	Pearson Education
3	Database Systems	6th Edition	S. K. Singh,	Pearson Education

IV Semester

AIML2259– Lab.: Database Management Systems

Sr. No.	List of Experiment
1	To implement different basic Data Definition Language (DDL) & Data Manipulation Language(DML) Commands in SQL , commands that involve constraints for a given schema
2	To implement aggregate function & grouping commands on a given schema
3	To implement basic set operations in SQL on a given schema
4	To apply BETWEEN…AND, NOT BETWEEN, IN, NOT IN, IS NULL, IS NOT NULL clause, single row , mutirow functions on created database tables
5	To implement commands for various joins on a given schema
6	Write SQL queries for given schema using Nested Subqueries and SQL Update on a given schema
7	To create and manipulate various database object of table using views.
8	Select any real time problem for database implementation. Draw an ER diagram for the selected problem in hand. Normalise the database up to appropriate normal form.
9	To display file database connectivity using JDBC
10	Create procedures using PL/SQL for given problem definition

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110

Bachelor of Technology

SoE & Syllabus 2021

5th Semester

(Department of Computer Science & Engineering

(CSE)Artificial Intelligence & Machine Learning

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No. AML-203.1

B.TECH SCHEME OF EXAMINATION 2021-22

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Computer Science & Engineering)

CSE (AIML)

SN	Sem	Type	BoS	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
Fifth Semester															
1	5	HS	CSE	AIML2301	Fundamentals of Economics & Management	**T**	3	0	0	3	3	30	20	50	3 Hours
2	5	PC	CSE	AIML2302	Foundation of Artificial Intelligence	**T**	3	0	0	3	3	30	20	50	3 Hours
3	5	PC	CSE	AIML2303	**Lab:** Foundation of Artificial Intelligence	**P**	0	0	2	2	1		60	40	
4	5	PC	CSE	AIML2304	Machine Learning Essentials	**T**	3	0	0	3	3	30	20	50	3 Hours
5	5	PC	CSE	AIML2305	**Lab:** Machine Learning Essentials	**P**	0	0	2	2	1		60	40	
6	5	PE	CSE		**Professional Elective-I**	**T**	3	0	0	3	3	30	20	50	3 Hours
7	5	PE	CSE		**Lab: Professional Elective-I**	**P**	0	0	2	2	1		60	40	
8	5	OE	CSE		**Open Elective - I ***	**T**	3	0	0	3	3	30	20	50	3 Hours
9	5	OE	CSE		**Open Elective - II ***	**T**	3	0	0	3	3	30	20	50	3 Hours
10	**5/6**	**STR**	CSE	AIML2310	Seminar	**P**	**0**	**0**	**0**	**0**	**1**		100		
					TOTAL FIFTH SEM		**18**	**0**	**6**	**24**	**22**				

*** Refer list Open Elective- I & II**

List of Professional Electives-I & II

Professional Electives -I

1	5	PE-I	CSE	AIML2311	PE I: Design Patterns
	5	PE-I	CSE	AIML2312	PE I: **Lab:** Design Patterns
2	5	PE-I	CSE	AIML2313	PE I: Embeded AI
	5	PE-I	CSE	AIML2314	PE I: **Lab:** Embeded AI
3	5	PE-I	CSE	AIML2315	PE I: Business Intelligence
	5	PE-I	CSE	AIML2316	PE I: **Lab:** Business Intelligence
4	~~5~~	PE-I	CSE	AIML2317	PE I: Advanced Web Technologies
	5	PE-I	CSE	AIML2318	PE I: **Lab:** Advanced Web Technologies

Open Elective 1

1	5	**OE1**	CSE	AIML2331	OE I: Introduction to Artificial Intelligence
2	5	**OE1**	CSE	AIML2332	OE I: Software Testing

Open Elective 2

1	5	**OE2**	CSE	AIML2341	OE II: Introduction to Machine Learning
2	5	**OE2**	CSE	AIML2342	OE II: Problem solving Techniques and Statistical methods

Audit Courses

1	5	HS		AU2126	YCCE Communication Aptitude Preparation (YCAP5.1) for CV,ME,CT,IT,CSE, IIoT, AIDS, CSD, AIML	**A**	3	0	0	3	0		

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 5 marks on lecture quizzes, 11 marks on TA2+TA4 activitied decided by course teacher, 4 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		June 2022	1.01	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

V Semester
AIML2301 - Fundamentals of Economics & Management

AIML2301	Fundamentals of Economics & Management			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Explain the Functions of Management and identify tools and techniques of Marketing of goods and services
2. Analyze the role of Financial Accountancy and Management in the Organization
3. Develop perspective about economy based on logical reasoning and estimate the economic outcomes.
4. Interprets comparative advantage of resources.

Unit:1	Principles of Management	7 Hours

Evolution of Management Thought: Scientific and Administrative Theory of Management, Definition and Concept of Management, Functions of Management: Planning, Organizing, Directing, Coordinating and Controlling, Motivational Theories, Concept of Leadership.

Unit:2	Marketing Management	7 Hours

Marketing Management - Definition & scope, Selling & Modern Concepts of Marketing, Market Research, Customer Behaviors, Product Launching, Sales Promotion, Pricing, Channels of Distribution, Advertising, Market Segmentation, Marketing Mix, Positioning, Targeting.

Unit:3	Financial Accountancy and Management	7 Hours

Definition & Functions of Finance department, Sources of finance, Types of capital, Types of Taxes, Introduction of Accountancy and its rules, Preparation of Books of Account- Jounal, Posting of transaction into ledger and preparation of trial balance, Introduction of trading account, profit and loss account and balance sheet

Unit:4	Introduction to Economics and engineering Economy:	6 Hours

Economics and engineering economy, Utility analysis- Cardinal, ordinal, Law of diminishing marginal utility, Laws of demand and supply, elasticity of demand, its measurement and application.

Unit:5	Engineering Production and Costs	7 Hours

Factors of Production: Land, Labour, Capital, Enterprise and their peculiarities, Concepts and types of costs, Law of Variable proportions (Law of diminishing marginal returns) and Return to Scale (Increasing, constant and decreasing), Economies and diseconomies of scale. Inflation: Meaning, types, causes and consequences, measures to control inflation, Concepts of deflation and Stagflation.		
Unit :6	**Market structures - equilibrium output and price**	**7 Hours**
Forms of market structures: Perfect competition, monopolistic competition, oligopoly, duopoly and monopoly, Demand and revenue curves for firm and industry in various forms of market structure, Total, average and marginal revenue curves, equilibrium of firms and industries under various forms of market structures, Price discrimination.		
Total Lecture Hours		**39 Hours**

Textbooks	
1.	Principle of Management, 9th edition , Harold Koontz Ramchandra, Tata McGrow hills
2.	Marketing Management: Planning, Implementation and Control, 3rd Edition, Ramaswamy V.S. and Namakumari S, Macmillian
3.	Financial Services, 19th Edition, Khan M Y, Tata McGraw Hill, 19
4.	Modern Economics, 13th Edition, H. L. Ahuja, S. Chand Publisher, 2009
5.	Modern Economic Theory, 3rd edition, K. K. Devett, S. Chand Publisher,2007
6.	Principle of Economics, 7th edition, Mankiw N. Gregory, Thomson, 2013
Reference Books	
1.	Foundations of Financial Markets and Institutions, 3rd Edition, Fabozzi, Pretice Hall
2.	Fundamentals of Financial Instruments , 2nd Edition, Parameshwaran, Wiley India
3.	Marketing Management , 3rd Edition , RajanSaxena, Tata McGraw Hill
4.	Advance Economic Theory, 17th Edition, H. L. Ahuja**,** S. Chand Publisher, 2009
5.	International Trade, 12th edition, M. L. Zingan, Vindra Publication, 2007
6.	Macro Economics, 11th edition, M. L. Zingan, Vindra Publication, 2007
7.	Monitory Economics:, 1st Edition, M. L. Sheth, Himayalaya Publisher, 1995
8.	Economics of Development and Planning, 12th edition, S. K. Misra and V. K. Puri, Himalaya Publishing House, 2006.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc22_mg104/preview
2	https://nptel.ac.in/
3	https://onlinecourses.nptel.ac.in/noc20_mg31/preview
4	https://onlinecourses.nptel.ac.in/noc21_hs52/preview
5	https://onlinecourses.nptel.ac.in/noc22_hs67/preview

V Semester
AIML2302 - Foundation of Artificial Intelligence

AIML2302	Foundation of Artificial Intelligence			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

C01: Understand concepts of Artificial Intelligence and different types of intelligent agents and their architecture.
C02: Identify problems where artificial intelligence techniques are applicable
C03: Formulate problems as state space search problem & efficiently solve them.
C04: Solve various constraint satisfaction problem and game playing techniques.
C05: Reasoning with uncertainty and Machine learning algorithms

Unit:1	Introduction to AI	6 Hours

Introduction to AI, The History of Artificial Intelligence, Strong AI, Weak AI, Intelligent Agents: Agents & environments, Concept of Rationality, Nature of Environments, The Structure of Agents, Application of AI.

Unit:2	Search Techniques	8 Hours

Solving Problems by Searching: Problem Solving Agents, Searching for Solutions, Uninformed Search Strategies, Informed Search Strategies, Heuristic Functions, Local Search Algorithms and Optimization Problems, Local Search in Continuous Space, Searching with Non deterministic actions.

Unit:3	Adversarial Search	7 Hours

Games Theory, Optimal decision in games, The Mini-Max Algorithm, Alpha-Beta pruning, Constraint Satisfaction Problem, Constraint Propagation, Backtracking Search, Local Search for Constraint Satisfaction Problems.

Unit:4	Knowledge Representation	6 Hours

Knowledge representation: issues, representation and mapping approaches, procedural vs. declarative knowledge, Introduction to propositional logic, Forward Reasoning, Backward Chaining, unification and resolution algorithms.

Unit:5	First Order Logic	6 Hours

Syntax, Semantic of first order logic, Symbols of Interpretations, Quantifiers, Equality, Using First

Order Logic, Assertions and Queries in first order logic, Knowledge engineering in first order logic, propositional vs first order logic, Unification and lifting, Forward chaining, Backward Chaining.		
Unit :6	**Reasoning in Uncertain Domain**	**6 Hours**
Uncertainty, Handing uncertain knowledge, rational decisions, basics of probability, axioms of probability, inference using full joint distributions, independence, Baye's Rule and conditional independence, Bayesian networks, Semantics of Bayesian networks, Exact inference in Bayesian Networks.		
Total Lecture Hours		**39 Hours**

Textbooks	
1	Artificial Intelligence A Modern Approach, Stuart Russell,Peter Norvig, Pearson
2	Artificial Intelligence, Third edition, by E. Richand K. Knight and S. Nair, McGraw Hill
Reference Books	
1	Introduction to Artificial Intelligence and Expert System, D. W. Patterson, PHI
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc23_cs92/preview
2	https://onlinecourses.nptel.ac.in/noc23_ge40/preview

V Semester
AIML2303 – Lab: Foundation of Artificial Intelligence

AIML2303	LAB – Foundation of Artificial Intelligence	L=0	T=0	P=2	CREDITS = 1

EVALUATION SCHEME							
MSPA – I	MSPA –II		MSPA – III	MSPA – IV	ESE	TOTAL	ESE DURATION
15	15		15	15	60	100	--

Sr. No.	Experiments based on
1	To implement 8-puzzle problem using uniformed searching technique: Depth First Search
2	To implement Missionaries and cannibal Problem using uniformed searching technique: Breath First Search
3	To implement Heuristic (Steepest Ascent) Search for Tic-Tac-Toe game problem.
4	To implement Min-Max Algorithm for game solving.
5	To implement Best First Search for Travelling Salesman Problem.
6	To implement A* Algorithm for Travelling Salesman Problem and compare it with Best First Search.
7	To implement 8 Queens Problem.
8	To implement Resolution theorem (Negation).
9	To implement Naïve Bayes Classifiers.
10	To implement and demonstrate Bayesian network using pgmpy.

V Semester
AIML2304 – Machine Learning Essentials

AIML2304	Machine Learning Essentials			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

After undergoing the course, student will be able to:

1. Understand various supervised machine learning algorithms
2. Understand various unsupervised machine learning algorithms
3. apply supervised and unsupervised learning on the given set of samples and design the model to accomplish the given task.
4. understand various performance evaluation measures for supervised and unsupervised learning

Unit:1	Introduction to machine learning	6 Hours

Overview of Machine Learning, Types of Machine Learning: Supervised, Unsupervised, Reinforcement learning, Classification, Regression, Supervised and Unsupervised Learning, Learning Associations, Machine Learning Workflow, Examples of Machine Learning Applications.

Unit:2	Supervised Learning-1	6 Hours

Linear and polynomial regression, classification with k-Nearest Neighbours, Naive Bayes Classifiers, Decision Trees, Generalization, logistic regression, bias and variance, Overfitting, and Underfitting

Unit:3	Supervised Learning-2	6 Hours

Random forests, Kernelized Support Vector Machines, Uncertainty in Multiclass Classification, feature engineering and selection, evaluation metrics for supervised learning

Unit:4	Unsupervised Learning	6 Hours

k-Means Clustering , Choosing the Number of Clusters, Semi-Supervised Learning , Introduction to Principle Component Analysis, evaluation metrics for unsupervised learning

Unit:5	Design and Analysis of Machine Learning Experiments	6 Hours

Factors, Response, and Strategy of Experimentation, Randomization, Hypothesis testing, Replication, and Blocking, Guidelines for Machine Learning Experiments , Cross-Validation and Resampling Methods, K-Fold Cross-Validation, Comparing Two Classification Algorithms.

Unit :6	Advances in Machine Learning	6 Hours

Introduction to learning using Neural networks, types of artificial neuron and activation functions, Feedforward vs. Recurrent networks, multi-layer feedforward networks, Introduction to deep learning, deep learning frameworks.

Total Lecture Hours	**36 Hours**
Textbooks	
1	Introduction to Machine Learning", Ethem Alpaydin, The MIT Press, second edition
2	Deep learning:Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning (http://www.deeplearningbook.org/)
Reference Books	
1	Machine Learning", Tom Mitchell, McGraw-Hill Science/Engineering/Math, 1997
2	Introduction to Machine Learning with Python, A Guide for Data Scientists Andreas C. Müller and Sarah Guido ORIELLY
3	Christopher M. Bishop, Pattern Recognition and Machine Learning. http://research.microsoft.com/enus/um/people/cmbishop/prml/.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/e-copies%20of%20books/7.Information%20Technology/60.Introduction_to_Machine_Learning_-_2e_-_Ethem_Alpaydin.pdf
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs24/preview
2	https://onlinecourses.nptel.ac.in/noc21_cs85/preview

V Semester
AIML2305 – Lab: Machine Learning Essentials

AIML-2305 LAB – Machine Learning Essentials			L=0	T=0	P=2		CREDITS = 1
MSPA – I	**MSPA –II**	**MSPA – III**	**MSPA – IV**		**ESE**	**TOTAL**	**ESE DURATION**
15	15	15	15		60	100	--

Sr. No.	Experiments based on
1	a) Linear regression using linear least squares fit method b) Linear regression with Ordinary least squares method using ML Library
2	a) Implementing linear classifier using Linear discriminant function b) Implementing polynomial regression
3	Program for Classification using KNN algorithm
4	Implementing KNN for regression
5	Implementing Naïve Bayes Classifier
6	Decision Trees using Scikit-learn
7	Implementing SVM Classifier
8	Implementing K-means clustering
9	Dimensionality reduction using Principal Component Analysis
10	Implementing a feed forward Neural Network based estimation using Scikit learn
11	Experiment on classification using Pre-trained deep network

V Semester
AIML2311 – PE I: Design Patterns

AIML2311	PE I: Design Patterns			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Understand the fundamentals of design pattern.
2. Apply object oriented techniques and tools to Implement various design patterns.
3. Analyze the complexity of design patterns.
4. Design solution for various types of patterns.

Unit:1	**Introduction**	**7 Hours**

Introduction to Design Patterns and Observer Pattern: Basics of Design patterns, Description of design patterns, Catalog and organization of catalog, design patterns to solve design problems, selection of design pattern, Use of design patterns.

Unit:2	**Creational Patterns**	**7 Hours**

Abstract Factory, Builder, Factory Method, Prototype, Singleton, Creational Patterns

Unit:3	**Structural Pattern**	**6 Hours**

Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy, Discussion of Structural Patterns

Unit:4	**Behavioural Patterns**	**6 Hours**

Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns

Unit:5	**A Case Study**	**6 Hours**

Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation, Summary

Unit :6	Complexity Analysis of Design Patterns	6 Hours
Complexity Analysis of Design Patterns, Methods to analyze the complexity of design patterns, Implementation techniques and applications of design pattern in game design, product design		
Total Lecture Hours		**38 Hours**

Textbooks	
1	Head First Design Patterns, Eric Freeman and Elisabeth Freeman
2	Design Patterns Explained, Shalloway and Trott
Reference Books	
1	Pattern's in JAVA Vol-I , Mark Grand , Wiley DreamTech.
2	Pattern's in JAVA Vol-II , Mark Grand , Wiley DreamTech.
3	Introduction to design Patterns in C++ with Qt , Alan Ezust, Paul Ezust
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Technology/59-Design%20Pattern_7th%20Semester_Head%20First%20Design%20Patterns.pdf
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc23_cs46/preview

V Semester

AIML2312 –Lab PE I: Design Patterns

AIML2312	LAB – PE I: Design Patterns	L=0	T=0	P=2	CREDITS = 1

EVALUATION SCHEME						
MSPA – I	MSPA – II	MSPA – III	MSPA – IV	ESE	TOTAL	ESE DURATION
15	15	15	15	60	100	--

Sr. No.	Experiments based on
1	Create a design template for a specific problem arises during development of software application.
2	Write a java program to create a shape and concrete class implementing these interfaces. (Factory pattern).
3	Write a java program to create a single object class. (Singleton pattern).
4	Write a java program to create an abstract class shape and concrete classes extending the shape class. (Prototype design pattern).
5	Write a java program to create an adapter class media adapter which implements the media player interface and uses advance media player object to play required format (adapter design pattern).
6	Write a java program to create employee class to add department level hierarchy and print all employees. (Composite design Pattern)
7	Write a Java Program to create Shape interface and add a Shape Decorator Class an additional feature as Red Shape Decorator and give output as Red Shape Circle or Rectangle(Decorator Pattern)
8	Write a java program to create draw api interface which is acting as a bridge implementer and concrete classes redcircle, greencircle implementing drawapi interface.(bridge design pattern).
9	Write a java program to create a Shape interface and concrete classes implementing the Shape interface. A facade class Shape Maker is defined as a next step.(Façade Pattern)
10	Write a java program to create two objects , Stock which gives command and Broker which invokes the object and implement the interface Order.(Command Pattern)

V Semester
AIML2315 –PE I: Business Intelligence

AIML2315	PE I: Business Intelligence			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course

After completion of the course Students will be able to :

- Assemble BI as a Process, identify its application in various domains and functional area, its roles and responsibilities.
- Identify functions of building blocks in N_tier BI ecosystem
- Identify different stages in Lifecycle of a BI project.
- Differentiate between traditional BI and self-service BI (PO1-2)

1. Apply Multiple programing language for BI (PO2-3)
2. Model a business scenario; identify the metrics, indicators, various dimensions, and aggregation strategies and make recommendations to achieve the business goal (PO3-3)

3.Obtain hands on experience with some popular BI software for analysis, reporting, visualization of results

(PO1-2, PO2-2,PO3-2,PO5-3)

After completion of the course:

Unit:1	Introduction to Business Intelligence	8 Hours

Business intelligence: Overview, EIS, MIS,DSS& BI, information pyramid-data, information, Knowledge & intelligence. Basis For operational, tactical & strategic decision making , OLTP vs. OLAP, Requirement gathering in BI through business question ,BI in various domains and functional area

Unit:2	Principles of Dimensional Modelling	7 Hours

Foundation for Fact based decision making, The STAR and SNOWFLAKE schema, Pros & Cons of the STAR/SNOWFLAKE Schema Dimensional Model, Slowly Changing Dimension tables, Fact-less Fact Tables, Aggregation Strategy, Time Dimension

Unit:3	Data Pre-processing	7 Hours

Basics of Data Integration (Extraction Transformation Loading): Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data – types and sources, Introduction to data quality, data profiling concepts and applications, introduction to ETL

Unit:4	Business Intelligence system architecture	6 Hours

Need for enterprise class business intelligence infrastructure, The BI ecosystem, Building blocks of a n-tier BI system-servers & communication protocols ,The central repository-metadata, Information consumption user interfaces-desktop vs. web vs. Mobile. Open architecture, Scalability, performance in BI-in memory analytics.		
Unit:5	**BI Project Lifecycle**	**6 Hours**
Typical BI project lifecycle, Requirements gathering & analysis-functional & non- functional requirements, reports and dashboards design- mock – up and storyboarding, Testing in a BI project, BI project deployment, Post production support		
Unit :6	**Self-service Analytics and USE Cases**	**6 Hours**
Self-service Analytics: Overview, pros, cons. Use cases of self-service analytics. Use cases of Business Intelligence (BI): Water quality monitoring, Air quality monitoring, Waste management, Energy efficiency, Climate change.		
Total Lecture Hours		**40 Hours**

Textbooks	
1	Turban E., Sharda R., Delen D., King D., Business Intelligence, Pearson Education.
2	Microsoft Power BI complete reference, Devin Knight, Brian Knight, Mitchell Pearson, Manuel Quintana, Brett Powell. Birmingham, UK : Packt Publishing, 2018.
Reference Books	
1	Sabherwal R. and Becerra-Fernandez I., Business Intelligence, Wiley
2	Kimball R., Ross M., The Kimball Group Reader: Relentlessly Practical Tools for Data Warehousing and Business Intelligence, Wiley and Sons (2010).
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/e-copies%20of%20books/7.Information%20Technology/26.Business%20Intelligence_%20The%20Sav%20-%20David%20Loshin_1391.pdf
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/book%20details/CSD.aspx
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_mg65/preview
2	https://nptel.ac.in/courses/110107092

V Semester
AIML2316 –Lab PE I: Business Intelligence

AIML2316				LAB – PE I: Business Intelligence		L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME									
MSPA – I	MSPA –II		MSPA – III	MSPA – IV	ESE	TOTAL	ESE DURATION		
15	15		15	15	60	100	--		

Sr. No.	Experiments based on
1	a. Design a multidimensional data cube for given data Using EXCEL b. Perform OLAP- slicing operation on it
2	Creation Of Dashboard Using EXCEL
3	Microsoft Power BI: Installation tool, Importing Data from file, Data Wrangling (Editing Data).
4	Visualization Of Data Using different visualizations in Power BI analytic desktop, Filtering data, and delivering Insights from data
5	Data Visualization: Create interactive and visually appealing dashboards and reports to present data in a meaningful way, making it easier to identify patterns and trends. (Data available with BI server)
6	Case study 1- Supply Chain Analytics: Analyze supply chain data to improve efficiency, reduce costs, and identify potential bottlenecks in the supply chain process.
7	Case study 2 - Business Performance Monitoring: Monitor key performance indicators (KPIs) in real-time and track business metrics to evaluate the performance of the organization.
8	Case study 3- Geographic Analysis: Utilize geographic information system (GIS) data to create location-based visualizations and perform spatial analysis.

V Semester
AIML2317 –PE I: Advanced Web Technologies

AIML2317	PE I: Advanced Web Technologies			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Understand fundamental concepts of Web Services.
2. Design modern interactive web pages using HTML5, CSS3, Javascript.
3. Develop advanced client side programming.
4. Develop fast, flexible, and scalable backend applications using nodejs and mongoDB .

Unit:1	Introduction to Web Technology	6 Hours

Client, Servers and Communication, Internet Protocols (HTTP,FTP, SMTP),WWW.
Web Basics: Web Browsers, Web Servers, Tier Technology and its types, Static and Dynamic Web Page. Client side and Server side Scripting.

Unit:2	HTML5,CSS3	7 Hours

HTML5: Structure of an HTML Program, Basic HTML Tags (Headings, Paragraph, Division, Text formatting, Image, Anchors), HTML Lists (Ordered Lists, Unordered Lists, Description Lists), HTML Links (href attribute, target attribute), HTML colors, Table handling in HTML, HTML Layout Elements, HTML class and id Attribute, HTML Forms, HTML Responsive Web Design.
CSS3: Inline, Internal, External, CSS3 selectors, CSS3- Colors, Backgrounds, Borders, Text, Font, List, CSS3 Box Model, CSS3 Navigation Bar (Vertical, Horizontal), Introduction to Bootstrap.

Unit:3	Client Side Scripting with JavaScript	7 Hours

Introduction to JavaScript, Variables and Data Types, Operators and Expressions in JavaScript, Functions In JavaScript, Arrays, Loops and control statement, RegExp, Dialog Boxes, JavaScript Events. Event Handling and Form Validation, Error Handling, Handling Cookies, XML, JSON. Introduction to Web Frameworks- React JS, Angular JS.

Unit:4	Advanced Client side programming	6 Hours

WebSockets, Server-Sent Event (SSE), WebRTC, Web Graphics, Canvas, WebGL, WebWorkers, SVG.
Libraries: Modernizr, Polyfills, Polymer.

Unit:5	Introduction to Node.js	6 Hours
Introduction, Modules, HTTP Module, File System Module, URL Module, NPM, Events, Upload Files.		
Unit :6	**Node.js and Database Connectivity with MongoDB**	**6 Hours**
Introduction to MongoDB, Creating a Database, Create Collection, Insert, Find, Delete, Update, Node.js Connection with MongoDB.		
Total Lecture Hours		**38 Hours**

Textbooks	
1	HTML & CSS: The Complete Reference,Fifth Edition, Thomas A. Powell
2	Web Technologies: Html, Javascript, Php, Java, Jsp, Asp.Net, Xml And Ajax, Black Book , Kogent Learning Solutions Inc., Dreamtech Press
Reference Books	
1	Pro HTML5 with CSS, JavaScript, and Multimedia., Mark J. Collins
2	Web Development with MongoDB and Node., Bruno Joseph D'mello
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/book%20details/CSE.aspx
2	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-5409-3
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.swayam2.ac.in/nou20_cs05/preview

V Semester
AIML2318–Lab PE I: Advanced Web Technologies

AIML2318	LAB – PE I: Advanced Web Technologies			L=0	T=0	P=2	CREDITS = 1
EVALUATION SCHEME							
MSPA – I	MSPA –II	MSPA – III	MSPA – IV	ESE	TOTAL	ESE DURATION	
15	15	15	15	60	100	--	

Sr. No.	Experiments based on
1	Write a HTML code to create single page website using Layout Elements
2	Write a HTML code to create responsive website using <meta> tags.
3	Create a JavaScript Calculator using the JavaScript, HTML and CSS programming languages.
4	Creating Image Slider Using JavaScript, HTML, And CSS
5	Write JavaScript code to validate the following fields of the Registration form. First Name: Last Name: Password: Email ID: Mobile Number: Address:
6	Write a script which creates and retrieves Cookies information
7	Create a web page which shows the use of Canvas & SVG
8	Creating the MongoDB Database in Robo 3T GUI
9	Create a simple "Hello, World!" server using Node.js and Express.
10	Create a RESTful API that performs CRUD operations on a database

V Semester

AIML2331 – OE I: Introduction to Artificial Intelligence

AIML2331	OE I: Introduction to Artificial Intelligence			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Understand concepts of Artificial Intelligence and different types of intelligent agents and their architecture.

Unit:1	**Introduction to AI**	**6 Hours**
Introduction : What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Risks and Benefits of AI, Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents, Representation the AI Problems, Production System		
Unit:2	Knowledge Representation	**6 Hours**
Predicate and propositional logic , Forward and Backward Chaining , Backtracking		
Unit:3	**Local Search Algorithms and Optimization Problems**	**6 Hours**
Local Search in Continuous Space, Searching with Non deterministic actions, Searching with partial observations, online search agents and unknown environments.		
Unit:4	**Adversarial Search & Games**	**6 Hours**
Game Theory, Optimal Decisions in Games, Mini-Max Search, Alpha Beta Pruning, and Limitations of Game Search Algorithms.		
Unit:5	**Uncertainty in AI**	**6 Hours**
Conditional Reasoning & Bayes Rule, Bayesian Networks, Maximum Likelihood Learning, Maximum A-posterior learning, Markov Decision Processes		
Unit:5	**Introduction to Knowledge**	**6 Hours**
Introduction, Types of Knowledge, Knowledge Representation, Knowledge Storage, Knowledge Acquisition, Knowledge Organization and Management, Basic Concepts of Knowledge Engineering		
Total Lecture Hours		**36 Hours**

Textbooks	
1	Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009Tata McGraw-Hills Publication Company Limited, New Delhi.
2	Elaine Rich, Kevin Knight, Shivshankar Nair, Artificial Intelligence, McGraw Hill.
Reference Books	
1	R. C. Schank and C. K. Riesbeck: Inside Computer Understanding: Five Programs Plus Miniatures, Lawrence Erlbaum, 1981.
2	Murray Shanahan: A Circumscriptive Calculus of Events. Artificial. Intelligence 77(2), pp. 249-284, 1995.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	Handbook of Artificial Intelligence, Edited By Avronn Barr and Edward Feigenbaum https://stacks.stanford.edu/file/druid:qn160ck3308/qn160ck3308.pdf
2	Patrick Henry Winston. Artificial Intelligence, Addison-Wesley, 1992. https://courses.csail.mit.edu/6.034f/ai3/rest.pdf
MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs42/

V Semester
AIML2332 – OE I: Software Testing

AIML2332	OE I: Software Testing			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Formulate problem by following Software testing life cycle.
2. Design Manual Test cases for Software testing approaches.
3. Demonstrate utilization of testing automation though testing tool.

1	**Basic concepts of Testing**	**6 Hours**
Need of Testing, Basic concepts-errors, faults, defects, failures, objective of testing, central issue in testing, Testing activities, V-Model, Sources of information for test cases, Monitoring and Measuring Test Execution, Test tools and Automation, Limitation of Testing.		
2	**Unit Testing**	**7 Hours**
Concepts of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Tools for Unit Testing.		
3	**Control Flow Testing**	**7 Hours**
Outline of Control Flow Testing, Control Flow Graphs, Path in Control Flow Graph, Path selection criteria, All path coverage criteria, Statement coverage, Path coverage.		
4	**Data Flow and System Integration Testing**	**6 Hours**
Introduction Data flow testing, Data flow graph, Data flow testing criteria, Fundamentals of System Integration: Types of interfaces and interface errors, System integration testing, Software and Hardware integration.		
5	**System Testing**	**6 Hours**
Taxonomy of system test, Basic Test, Functionality test, Robustness test, Performance test, Scalability test, Stress test, Load and Stability test, Reliability test, Regression test, Documentation Test.		
6	**Test Design**	**6 Hours**
Test cases, Necessity of test case documentation, Test case design methods, Functional specification-based test case design, Use case bases, application based test case design, level of test execution.		
Total Lecture Hours		36 Hours

Textbooks	
1	Software Testing and Quality Assurance ,1st Edition, Kshirsager Naik and Priyadarshini Tripathi , Wiley
2	Software Testing Principles, Techniques and tools, 1st Edition, M. G. Limaye , McGraw Hills
Reference Books	
1	Foundations of Software Testing, 2nd Edition, Aditya P. Mathur , Pearson Education.
2	Software Testing Principles, Techniques and tools, 1st Edition, M. G. Limaye , McGraw Hills
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Science%20and%20Engineering/
2	http://103.152.199.179/YCCE/e-copies%20of%20books/7.Information%20Technology/
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs13/preview
2	https://onlinecourses.nptel.ac.in/noc22_cs61/preview

V Semester
AIML2341 – OE II: Introduction to Machine Learning

AIML2341	OE II: Fundamentals of Machine Learning			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

After undergoing the course, student will be able to:

1. Understand various supervised machine learning algorithms
2. Understand various unsupervised machine learning algorithms
3. Apply supervised and unsupervised learning on the given set of samples and design the model to accomplish the given task.
4. understand various performance evaluation measures for supervised and unsupervised learning

Unit:1	Introduction to machine learning	6 Hours

Overview of Machine Learning, Types of Machine Learning: Supervised, Unsupervised, Reinforcement learning, Classification, Regression, Supervised and Unsupervised Learning, Learning Associations, Machine Learning Workflow, Examples of Machine Learning Applications.

Unit:2	Supervised Learning-1	6 Hours

Linear and polynomial regression, classification with k-Nearest Neighbours, Naive Bayes Classifiers, Decision Trees, Generalization, logistic regression, bias and variance,Overfitting, and Underfitting

Unit:3	Supervised Learning-2	6 Hours

Random forests, Kernelized Support Vector Machines, Uncertainty in Multiclass Classification, feature engineering and selection, evaluation metrics for supervised learning

Unit:4	Unsupervised Learning	6 Hours

k-Means Clustering , Choosing the Number of Clusters, Semi-Supervised Learning , Evaluation metrics for unsupervised learning

Unit:5	Design and Analysis of Machine Learning Experiments	6 Hours

Factors, Response, and Strategy of Experimentation, Randomization, Hypothesis testing, Replication, and Blocking, Guidelines for Machine Learning Experiments , Cross-Validation and Resampling Methods, K-Fold Cross-Validation, Comparing Two Classification Algorithms.

Unit :6	Advances in Machine Learning	6 Hours

Introduction to learning using Neural networks, types of artificial neuron and activation functions, Feedforward vs. Recurrent networks, multi-layer feedforward networks.

Total Lecture Hours	36 Hours

		June 2023	1.02
Chairperson	Dean (Acad. Matters)	Date of Release	Version

Applicable for AY2023-24 Onwards

Textbooks	
1	Introduction to Machine Learning", Ethem Alpaydin, The MIT Press, second edition
2	Deep learning:Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning (http://www.deeplearningbook.org/)
Reference Books	
1	Machine Learning", Tom Mitchell, McGraw-Hill Science/Engineering/Math, 1997
2	Introduction to Machine Learning with Python, A Guide for Data Scientists Andreas C. Müller and Sarah Guido ORIELLY
3	Christopher M. Bishop, Pattern Recognition and Machine Learning. http://research.microsoft.com/enus/um/people/cmbishop/prml/.
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/e-copies%20of%20books/7.Information%20Technology/60.Introduction_to_Machine_Learning_-_2e_-_Ethem_Alpaydin.pdf
MOOCs Links and additional reading, learning, video material	
1	https://onlinecourses.nptel.ac.in/noc21_cs24/preview
2	https://onlinecourses.nptel.ac.in/noc21_cs85/preview

V Semester
AIML2342 – OE II: Problem solving Techniques and Statistical methods

AIML2342	OE II: Problem solving Techniques and Statistical methods			L= 3	T=0	P=0	Credits=3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total		ESE Duration
	15	15	20	50	100		3 Hrs

Course Outcomes:

Upon successful completion of the course the students will be able to

1. Apply Techniques of Problem solving for the solution of mathematical problems.
2. Solve problems related to Numbers, Sets, and Functions, Induction, Combinatorics.
3. Define, formulate and solve problems in a systematic manner.
4. Understand fundamental concepts of data analysis using statistics.

Unit:1	Introduction	6 Hours

Numbers, Sets and Functions, Problem Solving Techniques,Language and Proofs, Quantifiers and Logical Statements, Compound Statements, Elementary proof techniques.

Unit:2	Combinatorics	7 Hours

Induction, Bijection and Cardinality, Combinatorics,

Unit:3	Graph	7 Hours

Counting, Graph Theory, Recurrence Relations

Unit:4	Basic Statistics	6 Hours

Sources of Data, Organization of Data, The Histogram, Measures of central tendency, Mean Deviation, Standard Deviation, Correlation, Coefficient of correlation, Rank correlation, Regression.

Unit:5	Probability	6 Hours

Equally likely, mutually exclusive events, definitions of probability, additions & multiplication theorems of probability and problems based on them. Bayesian approach, distributions; Poisson, normal, Erlang, Gamma and Weibull probability distributions

Unit :6	Multivariate Data	6 Hours

Random Vectors and Matrices, sample estimate of centroid, standard deviation, SSCP, dispersion, variance, covariance, correlation matrices.

Total Lecture Hours	38 Hours

Textbooks	
1	Mathematical Thinking-Problem Solving and Proofs. 2nd Edition (2000), JohnP.D'Angelo and Douglas B.,Prentice Hill , West
2	Statistics for Management, Levin R.I. and Rubin D.S., Pearson education
Reference Books	
1	Probability and Statistics , Third edition ,Murray R. Spiegel, John J.Schiller, R AluSrinivasan, Mc Graw Hill education
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Science%20and%20Engineering/
MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/111105077
2	https://onlinecourses.nptel.ac.in/noc21_ma74/preview

Programmes offered by the Institution

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

Hingna Road, Wanadongri, Nagpur - 441 110

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PROGRAME OFFERED IN THE A.Y. 2022-23

UG PROGRAMS

SR.NO.	COURSE NAME	INTAKE
1	B.Tech Civil Engineering	120
2	B.Tech Mechanical Engineering	120
3	B.Tech Electrical Engineering	120
4	B.Tech Electronics Engineering	120
5	B.Tech. CSE (IOT)	60
6	B.Tech Electronics & Telecommunication Engineering	180
7	B.Tech Computer Technology	120
8	B.Tech Computer Science & Design	120
9	B.Tech Information Technology	120
10	B.Tech Artificial Intelligence & Data Science	60
11	B.Tech Computer Science and Engineering	60
12	B.Tech Artificial Intelligence & Machine Learning	60
	TOTAL	**1260**

PG PROGRAMS

SR.NO.	COURSE NAME	INTAKE
1	M.Tech Environmental Engineering	18
2	M.Tech Structural Engineering	25
3	M.Tech CAD-CAM	12
4	M.Tech Integrated Power Systems	12
5	M.Tech Communication Engineering	12
6	M.Tech Computer Science and Engineering	12
	TOTAL	**91**

Y.C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR

Principal
Yeshwantrao Chavan
College of Engineering
Wanadongri Hingna Road,
NAGPUR - 441110

POs, PSOs and COs

Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukdoji Maharaj Nagpur University)
Hingna Road, Wanadongri, Nagpur 441 110

B.E. - Civil Engineering

Vision of the Department
To become most sought after destination for learning and research in civil engineering.

Mission of the Department
To prepare Civil Engineering professionals by practicing analytical, design tools, Field learning and live industrial projects in conducive environment.

Program Educational Objectives

PEO1- To prepare students to succeed in employment, profession and/or to purse post graduation and research in civil engineering discipline in particular and allied engineering disciplines in general.

PEO2- To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to formulate, analyse and solve civil engineering related problems.

PEO3- To prepare the students to acquire the knowledge in breadth in order to solve mathematical problems related to analysis and design of various systems pertaining to different fields of Civil Engineering in order to utilize their skills to perform location surveying, cost estimates and activities related to Civil Engineering projects, using conventional and modern engineering tools.

PEO4- To inculcate ethical practices and to establish understanding of professionalism, safety, sustainability, their duties and contribution to the society.

PEO5- To provide students with academic environment that makes them aware of excellence and to enable them to understand the significance of life –long learning in global perspective.

Programme Outcomes

PO 1- Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO 2- Problem Analysis: Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences

PO 3- Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental Consideration

PO 4- Conduct investigations of complex problems using research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

PO 5- Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an under- standing of the limitations.

PO 6- The Engineer and Society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO 7- Environment and Sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

PO 8- Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO 9- Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multi disciplinary settings.

PO10- Communication: Communicate effectively on complex engineering activities with the engineering com- munity and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

PO11- Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12- Life-long Learning: Recognize the need for and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1 Carry out structural analysis and design, develop minor project plans.

PSO2 Examine geotechnical applications which includes the design of shallow and deep foundations, common issues in foundation construction, site characterization and rock slope assessment, tunneling and earth dam designs

PSO3 Carry out location survey and quantity survey for cost estimation of structures, including interpretation and understanding of civil engineering drawings.

Program Educational Objectives (PEOs) of M. Tech. (Structural Engineering)

PEO1 To provide fundamental knowledge of Civil engineering in general and Structural Engineering in specific for better understanding of various Structural systems.

PEO2 To provide understanding of and ability to apply Structural engineering knowledge and approaches to generate effective engineering solutions.

PEO3 To provide academic environment to work independently and in a team , to initiate research in demanding areas and develop a habit of upgrading knowledge of advancements in technologies for sustainable development in conjunction with contemporary issues.

PEO4 To inculcate professional and ethical attitude, effective communication skills to become successful professional and understand responsibility towards wellbeing of society.

Program outcomes (POs)of M. Tech. (Structural Engineering)

PO1 An ability to independently carry out research /investigation and development work to solve practical problems in Structural Engineering

PO2 An ability to write and present a substantial technical report/documents in the area of structural engineering

PO3 An ability demonstrate advances in structural engineering.

PO4 An ability to learn and apply advanced engineering techniques and software tools

PO5 An ability to acquire professional, ethical and responsible attitude towards development of the profession and society.

PO6 An ability to adapt lifelong learning to upgrade knowledge and competence continuously.

Program Educational Objectives (PEOs) of M. Tech. (Environmental Engineering)

PEO1 To provide fundamental knowledge of Civil engineering in general and Environmental Engineering in specific for better understanding of various environmental systems.

PEO2 To provide understanding of and ability to apply environmental engineering knowledge and approaches to generate effective engineering solutions.

PEO3 To provide academic environment to work independently and in a team , to initiate research in demanding areas and develop a habit of upgrading knowledge of advancements in technologies for sustainable development in conjunction with contemporary issues.

PEO4 To inculcate professional and ethical attitude, effective communication skills to become successful professional and understand responsibility towards wellbeing of society.

Programme Outcomes of M. Tech Environmental Engineering Programme

PO1 An ability to carry out experimental investigation as well as use of software tools for conducting independently a research work

PO2 An ability to design various units and systems for treatments of water and wastewater, supply of water as well as collection of wastewater

PO3 An ability to write and present a substantial technical report/document as well as demonstrate communication and presentation skill.

PO4 An ability to understand impact of pollutants on environmental and ways means to control the pollution of environmental including using management tools.

First Year: Semester I:

Course Name: Engineering Mechanics	Course Code: CV2101
CO1	Describe the fundamental concepts of statics and dynamics
CO2	Apply the basic concepts of applied mechanics for solution of problems on planar force system.
CO3	Determine the properties of surface like centroid, moment of inertia, etc. for planar surfaces and mass moment of inertia for rigid body.
CO4	Analyze pin jointed truss frame structure and beam structure analytically and graphically.
CO5	Evaluate the dynamic variables of kinetics of particles and simple lifting machine

Course Name: LAB: Engineering Mechanics	Course Code: CV2102
CO1	Describe the fundamental concepts of statics and dynamics
CO2	Apply the basic concepts of applied mechanics for solution of problems on planar force system.
CO3	Determine the properties of surface like centroid, moment of inertia, etc. for planar surfaces and mass moment of inertia for rigid body.
CO4	Analyze pin jointed truss frame structure and beam structure analytically and graphically.
CO5	Evaluate the dynamic variables of kinetics of particles and simple lifting machine

First Year: Semester II:

Course Name: Engineering Mechanics	Course Code: CV2101
CO1	An ability to apply the concept of mechanics and can solve problems on planar force system for smooth as well rough surfaces.
CO2	An ability to analyze pinned jointed truss frame using method of joint.
CO3	An ability to understand the properties of surface and can find centroid, moment of inertia, product of inertia, etc.
CO4	An ability to determine the dynamic variables by applying Kinetics of Particle, work energy method and linear impulse momentum methods.

Course Name: LAB: Engineering Mechanics	Course Code: CV2102
CO1	An ability to apply the concept of mechanics and can solve problems on planar force system for smooth as well rough surfaces.
CO2	An ability to analyze pinned jointed truss frame using method of joint.
CO3	An ability to understand the properties of surface and can find centroid, moment of inertia, product of inertia, etc.
CO4	An ability to determine the dynamic variables by applying Kinetics of Particle, work energy method and linear impulse momentum methods.

Second Year: Semester III:

Course Name: Fluid Mechanics	Course Code: CV2205
CO1	Examine the fundamental principles of fluid mechanics and related applications and estimate Fluid pressure, forces on various surface.
CO2	Analyze the motion of fluid, various flow pattern produced without reference of force
CO3	Understand the kinetics of flow and computation of flow using various devices.

Course Name: LAB: Fluid Mechanics	Course Code: CV2206
CO1	An ability to determine floating conditions of ship model.
CO2	An ability to verify Bernoulli's theorem.

CO3	An ability to measure velocity, discharge in pipe, tank, channel andto determine hydraulic coefficients of devices.
CO1	An ability to determine hydraulic jump, roughness, concept of specific energy in open channels.
CO2	An ability to determine types of flow in pipes and flow around immersed bodies

Course Name: Geotechnical Engineering	Course Code: CV2203
CO1	An ability to characterize and classify soils.
CO2	An ability to determine index and engineering properties of soil.
CO3	An ability to understand surface stresses and their distribution within a soil mass.
CO4	An ability to understand the principles of compaction and consolidation.
CO5	An ability to determine shear strength of soil.

Course Name: LAB: Geotechnical Engineering	Course Code: CV2204
CO1	An ability to determine the Index properties of soil.
CO2	An ability to determine the Engineering properties of soil.

Course Name: Strength of Materials	Course Code: CV2201
CO1	An ability to understand basic concepts and mechanical properties of materials.
CO2	An ability to analyze behavior of material under various types of loading pattern.
CO3	An ability to draw diagram showing variation of shear force, bending moment and stresses.
CO4	An ability to check feasibility of different sections subjected to different loading patterns.

Course Name: LAB: Strength of Materials	Course Code: CV2202
CO1	An ability to understand basic concepts & mechanical properties of material.
CO2	An Ability to understand behavior of various materials such as Steel, Aluminum, Wood etc. when subjected to various types of loading.

Course Name: Water Supply Engineering	Course Code: CV2207
CO1	An ability to understand significance of community water supply scheme.
CO2	An ability to design water conveyance system.
CO3	An ability to understand importance of water quality and its treatment aspects.
CO4	An ability to understand different patterns of distribution of water.
CO5	An ability to understand the significance and concept of solid waste management.

Course Name: LAB: Water Supply Engineering	Course Code: CV2208
CO1	To understand importance of water quality standards.
CO2	An ability to perform various physical and chemical tests on water sample.
CO3	An ability to understand various biological tests performed on water sample and to perform a few biological tests on water.

Second Year: Semester IV:

Course Name: Advanced Mathematical Techniques	Course Code: GE2204
CO1	Utilize numerical techniques to obtain approximate solutions of mathematical
CO2	Measure the Statistical parameters for random variables
CO3	Design and determine the solution of linear programming problems
CO4	Explain the basic concept of fuzzy sets, Relations and fuzzy logic.

Course Name: Concrete Technology	Course Code: CV2251
CO1	An ability to understand the properties of the constituent materials of concrete.
CO2	An ability to understand the properties of fresh and hardened concrete and tests to determine these properties
CO3	An ability to design concrete mixes and apply statistical quality control techniques
CO4	An ability to understand admixtures and their role in concrete properties
CO5	An ability to understand the durability of concrete.
CO6	An ability to understand importance of Non-destructive testing and various equipment used.

Course Name: Lab: Concrete Technology	Course Code: CV2252
CO1	An ability to conduct different tests on cement.
CO2	An ability to assess the different properties of coarse and fine aggregate.
CO3	An ability to conduct different workability tests on fresh concrete and various tests on hardened concrete.
CO4	An ability to understand working of various Non-destructive testing equipment.

Course Name: Surveying	Course Code: CV2253
CO1	An ability to understand the basic concepts of surveying and use of conventional surveying equipment.
CO2	An ability to understand the basic principles, operation, handling & uses of various advanced surveying equipment.
CO3	An ability to draw the location map, contour map using various surveying equipment.

Course Name: Lab : Surveying	Course Code: CV2254
CO1	An ability to work in a team to carry out a survey of a small area using appropriate methods.
CO2	An ability to describe the observation, computation and adjustment of a Traverse to carry out basic survey computation and adjustment.
CO3	An ability to understand the angle and distance measurement; and differential, profile, cross-section, and topographic leveling procedures and apply them to field conditions.

Course Name: Structural Analysis	Course Code: CV2255
CO1	An ability to understand basic concepts of structural analysis.
CO2	An ability to apply various methods of structural analysis to analyze different types of structures.
CO3	An ability to express results of forces generated in structure with diagrams.

Course Name: Lab: Structural Analysis	Course Code: CV2256
CO1	An ability to understand various types of strain gauges and to measure the strain in beam.
CO2	An ability to find the defections in truss analytically and graphically.
CO3	An ability to determine the horizontal thrust of different types of arches.
CO4	An ability to understand the various properties of beam.
CO5	An ability to understand the behavior of the column, curved member and portal frame.

Course Name: Transportation Engineering	Course Code: CV2257

CO1	An ability to understand basic concepts of transportation and traffic engineering.
CO2	An ability to understand concepts of geometric design, construction and maintenance of road pavements.
CO3	An ability to understand importance of various tests conducted on highway materials.
CO4	An ability to understand basics of bridge and railway engineering

Course Name: Lab :Transportation Engineering	Course Code: CV2258
CO1	An ability to conduct various tests on aggregates and soil.
CO2	An ability to conduct various tests on aggregates, bitumen and bitumen mix.

Course Name: Fundamentals of Economics	Course Code: GE1312
CO1	Recognize consumer's behavior and analyze Market price
CO2	Extrapolate operations in market with production constraints
CO3	Describe the national income accounting and public finance
CO4	Analyze international trade and institutions.

Third Year: Semester V:

Course Name: OE I : Building Services Engineering	Course Code: CV1327

CO1	An ability to understand relevance of services related to lighting, ventilation & acoustics & understand the methodologies, materials & equipment in this regards.
CO2	An ability to understand special installations in buildings such as electrical, air conditioning, heating & mechanical ventilation & related practices.
CO3	An ability to understand specifications & usage of mechanical installations like lifts, security systems etc. & special features required as per need.
CO4	An ability to understand causes of fires in buildings & their preventive and protective strategies

Course Name: OE I: Construction Techniques	Course Code: CV1329
CO1	An ability to understand the construction techniques to be used in the construction of building
CO2	An ability to understand the demolition techniques, Importance of rehabilitation, Strengthening etc.

Course Name: OE I : Environmental Management	Course Code: CV1325
CO1	Identify the scientific and social aspects of environmental issues.
CO2	Understand the procedure of environmental protection by legislation.
CO3	Understand the role of environmental management system in protecting the resources.

Course Name: Reinforced Concrete Structures	Course Code: CV1331
CO1	An ability to understand the structural properties of steel and concrete and their applications in structural planning.
CO2	An ability to acquire the knowledge about the basic methods of structural design.
CO3	An ability to understand the analysis, design and detailing of RCC structural elements required for building.
CO4	An ability to understand the concept and application of Prestressed concrete

Course Name: Structural Analysis-I	Course Code: CV1307
CO1	An ability to understand the basic concept of structural analysis
CO2	An ability to understand the behavior of structural components subjected to various loadings.

CO3	An ability to understand various methods of analysis of structural elements.

Course Name: LAB: Structural Analysis-I		Course Code: CV1308
CO1	An ability to understand various types of strain gauges and to measure the strain in beam.	
CO2	An ability to find the defections in truss analytically and graphically.	
CO3	An ability to determine the horizontal thrust of different types of arches.	
CO4	An ability to understand the various properties of beam.	
CO5	An ability to understand the behavior of the column, curved member and portal frame.	

Course Name: Surveying-II		Course Code: CV1301
CO1	An ability to understand the importance of modern technique of surveying.	
CO2	An ability to understand and operate the modern Surveying equipment's	
CO3	An ability to understand basic concepts of GIS, GPS & Remote sensing	

Course Name: LAB: Surveying-II		Course Code: CV1302
CO1	An ability to measure distance by using tachometry	
CO2	An ability to plot Horizontal curve by using theodolite	
CO3	An ability to understand the rectangular coordinate system	
CO4	An ability to Understand (introductory level) geographic information systems and Global positioning system (GIS, GPS)	

Course Name: Transportation Engineering-I		Course Code: CV1304
CO1	An ability to understand concept of Geometric design of roads and various aspects of traffic engineering.	
CO2	An ability to understand various types of bridges and their design aspects.	
CO3	An ability to understand various traffic characteristics and analysis and use the data for road design.	
CO4	An ability to understand various Highway materials and their suitability under different conditions.	

Course Name: LAB: Transportation Engineering-I		Course Code: CV1305
CO1	An ability to conduct various tests on aggregates and study its desirable properties.	
CO2	An ability to conduct various tests on bitumen and understand its properties.	
CO3	An ability to perform the CBR value.	
CO4	An ability to perform Marshall stability of bituminous mixture.	
CO5	An ability to conduct traffic volume survey.	
CO6	An ability to understand about bridges and various components.	

Third Year: Semester VI:

Course Name: Fluid Mechanics – II		Course Code: CV1310
CO1	Students will be able to examine the fundamental principles of fluid mechanics and related applications.	
CO2	Students will be able to analysis of network and Estimate discharge, shear stresses, pressure drop, water losses, water hammer in pipe flow.	
CO3	Students will be able to estimate flow parameter and Design the most economical open channels for conveyance of water	
CO4	Students will be able to estimate and study the specific energy, slope, analize flow profile, profile length, uniform flow, critical flow, gradually & Rapidly varied flow in open channel.	
CO5	Students will be able design and analyze the model to predict the performance of hydraulic structure, partially and fully submerged body.	

Course Name: Lab: Fluid Mechanics – II	Course Code: CV1311
CO1	An ability to determine the forces around the submerged bodies.
CO2	An ability to carry out the head loss in pipes for design of pipe network.
CO3	An ability to carry out analysis of water distribution network.
CO4	An ability to determine velocity and sketch various profiles, back water length, hydraulic jump, roughness, concept of specific energy in open channels.
CO5	An ability to determine the performance of hydraulic machines.

Course Name: Lab : Seminar	Course Code: CV1314
CO1	An ability to utilize technical resources.
CO2	An ability to understand information in detail for report writing.
CO3	An ability to write and present report of associated work effectively.

Course Name: PE I : Water Treatment	Course Code: CV1315
CO1	An ability to understand importance of water treatment
CO2	An ability to analyse available data and design a water treatment unit.

Course Name: PE I : Prestressed Concrete	Course Code: CV1316

CO 1	An ability to understand the basic concepts of prestressed concrete structures.
CO 2	An ability to analyze the prestressed concrete structural elements.
CO 3	An ability to design the prestressed concrete structural elements.
CO 4	An ability to exercise the limit state of serviceability to prestressed concrete members.

Course Name: PE I : Building Services	Course Code: CV1317
CO1	An ability to understand relivance of services related to lighting, ventilation & acoustics & understand the methodologies, materials &equipments in this regards.
CO2	An ability to understand special installations in buildings such as electrical, air conditioning, heating & mechanical ventilation & related practices.
CO3	An ability to understand specifications & usage of mechanical installations like lifts, security systems etc& special features required as per need.
CO4	An ability to understand facilities necessary for physically handicapped and aged people.

Course Name: PE I : Pavement Design	Course Code: CV1323
CO1	Students will be able to identify various types of pavement, design parameters and material characteristic for flexible and rigid pavements.
CO2	Students will be able to analyze and design of flexible and rigid pavements for highway and airfields pavement.
CO3	Students will be able to identify and refer various standards and specifications related to highway and airfields pavement.
CO4	Students will be able to rectify various pavement distresses and their repair or maintenance strategies.

Course Name: Steel Structures	Course Code: CV1332
CO1	An ability to understand effect of forces and its impact on structure

CO2	An ability to identify the type of structure and its design methodology
CO3	An ability to utilize the application of Indian Standard code for design purpose.
CO4	An ability to design the simple, built up section and column bases.

Course Name: Geotechnical Engineering - II	Course Code: CV1333
CO1	An ability to understand & apply the fundamentals of earth pressure to earth retaining structure.
CO2	An ability to understand & apply knowledge of stability of slopes and ground improvement techniques
CO3	An ability to comprehend and utilize the geotechnical literature to establish the framework for foundation design.
CO4	An ability to execute a site investigation for determination of soil properties and to develop good technical reporting and data presentation skills.

Course Name: OE II: Elements of Earthquake Engineering	Course Code: CV1341
CO1	An ability to understand the necessity and importance of earthquake engineering
CO2	An ability to understand the provision of IS code used for earthquake resistant design of structure
CO3	An ability to understand provision for earthquake resistant design of structures as per Indian standard
CO4	An ability to study of damages caused due to past earthquake in & outside India and remedial measures

Course Name: OE II: Air Pollution and Solid Waste Management	Course Code: CV1342
CO1	Students will be able to Analyze the type, sources & effect of air pollutants.
CO2	Students will be able to Determine and estimate the parameters affecting air pollution and various methods of measurement.
CO3	Students will be able to Use various air pollution control equipments& pollution caused due to automobile exhaust and basics of noise pollution.
CO4	Students will be able to Interpret the concepts of solid waste management, treatment and disposal methods.

Course Name: OE II : Introduction to Finite Element Method	Course Code: CV1343
CO1	An ability to apply the steps required for FEM solution to variety of physical systems.
CO2	An ability to create models for simple structures.
CO3	An ability to solve engineering problems.
CO4	An ability to extend the knowledge of the application of FEM to solve engineering problems.

Fourth Year: Semester VII:

Course Name: Environmental Engineering-II	Course Code: CV1441
CO1	An ability to understand importance of effective collection and conveyance of sewage.
CO2	An ability to understand methods of construction and maintenance of sewerage system including house drainage system.
CO3	An ability to understand working of sewage treatment plant including difference with industrial wastewater treatment plant.
CO4	An ability to understand importance of air pollution control including methods to control it.

Course Name: PE II: Advanced Hydraulics	Course Code: CV1411

CO1	Examine the fundamental principles of fluid mechanics and related applications.
CO2	Estimate and analyze various flow parameters, flow profiles and profile length in open channel.
CO3	Estimate time flow establishment for unsteady flow and the pressure develop in pipe by considering Rigid and Elastic water column theory.
CO4	Analyze the stability of surge tank

Course Name: PE II : Computer Application in Civil Engineering	Course Code: CV1459
CO1	An ability to understand the basic concepts of C Programming language
CO2	An ability to develop computer programs for the solution of Civil Engineering problems.
CO3	An ability to translate numerical methods into simple, reusable program modules
CO4	An ability to develop good technical understanding & application with good presentation skills.

Course Name: LAB: Computer Application in Civil Engineering	Course Code: CV1442
CO1	An ability to understand the basic concepts of C Programming language.
CO2	An ability to develop computer programs for the solution of Civil Engineering problems.
CO3	An ability to translate numerical methods into simple, reusable program modules.
CO4	An ability to develop good technical reporting and data presentation skills.

Course Name: PE II : Natural Resources Management	Course Code: CV1413
CO1	An ability to solve important natural resource management problems.
CO2	An ability to describe planning and responsibilities taken by professional authorities.
CO3	An ability to understand laws, policies & practice implementation for private and public resource owners and users.
CO4	An ability to work on multiple environmental issues for a sustainability.

Course Name: PE II : Traffic Engineering	Course Code: CV1410
CO1	An ability to understand different methods for measurement of spot speed, journey speed & running speed,
CO2	An ability to understand different statistical methods which can be used in various analyses of traffic studies.
CO3	An ability to understand design of rotary intersections, Parking& Accidents
CO4	An ability to understand design of signals at various intersections considering practical problems.

Course Name: Structural Analysis - II	Course Code: CV1402
CO1	An ability to understand the matrix methods of structural analysis and its applications.
CO2	An ability to understand the flexibility matrix method and apply its application to beam structure.
CO3	An ability to understand the stiffness matrix method and apply its application to pin jointed frame structure and beam structure.
CO4	An ability to understand the column analogy method and apply its application to beam and frame structure.
CO5	An ability to understand the moment distribution method and apply its application to frames with sway.
CO6	An ability to understand the approximate method of analysis and apply its application to multistoried frame structures

Course Name: LAB: Structural Analysis - II	Course Code: CV1403

CO1	An ability to understand the effect of forces on structure.
CO2	An ability to develop and execute the Beam models in the software package without any error
CO3	An ability to develop and execute the Plane truss models in the software package without any error
CO4	An ability to develop and execute the Frame models in the software package without any error
CO5	An ability to compare the result between hand calculation (manual analysis) and output result of the software.
CO6	An ability to understand the application of software package and limitation of manual analysis

Course Name: Transportation Engineering-II	Course Code: CV1422
CO1	An ability to update and upgrade knowledge about transportation system in India
CO2	An ability to design railway tracks, crossings
CO3	An ability to avail information about development of air transportation in urban areas
CO4	An ability to understand the construction of tunnel and advances in tunneling

Course Name: Water Resource Engineering	Course Code: CV1410
CO1	An ability to understand water requirement for various crop pattern.
CO2	An ability to understand parameters and procedures adopted in reservoir planning.
CO3	An ability to understand the design of water conveyance system like canal.
CO4	An ability to understand the analysis and design of various water retaining structures like weirs and dams.

Fourth Year: Semester VIII:

Course Name: Estimating and Costing	Course Code: CV1442
CO1	An ability to understand the definitions in estimates of structures.
CO2	An ability to develop the specifications and find out the quantities of materials in different items to prepare the estimate.
CO3	An ability to workout the valuation and rent of civil engineering structures.
CO4	An ability to workout the estimate and costing of building, road, hill road and canal.
CO5	An ability to fill the tenders and carry out the construction of civil engineering structures.

Course Name: Comprehensive Viva-Voce	Course Code: CV1424
CO1	An ability to collect information regarding only topic related in civil engineering
CO2	An ability to present the information collected in the expected format
CO3	An ability to express and communicate about the information collected

Course Name: Project Phase-II (GEO)	Course Code: CV1425
CO1	Demonstrate a sound technical knowledge of their selected project topic.
CO2	Understand problem identification, formulation and solution.
CO3	Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team.
CO4	Communicate effectively to discuss and solve engineering problems.

Course Name: Project Phase-II (STR & CT)	Course Code: CV1425
CO1	Demonstrate a sound technical knowledge of their selected project topic.

CO2	Understand problem identification, formulation and solution.
CO3	Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team.
CO4	Communicate effectively to discuss and solve engineering problems.

Course Name: Project Phase-II (TRE)	Course Code: CV1425
CO 1	Demonstrate a sound technical knowledge of their selected project topic.
CO 2	Understand problem identification, formulation and solution.
CO 3	Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team.
CO 4	Communicate effectively to discuss and solve engineering problems.

Course Name: Project Phase-II (WRE)	Course Code: CV1425
CO 1	Demonstrate a sound technical knowledge of their selected project topic.
CO 2	Understand problem identification, formulation and solution.
CO 3	Design engineering solutions to complex problems utilizing a systems approach including ability to work in a team.
CO 4	Communicate effectively to discuss and solve engineering problems.

Course Name: Extra / Co-Curricular / Competitive Examination	Course Code: CV1426
CO1	An ability to work initially as well as part of team to achieve set goals
CO2	An ability to work to serve society and for betterment of society.
CO3	An ability to communicate with people at large.

Course Name: PE IV: Waste Water Treatment	Course Code: CV1427
CO1	An ability to understand the necessity of water quality management
CO2	An ability to understand & design various treatment units for wastewater treatment
CO3	An ability to understand Advanced waste water treatment
CO4	An ability to understand treatment for Industrial waste.

Course Name: PE IV : Earthquake Engineering	Course Code: CV1428
CO1	After completion of course the student will be able to understand the fundamentals and Importance of Earthquake Engineering
CO2	Apply the basic principles for seismic design and construction of structures in accordance with the provisions of Indian Standard Codes.
CO3	Understand various special aspects in Multi-story buildings
CO4	Understand the social aspects of earthquake disaster, its management and damages caused due to past Earthquake in & outside India and remedial measures.

Course Name: PE IV : Matrix Analysis of Structures	Course Code: CV1429
CO1	An ability to understand the stiffness method for analyzing statically indeterminate structures.

CO2	An ability to model the behaviour of various structural elements and systems.
CO3	An ability to understand the effect of various loading and support conditions on structural elements and systems.
CO4	An ability to implement the computer program to analyse the structures.

Course Name: PE V: Water Transmission & Distribution Systems	Course Code: CV1432
CO1	Students will be able to examine the fundamental principles of fluid mechanics and related applications.
CO2	Students will be able to estimate discharges in multy -reservoir system connected by pipes
CO3	Students will be able to analyze the water distribution network by using various method
CO4	Students will be able to design optimal diameter of rising main and water distribution network
CO5	Students will be able to optimize water distribution network

Course Name: PE V : Advanced Steel Design	Course Code: CV1433
CO1	An ability to understand different types of loading with respect to structural parameters.
CO2	An ability to identify the type of structure and its design methodology.
CO3	An ability to utilize the application of Indian Standard code for design purpose.

Course Name: PE V: Maintenance & Rehabilitation Engineering	Course Code: CV1434
CO1	Students will know about different high quality materials for civil engineering applications.
CO2	Ability to use materials for better and durable Civil Engineering Structures.
CO3	Student will know about various smart materials.

Course Name: PE III - New Engineering Materials	Course Code: CV1446
CO1	An ability to understand different high quality materials for Civil Engineering applications
CO2	An ability to use engineering materials for better and durable Civil Engineering Structures
CO3	An ability to utilize bio nondegradable materials for Civil Engineers
CO4	An ability to understand the use of Composite sections for effective utilization of materials

Course Name: PE III : Advanced R.C.C.	Course Code: CV1447
CO 1	An ability to understand the importance of various structures like multistoried buildings, bridges, water tanks and retaining walls.
CO 2	An ability to analyze the structures for various types of loading conditions as per Codal provisions
CO 3	An ability to design various structures such as bridges, tanks, and retaining walls.

Course Name: PE III : Remote Sensing & GIS	Course Code: CV1448
CO1	Explain the principles of Geoinformatics.
CO2	Describe the process of data acquisition of satellite images and their characteristics.

CO3	Illustrate knowledge of remote sensing and GIS in different civil engineering applications.

Course Name: PE III : Urban Transportation Planning	Course Code: CV1451
CO1	Students understood about traffic forecasting and its effects on environment.
CO2	Students understood the necessity and importance of Traffic regulations.
CO3	Students understood the necessity and arrangement of street lighting.
CO4	Students understood about planning process and traffic problems.

Course Name: PE IV : Advanced Survey	Course Code: CV1452
CO 1	The students will be able to understand the advantages of electronic surveying over conventional surveying methods.
CO 2	The student will be able to handle and understand the working principle of Advanced Electronic Devices and total Station.
CO 3	The student will be able to understand and to apply knowledge of GPS, GIS and Remote Sensing technique / data for required purpose.

Course Name: PE V – Advanced Foundation Engineering	Course Code: CV1458
CO1	An ability to understand various approaches of determining bearing capacity of shallow foundation.
CO2	An ability to predict and calculate settlement of foundation.
CO3	An ability to design deep and machine foundations

Yeshwantrao Chavan College of Engineering, Nagpur

Name of the Department: Civil Engineering

Name of the UG Programme: MTech Environmental Engineering

Course Outcomes (CO)

First Year: Semester I:

Course Name: Environmental Chemistry and Microbiology	**Course Code: CV3961**
CO1	An ability to understand the concepts Environmental chemistry & to learn how the concepts of environmental chemistry can be put to practical applications
CO2	An ability to explain microbial technology in environmental engineering practices

Course Name: Lab Environmental Chemistry and Microbiology	**Course Code: CV3962**
CO1	An ability to understand importance of water quality standards
CO2	An ability to perform various physical and chemical tests on water sample
CO3	An ability to understand various biological tests performed on water sample and to perform a few biological tests on water

Course Name: Water Supply and Waste Water Collection System	**Course Code: CV3963**
CO1	An Ability to understand fundamental of design of the pipe in water distribution system and wastewater collection system
CO2	An Ability to understand different methods of analysis of pipe network for water distribution.
CO3	Ability to design of water distribution system and sewerage system

Course Name: Lab Water Supply and Waste Water Collection System	**Course Code: CV3964**
CO1	An Ability to understand fundamental of design of the pipe in water

	distribution system and wastewater collection system
CO2	An Ability to understand different methods of analysis of pipe network for water distribution.
CO3	Ability to design of water distribution system and sewerage system

Course Name: Municipal Water Treatment	**Course Code: CV3965**
CO1	An ability to understand the fundamentals related to water treatment
CO2	An Ability to design different water treatment Units

Course Name: Municipal Solid Waste Management	**Course Code: CV3966**
CO1	An ability to understand different characteristic of solid waste.
CO2	An ability to understand different methods of collection, transfer and transport of solid waste.
CO3	An ability to understand different Processing and disposal methods for solid waste.

Course Name: Municipal Waste water Treatment	**Course Code: CV3966**
CO1	An ability to understand basics of different wastewater treatment processes
CO2	An ability to understand working of different sewage treatment units
CO3	An ability to design different sewage treatment units.
CO4	An ability to understand different methods of treatment and disposal of bio-solids

First Year: Semester II:

Course Name: Industrial Wastewater Treatment and Reuse	**Course Code: CV 3975**
CO1	An ability to understand importance of industrial wastewater treatment.
CO2	An ability to understand the fundamentals of various treatment processes.
CO3	An ability to understand treatment methodologies for various industrial wastewaters.
CO4	An ability to design various treatment units for Industrial wastewater

Course Name: Environmental Management	Course Code: CV 3976
CO1	An ability to grasp the fundamentals and identify the tools used for Environmental Management
CO2	An ability to understand environmental impact assessment (EIA) as an environmental management tool
CO3	An ability to understand the evolution of environmental policies and laws and implications of international policies and laws for India.

Course Name: Air Quality Management	Course Code: CV 3977
CO1	An ability to understand air pollution and its control
CO2	An ability to understand various meteorological factors and its influence on air pollution.
CO3	An ability to understand the basic principles, equipment, and methods used to control particulate matter, gaseous emission and automobile emission
CO4	An ability to understand basics of urban air pollution, odour and noise pollution

Course Name: Rural Water Supply and Sanitation	Course Code: CV 3978
CO1	An Ability to understand the knowledge regarding rural water supply and sanitation scheme.
CO2	An Ability to understand different compact units of rural water treatment and supply.
CO3	An Ability to tell simple wastewater treatment for rural water supply

Course Name: PE-I : Hazardous Waste Management	Course Code: CV 3979
CO1	An ability to understand principle of methods given to hazardous waste.
CO2	An ability to understand the common functional elements of waste management system
CO3	An ability to suggest suitable waste processing technologies and disposal methods.

Course Name: PE-I : Water Resources Management	Course Code: CV 3980
CO1	An ability to understand water resources planning
CO2	An ability to understand water policies and application of remote-sensing.
CO3	An ability to understand different methods of conservation and recharging of water resources
CO4	An ability to Understand inter-basin transfer and EIA of water Resource development projects

Course Name: PE-I : Environmental Biotechnology	Course Code: CV 3981

CO1	An Ability to understand the fundamental concept of microbial biochemistry and biotechnology
CO2	An Ability to understand the Relationship between cell signalling and gene transcription.

Course Name: PE-I : Advanced Water Treatment	**Course Code: CV 3982**
CO1	An ability to understand the fundamental, scientific basis governing the design and performance of the treatment technologies.
CO2	An ability to understand the role of each unit operation
CO3	Process within typical treatment process trains and their interaction

Course Name: PE-II : Energy Conversion and Environment	**Course Code: CV 3983**
CO1	An Ability to Understand and apply basic concept of waste to energy technology and environmental protection.
CO2	An Ability to understand the concept of environmental appraisal, energy audit and assessment of energy potential of energy sources

Course Name: PE-II : Applied Structure	**Course Code: CV 3984**
CO1	1. An Ability to design various pipes and associated structures.
CO2	2. An ability to analysis different loads conditions applicable for different environmental structures
CO3	3. An ability to design water tanks
CO4	An ability to understand importance of durability of water supply structures

Course Name: PE-II : Water Reuse and Recycling	**Course Code: CV 3985**
CO1	An Ability to understand the concept of sustainable water resources management as a foundation for water reclamation and reuse
CO2	An Ability to understand the various technologies and systems available for reclaimed water
CO3	An Ability to understand the Water reuse applications including agricultural uses, landscape irrigation, industrial uses, environmental and recreational uses, groundwater recharge

Course Name: Seminar	**Course Code: CV 3986**
CO1	An Ability to understand various aspects of presentation skills
CO2	An ability to carry out literature survey, compilation of literature data
CO3	An ability to understand effective technical paper writing

Second Year: Semester III:

Course Name: Project Phase-I		Course Code: CV 3989
CO1	An ability to understand the advances in Environmental engineering.	
CO2	An ability to understand the use of modern tools.	
CO3	An ability to work independently and in a team for effective communication	
CO4	An ability to understand the importance of lifelong learning	

Second Year: Semester IV:

Course Name: Project Phase-II		Course Code: CV 3990
CO1	An ability to understand the advances in Environmental engineering.	
CO2	An ability to solve real world Environmental engineering problems	
CO3	An ability to understand the importance of lifelong learning and the use of modern tools.	
CO4	An ability to work independently and in a team for effective communication.	

Yeshwantrao Chavan College of Engineering, Nagpur

Name of the Department: Civil Engineering

Name of the PG Programme: M.Tech (Structural Engineering)

Course Outcomes (CO)

First Year: Semester I:

Course Code: CV3901	Course Name: - Theory of Elasticity and Elastic Stability
CO1	Demonstrate the knowledge of fundamental methods of elasticity for 2-D and 3D stress analysis
CO2	Analyze bending and torsional problems and apprise various theories to solve 2-D problems
CO3	Apply the basic knowledge of elastic stability to various structural elements
CO4	Explain and solve the problems of beam-column, column and built up column using the concept of elastic stability

Course Code: CV3902	Course Name: - Structural Dynamics
CO1	An ability to apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response.
CO2	Ability to identify, formulate and solve engineering problems having motions varying with time. This will be accomplished by having students model, analyze and modify a vibratory structure, in order to achieve specified requirements.
CO3	Understanding professional and ethical responsibilities. This will be accomplished by emphasizing the importance of understanding how structural vibrations may affect safety and reliability of engineering systems.
CO4	An ability to Understand IS codes related to earthquake loading.

Course Code: CV3903	Course Name: - Lab : Structural Dynamics
CO1	An ability to understand the behavior of vibratory system during cyclic loading.
CO2	An ability to understand phenomenon like damping and its relevance in actual structural applications.
CO3	An ability to understand the effect of earthquake phenomenon on water media and subsoil.
CO4	An ability to understand provision of various Indian standards for design of structures from seismic safety point of view.

Course Code: CV3904	Course Name: - Matrix Analysis of Structures
CO1	Understand the different types of structures
CO2	Apply the matrix stiffness method to model the behavior of planar trusses, beams, and frames.
CO3	Analyze any multistoried building using Matrix Stiffness methods of structural analysis.
CO4	Recognize special effects on behavior of structures.
CO5	Implement the method developing their own computer program to analyze structures.

Course Code: CV3905	Course Name: - Lab:- Matrix Analysis of Structures
CO1	Apply the stiffness method for structural analysis.
CO2	Analyze continuous beams, plane truss, space truss, plane frame neglecting axial deformation, plane frame considering axial deformation, plane grids.
CO3	Recognize special effects on behavior structures.

Course Code: CV3906	Course Name: - Design of Substructures and Foundations
CO1	Students will be able to identify the type of foundations to be used for various site conditions
CO2	Students will be able to analyze and design different types of foundation structures.
CO3	Students will be able to draw RCC detailing and to prepare working drawing.
CO4	Students will be able to understand the importance of various codes used for different types of foundation structures.

Course Code: CV3907	Course Name: - Earthquake and Wind Effects on Structures
CO1	An ability to apply the knowledge of geological feature, plate tectonics in understanding occurrence of earthquake.
CO2	An ability to understand causes and sources of earthquake damages and possible response of structure and system to earthquake
CO3	An ability to understand characteristics of wind and its static and dynamic effects on structures
CO4	An ability to understand relevant I.S. codes and philosophy in design of earthquake& Wind resistant structure

Course Code: CV3908	Course Name: - Advanced Concrete Structures
CO1	An Ability to know provisions of relevant IS codes / IRC code required for design of advanced concrete structures such as water tank, bridges ,multistoried building
CO2	An ability to design advanced concrete structures such as water tank , bridge and culvert
CO3	An ability to understand the various methods of design of multistoried buildings, retaining wall.
CO4	An ability to draw RCC detailing of structures.

Course Code: CV3909	Course Name: - Lab : RCC Design Studio
CO1	An Ability to know provisions of relevant IS codes / IRC code required for design of advanced concrete structures such as water tank, bridges ,multistoried building
CO2	An ability to design advanced concrete structures such as water tank , bridge and culvert
CO3	An ability to understand the various methods of design of multistoried buildings.
CO4	An ability to draw RCC detailing of structures

First Year: Semester II:

Course Code: CV3915	Course Name: - Finite Element Method
CO1	An ability to derive element matrix equation by different methods by applying basic laws in structural analysis.
CO2	An ability to apply the knowledge of finite element method to solve simple problems.
CO3	An ability to extend the knowledge of finite element method to solve complex problems using various elements.
CO4	An ability to understand solution and modeling techniques used in finite element method

Course Code: CV3916	Course Name: - Lab: Finite Element Method
CO1	An ability to identify the information required to conduct a structural analysis using finite element software
CO2	An ability to interpret the solutions obtained from finite element analyses
CO3	An ability to have basic skills in using commercial finite element software and effective presentation of their analysis results
CO4	An ability to communicate effectively in writing to report (both textually and graphically) the method used, the implementation and the numerical results obtained

Course Code: CV3917	Course Name: - Theory of Plates and Shells
CO1	Demonstrate behavior of various plates
CO2	Analyze plates using different methods
CO3	Explain various theories of shells
CO4	Evaluate structural actions of shells using various theories

Course Code: CV3918	Course Name: - Advanced Steel Structures
CO1	An ability to understand the configuration (component of structures, civil\structural engineering drawing etc.) of the structure.
CO2	An ability to understand the effect of natural phenomenon (wind and earthquake), in structural engineering applications
CO3	An ability to analyze and design the advanced steel structures by applying the provision of Indian Standard Code

Course Code: CV3919	Course Name: - Lab: Steel Design Studio
CO1	An ability to apply the basic knowledge of structural steel.
CO2	An ability to develop the model (structure) in commercially available software, analyze and design it by applying appropriate loads
CO3	An ability to present the analysis and design results in schematic way of the desired structure

Course Code: CV3920	Course Name: - PE-I : New Engineering Materials
CO1	An ability to introduce different high quality materials for civil engineering applications
CO2	An ability to use engineering materials for better and durable Civil Engineering Structures

Course Code: CV3921	Course Name: - PE-I : Prestressed Concrete
CO1	Students will be able to apply basic concepts of prestressed concrete in construction industry.
CO2	Students will be able to identify, formulate and solve engineering problems pertaining to prestressed concrete.
CO3	Students will be able to Understand IS codes related to prestressed concrete.
CO4	Students will be able to design special prestressed concrete structures.

Course Code: CV3922	Course Name: - PE-I : Smart Structures and Applications
CO1	An ability to understand passive and active systems.
CO2	An ability to understand the characteristics and behavior of smart materials
CO3	An ability to understand control system and its applications
CO4	An ability to understand techniques of base isolation

Course Code: CV3923	Course Name: - PE-II : RC Tall Buildings
CO1	The students will be able to describe fundamental concept, principle and application of earthquake engineering.
CO2	The students will be able to analyze and design RCC structures with ductile detailing as per Indian standards.
CO3	The students will be able to apply technical design principles and techniques such as P-delta effect, soil structure interaction for a design of high rise structures.
CO4	The students will be able to apply various provisions for earthquake resistance design of structures as per Indian standards.

Course Code: CV3924	Course Name: - PE-II : Composite Structures
CO1	Students will be able to understand basic concepts and characteristics of Composite materials.
CO2	Students will be able to understand elastic behavior of lamina.
CO3	Students will be able to understand various failure theories.
CO4	Students will be able to analyse laminated plates under bending and vibration.

Course Code: CV3925	Course Name: - PE-II : RC Bridge Design
CO1	An ability to identify the types of bridge to be used for various site and loading conditions
CO2	An ability to understand applicability of IRC codes related to bridges
CO3	An ability to analyze and design slab bridges and its components

Course Code: CV3926	Course Name: - PE-III : Plastic Analysis & Design of Steel Structure
CO1	An ability to understand behavior of steel structure elements beyond yield point loading and basic concepts of plastic analysis
CO2	An ability to understand techniques for estimation of collapse loads on steel structures
CO3	To understand the effects of axial and shear forces on plastic moment of resistance
CO4	To understand philosophies of plastic design of steel structural elements

Course Code: CV3927	Course Name: - PE-III : Seismic Analysis and Design of Structures
CO1	An ability to apply basic concepts Earthquake resistant design in construction industry.
CO2	An ability to identify, formulate and solve engineering problems pertaining to earthquake effects on structures.
CO3	An ability to understand IS codes related to static as well as dynamic analysis of high rise buildings.
CO4	An ability to design special structures subjected to more effective earthquake forces

Course Code: CV3928	Course Name: - PE-III : Design of Industrial Structures
CO1	An expertise to understand planning of industrial structures.
CO2	The capability to analyse large span structures.
CO3	An expertise to understand stability of silos and bunkers under dynamic loads
CO4	The skill to analyse and design foundations for industrial structures

Second Year: Semester III:

Course Code: CV3939	Course Name: - Project Phase-I
CO1	An ability to understand the advances in structural engineering
CO2	An ability to understand the use of modern tools
CO3	An ability to work independently and in a team for effective communication
CO4	An ability to understand the importance of lifelong learning

Second Year: Semester IV:

Course Code: CV3940	Course Name: - Project Phase-II
CO1	An ability to understand the advances in structural engineering
CO2	An ability to solve real world structural engineering problems
CO3	An ability to understand the importance of lifelong learning and the use of modern tools
CO4	An ability to work independently and in a team for effective communication

B.E. – Mechanical Engineering

Vision of the Department
"To become an attractive destination for pursuing mechanical engineering with emphasis on innovation, research and value based education."

Mission of the Department
"To evolve mechanical engineering professionals through creative teaching, project based learning and research in a stimulating environment.**Program Educational**

Objectives of the program (PEO)

PEO1 To prepare the students to take-up career in different industries or to pursue higher studies in mechanical and interdisciplinary programs. (Preparation)

PEO2 Be competent with strong technological background to analyze data, formulate and undertake industrial problems and obtain viable solutions. (Core Competence)

PEO3 To prepare students with engineering breadth to innovate, create and design novel systems and to contribute in providing solutions to real-life problems. (Breadth)

PEO4 Be Competent for effective communication, in management and in professional skills and ethics. (Professionalism)

PEO5 To provide opportunity to the students to expand their horizon beyond mechanical engineering which enable them to understand the significance of life-long learning in global perspective. (Learning Environment)

Program Outcomes (PO) At the end of Program, Graduate students will have

PO1 **Engineering knowledge**: An ability to apply knowledge of mathematics, science and engineering.

PO2 **Problem Analysis:** Ability to design and conduct experiments, as well as to analyze and interpret data.

PO3 **Design and Development of Solution:** An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

PO4 **Conduct investigation of Complex problems:** Knowledge of Research methodology, data interpretation to provide valid Conclusion of contemporary issues.

PO5 **Modern Tool Usage**: An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

PO6 **The Engineer and Society:** Ability to Apply reasoning informed by the contextual knowledge to asses health, safety and cultural issues relevant to the professional engineering practices.

PO7 **Environmental and Sustainability**: The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.

PO8 **Ethics:** An understanding of professional and ethical responsibility.

PO9 **Individual And team Work:** An ability to function on multidisciplinary teams.

PO10 **Communication:** An ability to communicate effectively.

PO11 Project management and Finance: An ability to demonstrate knowledge and understanding of engineering and management principles and application to the project work.

PO12 Life-long learning. Recognition of the need for, and an ability to engage in life-long learning.

Program specific Outcomes (PSO)

PSO1 An ability to demonstrate knowledge, technical skill and problem solving techniques in mechanical system design & analysis.

PSO2 An ability to develop, realize and operate systems in mechanical engineering domain.

M.Tech. - CAD / CAM

Program Educational Objectives (PEOs) of M. Tech.

PEO1 To impart in depth knowledge to students in the current technologies in CAD, CAM and CAE and to equip them for research and professional development

PEO2 To develop analytical problem solving capabilities to develop practicable solutions to engineering problems

PEO3 To create technical ability in students by imparting hands on experience on software and advanced manufacturing machines

Program outcomes (POs)of M. Tech.

PO1 An ability to analyze mechanical components/systems for critical analysis and improvement in design.

PO2 An ability to apply knowledge and skills to develop solutions in the field of CAD/CAM.

PO3 An ability to handle sophisticated machines & instruments for carrying out analysis & research.

PO4 An ability to develop and execute programs for advanced manufacturing systems.

PO5 An ability to function in a multidisciplinary team for design and development of sophisticated mechanical system.

PO6 An ability to develop proficiency in communication of technical and research work

Course Outcomes (CO)

First Year: Semester I:

Course Name: Engineering Mathematics-I	**Course Code: GE-2101**
GE-2101 CO-1	Apply the knowledge of differentiation to develop the Mathematical equations and compute geometrical measures
GE-2101 CO-2	Determine the expansion and derivatives of functions of Multiple variables and use it to find extreme values of functions.
GE-2101 CO-3	Evaluate the integrals of single, multiple variables and use it to measure the dimensions of various geometrical figures.
GE-2101 CO-4	Discuss Calculus of Scalar and vector point function and use appropriate theorems to evaluate integrals of functions of single, multiple variables.

Course Name: Engineering Mathematics-II	**Course Code: GE-2102**
GE-2102 CO-1	Use appropriate Methods to solve first order and higher order differential equations and apply it to find solutions of engineering problems
GE-2102 CO-2	Analyse the functions of complex numbers and variables, prove Mathematical equations and evaluate the complex integrals
GE-2102 CO-3	Use Matrix method to solve linear equations , evaluate eigen values - eigen vectors and its applications.
GE-2102 CO-4	Measure the statistical parameters and derive the equations of best fit curves

Course Name: Communication Skill	**Course Code: GE-2107**
GE-2107 CO-1	Explain the basics of communication process as well as identify the barriers in communication.

GE-2107 CO-2	Classify and describe the different Speech Sounds of English Language.
GE-2107 CO-3	Apply different strategies and techniques of presentations, interviews and group communication.
GE-2107 CO-4	Drafting reports, memos and emails, considering the professional etiquettes and ethics with appropriate content and context.

Course Name: Social Science	**Course Code: GE-2108**
GE-2108 CO-1	Explain the basic concepts of Social Sciences.
GE-2108 CO-2	Describe the development of various Civilizations and their Culture.
GE-2108 CO-3	Analyze the Impact of Industrialization on society and discuss the Fundamental Concepts of Society.
GE-2108 CO-4	Explain Industrial Organization and Management.

Course Name: Engineering Physics **Course Name: Engineering Physics (Lab.)**	**Course Code: GE-2105 and GE 2106**
GE 2105 & GE2106 CO1	Examine the intensity variation of light due to interference, diffraction and its applications.
GE 2105 . CO2	Explain fundamentals of quantum mechanics and its application to problems dealing with quantum particle.
GE 2105 & GE2106 CO3	Develop ability to classify and analyze the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands for device applications.
GE 2105 & GE2106 CO4	Analyze the motion of charged particle in electric and magnetic fields and its applications to electron optic devices.
GE 2105 & GE2106 CO1	Illustrate working principle of lasers, ultrasonic waves and its properties for useful applications in the field of industry.

Course Name: Engineering Chemistry **Course Name : Engineering Chemistry (Lab.)**	**Course Code: GE2103 and GE 2104**
GE2103 and GE 2104 CO1	Assess qualitative and quantitative aspects of water as a conventional material for industrial and domestic applications.
GE2103 and GE 2104 CO2	Apply the knowledge of basic electrochemistry to understand battery technology, corrosion process and preventive techniques.
GE2103 and GE 2104 CO3	Know the basics and assess analytical aspects of industrial materials like fuels and lubricants for efficient utilization.
GE2103 and GE	Recognize the significance of cement and advanced engineering materials in technological applications.

2104 CO4	
GE2103 and GE 2104 CO5	Analyze and generate analytical and instrumental techniques.

First Year: Semester II:

Course Name: Engineering Mechanics Engineering Mechanics (Lab.)	**Course Code: CV-2101 - CV2102**
CV-2101- CO 1	An ability to apply the concept of applied mechanics and can solve problems on planar force system for friction as well as frictionless surfaces.
CV-2101- CO 2	An ability to analyze pin jointed truss frame structure and beam structure analytically and graphic
CV-2101- CO 3	An ability to understand centroid, moment of inertia, product of inertia and mass moment of inertia and can find properties of surfaces.
CV-210- 1CO 4	An ability to determine the dynamic variables of moving body, understand working principle of simple lifting machine.

Course Name: Basic Electronics	**Course Code: EE 2101**
EE 2101 CO1	Characterize Number systems, semiconductors, diodes, transistors and operational amplifiers.
EE 2101 CO2	Design simple analog circuits
EE 2101 CO3	Design simple combinational and sequential logic circuits
EE 2101 CO4	Identify functions of digital multimeter, Bridges and transducers in the measurement of physical variables

Course Name: Introduction to Computer Programming Introduction to Computer Programming (Lab.)	**Course Code: IT2101 Course Code: IT-2102**
IT2101, IT2102 CO1	Understand computer system, basics of algorithm & flowchart, and demonstrate straight line program using basic 'C' programming language constructs.
IT2101 IT2102 CO2	Design & Develop programs using different loop control structures, user defined functions, and Pointers.
IT2101 IT2102 CO3	Analyze and apply concepts of different dimensional Arrays as a data structure & development of programs using the same.
IT2101 IT2102 CO4	Design and develop programs using basics of Strings, Structures, union and Files in 'C' language.

Course Name:Electrical	**Course Code: EL 2101 EL-2102 (Lab.)**

Engineering Elect. Eng. Lab	
EL 2101 & EL 2102- CO-1	Reproduce fundamentals of dc circuits, single phase, and three phase ac circuits.
EL 2101 & EL 2102- CO-2	Analyse dc circuits, single phase and three phase ac circuits for basic electrical quantities such as current, voltage, power etc.
EL 2101 & EL 2102- CO-3	Explain construction, working, testing, and applications of various electrical machines.
EL 2101 & EL 2102- CO-4	Analyse performance of various electrical machines.
EL 2101 & EL 2102- CO-5	Perform laboratory experiments and demonstrate competency in collecting, interpreting, analysing data, communicate and present effectively through laboratory journals.

Course Name: Engineering Graphics Engineering Graphics Lab.	Course Code: ME2101 ME-2102
ME2101 ME-2102 CO1	Transform orthographic projections into isometric projections and vice versa.
ME2101 ME-2102 CO2	Evaluate Projections of various One Dimensional, Two dimensional, Three dimensional objects.
ME2101 ME-2102 CO3	Built the development of lateral surfaces of various solids and their cut section.
ME2101 ME-2102 CO4	Predict the intersections and intersections of various solid objects.
ME2101 ME-210 2CO5	Justify the use of software tools used for Two dimensional drawings.

Course Name: Workshop Practice	Course Code: ME 2103
CO1	Understand the carpentry tools, joints, machineries and its applications
CO2	Understand the fitting tools, measuring instruments, machineries and its applications
CO3	Understand the smithy tools furnaces and hand and power forging equipment's
CO4	Understand Gas and Electric welding processes, utility, tools and its applications

Second Year: Semester III:

Course Name: Engineering Mathematics III	Course Code: GE2201
CO1	Estimate the Calculus of Numerical Function.
CO2	Determine transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations.

CO3	Discuss the nature of periodic function and express it in terms of series.
CO4	Use appropriate method/s to solve partial differential equations

Course Name: Material Science and Metallurgy	**Course Code: ME2201**
CO1	Student will be able to distinguish microstructure and analyse the effect of Crystalline nature of metals
CO2	Student will be able to construct Iron-Iron carbide equilibrium diagram and analyse microstructure, general properties and heat treatment practices of commercial steels and Cast Iron.
CO3	Student will be able to analyse and implement suitable heat treatment processes
CO4	Student will be able to perceive the basics of powder Metallurgy for powder metallurgical components

Course Name: Material Science and Metallurgy LAB	**Course Code: ME2202**
CO1	Students will be able to create specimen for metallographic examination
CO2	Students will be able to analyze the microstructure and investigate various properties of ferrous and non-ferrous Materials
CO3	Students will be able to test different Engineering Materials

Course Name: Fluid Mechanics Fluid Mechanics LAB		**Course Code:** ME-1205 ME 1206
ME-1205 ME 1206 **CO1**	The student will be able to evaluate various fluid properties and analyze hydrostatic forces acting on submerged flat bodies	
ME-1205 ME 1206 **CO2**	The students will be able to classify and analyze the various flow pattern, and will be able to evaluate velocity and acceleration using fluid kinematics.	
ME-1205 ME 1206 **CO3**	The students will be able to analyze and solve ideal flow and real flow problems by applying bernoulli's equations and momentum equations. The students will also be able to describe and analyze the fluid flow over bodies.	
ME-1205 ME 1206 **CO4**	The students will be able to analayze the flow, through pipes. The students will be able to evaluate head losses, discharge, power lost etc for the flow through pipes with and without fittings	
Course Name: Machining process Machining process Lab		**Course Code: ME2203** **ME2204**
ME 2203 ME 2204 **CO1**	Distinguish among various cutting tool materials and tool geometries.	
ME 2203 ME 2204 **CO2**	Examine the different processes and machine tools for cylindrical surface machining.	
ME 2203 ME 2204 **CO3**	Differentiate various machining processes and conditions for flat surface machining using SPCT.	
ME 2203 ME 2204 **CO4**	Justify machining processes for flat surfaces marching using MPCT.	

Course Name: Mechanics of Materials Mechanics of Materials LAB	**Course Code: ME2205** **ME2206**
ME2205 **ME2206 CO1**	Describe the basic concepts of stress, strain and their variations under different types of loading
ME2205	Apply the basic concepts involved in mechanics of materials,

ME2206 CO2	bending moment, shear force, stresses in beams to solve complex problems
ME2205 ME2206 CO3	Analyze strain, impact loading and crippling load
ME2205 ME2206 CO4	Evaluate the torsional shear stress in shaft and solve the problem on Slope and deflection in beams under different loading and support conditions.

Course Name: KINEMATICS OF MACHINERY	**Course Code: ME2207**
CO1	Students should be able to understand the mechanical system, mechanism its components, relative motion between them.
CO2	Students should be able to determine the velocity & Acceleration of a kinematic link of a given mechanism and various forces coming on links in static condition.
CO3	Students should be able to identify the motion as per the application & draw the profile of a camfollowers mechanism.
CO4	Students should be able to understand the kinematics of gears and gear train. They should be able to select an appropriate gear system.

Second Year: Semester IV:

Course Name: - Advanced Mathematical Techniques	**Course Code: ME2204**
CO1	Utilize numerical techniques to obtain approximate solutions of mathematical equations
CO2	Measure the Statistical parameters for random variables
CO3	Explain the basic concept of fuzzy sets, Relations and fuzzy logic
CO4	Design and determine the solution of linear programming problems

Course Name: Engineering Thermodynamics	**Course Code: ME2212**
CO1	Apply the laws of thermodynamics for the analysis of thermodynamic systems to evaluate energy interactionin various processes s.
CO2	Evaluate the performance of cyclic devices, change in the entropy and availability in various processes applying the laws of thermodynamics.
CO3	Examine various thermodynamic parameters in the processes with phase change using steam tables, charts and relations applying the laws of thermodynamics.
CO4	Apply the laws of thermodynamics for the analysis of thermodynamic cycles.

Course Name: Design of machine elements	**Course Code:** ME 2251
CO1	Student will be able to apply the knowledge of design principal in machine components.
CO2	Student will be able to Design and analyze various joints i.e., Welded joints, Bolted joints and Riveted joints.

CO3	Student will be able to Learn the design principals of power screw, springs, clutches and brakes.
CO4	Student will be able to Apply principal of design of pressure vessel and power transmission shafts.

Course Name: Machine Drawing	**Course Code:** ME 2253
CO1	Apply standards practices and conventions in machine drawing
CO2	Draw a Orthographic and Isometric drawing
CO3	Preparing and visualizing detailed drawing of various machine components
CO4	Create a 2D and 3D using CAD software with due manufacturing consideration.

Course Name: Manufacturing process II **Manufacturing process II LAB**	**Course Code: ME2254** **2255**
ME2254 **2255 CO1**	The student will be able to illustrate the basics of moulding practices and various casting process .
ME2254 **2255 CO2**	The student will be able to illustrate CUPOLA and other furnaces.
ME2254 **2255 CO3**	The student will be able to Elaborate and classify different welding processes.
ME2254 **2255 CO4**	The student will be able to discuss various SMW processes

Course Name: Mechanical Measurement and Metrology **Mechanical Measurement and Metrology LAB**	**Course Code: ME2256** **ME2257**
ME2256 **ME2257 CO1**	The student will be able to Demonstrate the basic knowledge of measuring Instruments and evaluate various characteristics.
ME2256 **ME2257 CO2**	The student will be able to Select proper measuring instruments and use it for measuring various parameters
ME2256 **ME2257 CO3**	The student will be able to design limit gauges & tolerance charts.
ME2256 **ME2257 CO4**	The student will be able to Evaluate statistical process control and acceptance sampling procedures to improve quality of process.

Third Year: Semester V:

Course Name: Fundamental of Management	**Course Code: GE2311**
CO1	Explain the Legal provision and Functions of Management.
CO2	Analyze the role of Human Resource and Financial Management in the organization.
CO3	Analyze the project life cycles.
CO4	Identify tools and techniques for the marketing of goods and services

Course Name: HEAT TRANSFEFR HEAT TRANSFEFR lAB	Course Code: ME2301 ME2302
ME2301 ME2302 CO1	Analyze and solve the problems of unidirectional steady state heat conduction systems.
ME2301 ME2302 CO2	Investigate and apply the empirical correlations in convection and phase change processes to estimate the heat transfer coefficient.
ME2301 ME2302 CO3	Design & analyze the heat exchangers with LMTD & ϵ-NTU methods
ME2301 ME2302 CO4	Examine and evaluate the net thermal radiation exchange between surfaces and estimate radiation view factors using tables, graphs and the view factor relationships

Course Name: Operation Research Techniques	Course Code: ME2315
CO1	Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method.
CO2	To Solve transportation and Assignment Models and analyse the concept of dynamic programming to Solve problems of discreet and continuous variables.
CO3	Analyze projects for minimum total cost and smooth level of resources.
CO4	Evaluation of different replacement policies and its application in operation research and analyse of the application of simulation, inventory control model and waiting line mode.

Course Name: Applied Thermodynamics	Course Code: ME- 2307
CO1	Students shall be able to describe and analyze the basic principles of compressible fluid flow and apply those principles to its applications.
CO2	Students should illustrate and analyze Steam nozzle, steam turbine and condenser used in thermal power plants.
CO3	Students should able to illustrate and evaluate gas turbine cycle, its classification, and its application in power plant.
CO4	Students should able to evaluate gas turbine cycle, and its application to jet propulsion.

Course Name: OE-1: Automobile Engineering	Course Code: ME-1317
CO1	Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle.
CO2	Student will be able to describevarious power transmission systems from clutch to wheel in vehicle.
CO3	Student will be able to evaluate and describecontrol systems like steering and brakes in vehicle.
CO4	Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.

Course Name: DYNAMICS OF MACHINERY	**Course Code:** ME1323
CO1	Students should be able to understand the mechanical system, mechanism its components, relative between them.
CO2	Students should be able to determine the relative velocity & Acceleration of a kinematic link of a given mechanism and various forces coming on links in static condition.
CO3	Students should be able to identify the motion as per the application & draw the profile of a camfollowers mechanism.
CO4	Students should be able to understand various types of Gears used in Machine terminologies and concepts of velocity ratios in gear trains.

Course Name: DYNAMICS OF MACHINERY LAB	**Course Code:** ME1324
CO1	Students will be able to: Differentiate static and dynamic forces on different machines and mechanisms.
CO2	Analyze the unbalanced in rotating & reciprocating machines and corrections required to balance the same.
CO3	identify the vibrations in different machines.
CO4	Evaluate and justify vibrations.

Third Year: Semester VI:

Course Name: OE-II: Power Generation Engineering	**Course Code:** ME1333
CO1	Student will be able to describe basics of power generations systems.
CO2	Student will be able to analyze various conventional & non-conventional power plants.
CO3	Student will be able to analyze and examine combined operations of different power plants.
CO4	Student will be able to evaluate and describeHydroelectric power plant nuclear power plant

Course Name: Energy Conversion	**Course Code:** ME1310
CO1	The student will be able to describe and analyze the working of compressors.
CO2	The student will be able to describe and analyze the working of I.C.Engines
CO3	The student will be able to describe and analyze the working of Refrigeration systems
CO4	The student will be able to define evaluate Psychromatic properties and; describe and analyze the air conditioning processes

Course Name: COMPUTER AIDED DESIGN	Course Code: ME1312
CO1	Distinguish the various CAD CAM tools and also evaluate criteria for CAD CAM systems
CO2	Design 2D and 3D Transformation matrices
CO3	Calculate and analyse the parametric equations for wire frame. surface and solid modeling entities
CO4	Design the applications of modeling and evaluate data exchange formats

Course Name: COMPUTER AIDED DESIGN LAB	Course Code: ME1312
CO1	Execute transformation through C++ prgramming language
CO2	Apply appraches of sketcher modeling for developing CAD Model
CO3	Apply appraches of part modeling for developing CAD Model

Course Name: TOTAL QUALITY MANAGEMENT	Course Code: ME1331
CO1	Develop an understanding on quality management philosophies and frameworks.
CO2	Develop in-depth knowledge on various tools and techniques of quality management.
CO3	To Evaluate the applications of quality tools and techniques in both manufacturing and service industry
CO4	Ability to use quality management methods analyzing and solving problems of organization.

Fourth Year: Semester VII:

Course Name: Production Management	Course Code: ME1447
CO1	Ability to estimate and evaluate manage production system using work study.
CO2	Ability to design and evaluate plant layouts
CO3	Ability to predict and evaluate future demand using forecasting.
CO4	Ability to estimate production costing and apply by judging production planning and control.

Course Name: (PE-1) REFRIGERATION AND CRYOGENICS	Course Code: ME1469
CO1	The student will be able to describe, analyze and evaluate Vapour Compression Refrigeration System.
CO2	The student will be able to describe and analyze other refrigeration system such as Vapour Absorption Refrigeration System, Electrolux refrigeration system, steam jet refrigeration systems, thermoelectric refrigeration and vortex tube refrigeration
CO3	The student will be able to describe, analyze and evaluate Air Cycle Refrigeration Systems.
CO4	The student will be able to describe and analyzeCryogenic Systems.

Course Name: (PE-2) Renewable Energy System	**Course Code: ME1410**
CO1	Students will be able to apply the use of solar energy for the benefit of the society.
CO2	Students will be able to understand the better awareness of potential of Biogas and gasifiers also its use for the society.
CO3	Students will be able to understand the better awareness of potential of wind energy. Geothermal energy .
CO4	Students will be able to understand the better awareness of potential of ocean wave energy and tidal energy, MHD generation

Course Name: (PE-3)I.C.Engines	**Course Code:** ME-1419
CO1	Student should able to analyze basic working cycles, construction and and systems of I.C. Engines.
CO2	Student should able to analyze fuels, combustion process, pollution and its control of engines.
CO3	Student should able conduct a trial for Engine performance evaluation.

Course Name: Advanced Manufacturing Techniques	**Course Code:** ME 1456
CO1	Distinguish the various nontraditional manufacturing process based on energy sources.
CO2	Evaluate various advanced manufacturing process for new materials and the requirements of complex features on the basis of various parameters.
CO3	Justify the various advanced welding and bonding techniques as per the applications.
CO4	Evaluate the application of various advanced manufacturing techniques in industries

Course Name: Management Information Systems	**Course Code:** ME1443
CO1	Differentiate the nature, scope and the role of MIS in an organization.
CO2	Examining the system for processing the information.
CO3	Compose the DSS to solve the managerial problems.
CO4	Justify the application using MIS tools.

Course Name: Management Information Systems LAB	**Course Code:** ME1444
CO1	Differentiate the nature, scope and the role of MIS in an organization.
CO2	Examining the system for processing the information.
CO3	Apply the MIS tools for various application

Course Name: ENGINEERING OF PLASTICS	**Course Code: ME1404**
CO1	Students will be able to select the suitable plastic material for given application.
CO2	Students will be able to select suitable plastic processing technique.

CO3	Students will be able to select suitable machining and joining process for plastic components.
CO4	Student will be able to implement suitable processes for manufacturing various composite products.

Course Name: DESIGN OF MECHANICAL DRIVES	**Course Code: ME1448**
CO1	Describe the design process, material selection & calculations of stresses in flat belt, V belt, chain drive and rope drive, and finding its failure criteria.
CO2	Design the various gear drive such as spur, helical, worm & worm wheel and bevel gears, and finding its failure criteria.
CO3	Summarize the knowledge on shafts, coupling and flywheel and finding its failure criteria.
CO4	Evaluate the radial and thrust load for journal bearings, antifriction bearings and finding its failure criteria.

Course Name: PE-I:Tool Design	**Course Code:** ME1401
CO1	Student will be able to explain the fundamentals of Tool Design
CO2	Design various cutting tools, dies, Jigs & Fixtures and Forging dies
CO3	Evaluate the failure modes of tools and cost estimation
CO4	Compose planning for manufacturing of tools for various parts

Course Name: EL I: Material Handling System	**Course Code:** ME 1402
CO1	Explain the various typs of Material handling systems.
CO2	Design the various rope and chain assisted material handling systems
CO3	Explin various attachments, drives and safety components of material handling system
CO4	Analyze and select various material handling systems for different material handling situations

Course Name: EL III: Machine Tool Design	**Course Code: ME1476**
CO1	Explain the drives and mechanisms of machine tools
CO2	Design Gear boxes of machine tools
CO3	Design machine tool structures, guide ways and power screws, spindles and supports of machine tools.
CO4	Test the machine tools and examine the control system of machine tools.
Course Name: EL III: Machine Tool Design LAB	**Course Code: ME1477**
CO1	describe the drives and mechanisms of machine tools
CO2	design Gear boxes of machine tools
CO3	design machine tool structures, guide ways and power screws, spindles and supports of machine tools
CO4	describe testing and control system of machine tools

Course Name: FEM	**Course Code: ME1406**

CO1	Evaluate the fundamentals of Finite Elements Method.
CO2	Analyze the mechanical engineering problems.
CO3	Evaluate the stresses, strains and deformation in simple machine elements and design solutions for simple problems.
CO4	Build the solutions using the commercial softwares for simple machine elements.

Course Name: FEM LAB	**Course Code: ME1406**
CO1	Study, analyse and develop the fundamentals of Finite Elements Method for mechanical engineering problems
CO2	Evaluate the stresses, strains and deformation in simple machine elements and design solutions for simple problems.
CO3	Build the solutions using the commercial software's for simple machine elements.

Course Name: VIBRATION VIBRATION LAB	**Course Code: ME1415** **ME1416**
ME1415 **ME1416 CO1**	Analyze the various types of vibrations
ME1415 **ME1416 CO2**	Evaluate vibrations and carry out its analysis
ME1415 **ME1416CO3**	Predict/judge vibration parameters and evaluate through different approaches for multidegree freedom system
ME1415 **ME1416CO4**	Form and work on transformation of matrices for vibration for evaluating frequencies

Course Name: CIM	**Course Code: ME1417**
CO1	The Students will have ability to design and evaluate experimentation on CNC machines.
CO2	Desiging of GT cell layouts for transforming into flexible manufacturing system.
CO3	The students will be able to compose and transform robot programs various industrial applications.
CO4	The students will have ability to justify CAPP and CAQC to design computer integrated manufacturing

Course Name: project phase I	**Course Code:** ME1433
CO1	Concept and Objective of Project
CO2	Preliminary Approach & Literature Survey
CO3	Innovativeness, Technical Skills
CO4	Presentation & Reasoning Skills

Fourth Year: Semester VIII:

Course Name: Automation in Production	**Course Code: ME1435**
CO1	The students will have ability to design and evaluate product layout using line balancing
CO2	The students will be able to compose and evaluate CNC Programs.
CO3	The students will be able to examine use of robot and automated material to design automated systems
CO4	The students will be able to design GT cells to build FMS.

Course Name: EL V:PRODUCT DESIGN AND DEVELOPMENT	**Course Code:** ME 1455
CO1	Student will be able to Evaluate the product life cycle
CO2	Student will be able to Analyze and select the materials and manufacturing processes for designed product
CO3	Student will be able to Evaluate the product for different design criteria like robust design, benchmarking, DFX,etc and estimate the product costing
CO4	Student will be able to Explain the various prototyping methods and its economics

Course Name: (PE-4) Industrial Fluid Power	**Course Code:** ME-1437
CO1	To investigate the hydraulic fluids and apply the fluid power laws and principals for analysis of simple fluid power system.
CO2	To identify, analyze, and justify selection of suitable components of fluid power system for specific applications based on its function, performance and working characteristics.
CO3	To design and examine the fluid power system and to compose and interpret its circuit diagrams using standard symbols.
CO4	To examine the fluid piping and fittings, safety measures, maintenance, and trouble shooting for fluid power systems.

Course Name: (PE-4) Vehicle Engineering	**Course Code:** ME-1441
CO1	Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle.
CO2	Student will be able to describevarious power transmission systems from clutch to wheel in vehicle.
CO3	Student will be able to evaluate and describecontrol systems like steering and brakes in vehicle.
CO4	Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.

Course Name: Advance Welding Techniques	**Course Code:** ME1460
CO1	Student can be able to Justify the concept of advance welding processes applicable to industry.
CO2	Student can be able to examine the parameters needed for welding to increase the durability of product.

CO3	Student can be able to differentiate the concept of soldering and brazing and cutting process through welding.
CO4	Student can be able to evaluate welding defect through welding testing method.

Course Name: OPTIMISATION TECHNIQUES	**Course Code:** ME1475
CO1	Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method.
CO2	To Solve transportation and Assignment Models and analyse the concept of dynamic programming to Solve problems of discreet and continuous variables.
CO3	Analyze projects for minimum total cost and smooth level of resources.
CO4	Evaluation of different replacement policies and its application in operation research and analyse of the application of simulation, inventory control model and waiting line mode.

Course Name: EL IV: CNC & Robotics CNC & Robotics LAB	**Course Code:** ME 1439 ME1440
CO1	Explain the structure of NC,CNC and DNC
CO2	Design the tooling of CNC and compose the program for CNC
CO3	Explain the structure and kinematics of Robot
CO4	Explain the various grippers and sensors, Design the applications and Compose the programe for Robot

Course Name: EL V: Value Engineering	**Course Code:** ME 1453
CO1	Explain the various typs of Values and functions
CO2	Evaluate the product life cycle.
CO3	Analyze the project selection and estimate life cycle costs.
CO4	Evaluate and improve value of product/system by designing and critically analyzing the VE job plans and othe VE/VA techniques.

Course Name: (PE-5) Power Plant Engineering	**Course Code:** ME1457
CO1	Student will be able to understand the various Thermal power plant characters.
CO2	Student will be able to understand arrangement of power generation systems and components used in Hydraulic power plants.
CO3	Student will be able to undertake power load analysis & Economic analysis of power generations systems.
CO4	Student will be able to understand the Nuclear, Combine cycles and nonconventional power plants.

Course Name: PE-V : Air Conditioning	**Course Code:** ME1480
CO1	Student will be able to evaluate various psychrometric properties
CO2	student will be able to evaluate and analysePsychrometric process
CO3	The student will be able to describe human comfort parameter and evaluate various air conditioning load as per the human comfort and

	Industrial requirement .
CO4	The students will be able to describe various Air conditioning accessories, components, air distribution

Course Name: DESIGN OF EXPERIMENTS BY TAGUCHI METHOD		**Course Code:** ME1452
CO1	Calculate and represent Frequency Distribution, Histograms and Probability distribution	
CO2	Design the experiments	
CO3	Distinguish and analyze the different optimization techniques.	
CO4	Analyze the variance in observation data.	

Course Outcomes (CO):

First Year: Semester I:

Sr. No.	First Semester M. Tech. CAD/CAM	
	Course Code	
1		The students will be able to: (I). Demonstrate the knowledge of applied elasticity to solve simple problem. (II). Select the appropriate experimental technique, apply it and interpret the results.
2	ME 1902 Computer Integrated ma nufacturing	The students will be able to: (I). Demonstrate the knowledge of working and integration of CIM components. (II). Apply the fundamentals of group technology and flexible manufacturing system for CIM. III) Analyze and Select appropriate automated material handling and storage system. (IV). Plan and develop the processes for manufacturing using advanced
3	ME•1903 Computer Graphics and Solid Modeling	The students will be able to: (I). Demonstrate the knowledge of working for the CAD system. (II). Will have ability to apply approaches of geometric modeling for developing CAD model. (III). Demonstrate knowledge of various data exchange standards for

4	ME•1904 Lab: Computer Graphics and Solid Modeling	The students will be able to: (I). Demonstrate the knowledge and working of CAD system. (II). Will have ability to apply approaches of geometric modeling for developing CAD model.
5	ME•1905 CNC Technologies	The students will be able to: (I). Demonstrate the knowledge of CNC machines. (II). Design and implement CNC programme for making simple mechanical components using CNC machines. (III). Demonstrate the knowledge of integration of CNC machines with CIM systems.
6	ME•1906 Lab: CNC Technologies	The students will be able to: (I). Demonstrate the knowledge of CNC machines. (II). Design and implement CNC programme for making simple mechanical components using CNC machines.
7	ME•1907 Project Engineering (Professional Elective•I)	The students will be able to: (I). Apply planning and execution techniques for projects. (II). Demonstrate knowledge of industrial and plant design. (III). Function in multidisciplinary team for design, development planning and execution of project.
8	ME•1908 Tool Design (Professional Elective•I)	The students will be able to: (I). Learn various cutting tools and tooling required for manufacturing. (II). Design these tools and toolings. (III). Design and draw these toolings in CAD/CAM. (IV). Apply the knowledge of tool design while working on shop floors.
9	ME•1909 Object Oriented Programming (Professional Elective•I)	The students will be able to: (I). Demonstrate the knowledge of data structures. (II) Update data structures and data files. (III). Select and apply appropriate technique to solve engineering problem.
10	ME•1910 Reliability Engineering (Professional Elective•I)	The students will be able to: (I). Analyze the failure of component/systems to identify the underlying failure model. (II). Calculate the system reliability from component reliability. (III) Test the components/systems to find reliability and suggest improvements. (IV) Demonstrate the application of availability, maintainability
		Second
11	ME•1911 Robotics	The students will be able to: (I). Demonstrate the knowledge of Robots and their applications. (II). Design of Robot for Simple Applications. (III). Program the Robot for Industrial Application. (IV). Integrate Robot with CNC machines in CIM.
12	ME•1912 Modeling& Simulation	(I). The students will be able to analyze the dynamic system for its time response and stability. (II). The students will be able to simulate various discrete and process control systems.
13	ME•1913 Finite Element Method	The students will be able to: (I). Analyze the dynamic system for its time response and stability. (II). The students will be able to simulate various discrete and process control systems.

14	ME•1914Lab: Finite Element Method	The students will be able to: (I). Apply knowledge of theory of elasticity for solving simple problems. (II). Assemble global stiffness matrix carry out FEA and interpret the results for common mechanical, thermal analysis problems.
15	ME•1915Artificial Intelligence	The students will be able to: (I). Apply representation techniques and problem solving strategies to different AI applications. (II). Demonstrate knowledge of processes involved in expert system and in building such systems. (III). Able to write logical inference algorithm.
16	ME•1916 Seminar	The students will be able to: (I). Identify the topic for detailed study. (II). Conduct literature survey on the topic identified and identify research papers for detailed study. (III). Demonstrate the knowledge gained from study of research papers by preparing a seminar report and giving a presentation before seminar review committee.
17	ME•1917Product Data Management (Professional Elective•II)	The students will be able to: (I). Demonstrate the knowledge of database structure. (II).Design the database model with constraints. (III). Apply expert system for industry.
18	ME•1918 Mechatronics (Professional Elective•II)	The students will be able to: (I). Demonstrate the knowledge of Mechatronics systems and components. (II). Analyze and select proper sensors and actuators for Mechatronics system. (III). Demonstrate the knowledge of digital controllers and their interfacing with input and output devices. (IV). Apply soft computing techniques for advancement of Mechatronics systems.
19	ME•1919Machine Tool Design (ProfessionalElective•II)	The students will be able to: (I). Demonstrate the fundamentals of machine tool design. (II). Design speed and feed gear box. (III). Design overall structure of machine tool along with guide ways, power screws and spindles.
20	ME•1920 Plant Design (ProfessionalElective•II)	The students will be able to: (I). Design pressure vessels and mountings for process industries. (II). Design storage tanks and heat exchangers for process industries. (III).Design valves and piping systems for process industries. (IV).Analyze the piping systems to identify problems.
Third Semester M. Tech. CAD/CAM		
21	ME•1921Product Design & Development	Students will be able to: (I). Implement product development. (II). Select proper material for product. (III). Select proper manufacturing process.

22	ME•1922 Project Phase •I	The students will be able to: (I). Identify the problem area for project work. (II).Carry out literature survey and collect all the relevant literature. (III).Define the problem. (IV).Prepare a plan of and schedule of work to solve the above problem. (V).Prepare a detailed report and present before the committee.
23	ME•1923 Computational Fluid Dynamics (Professional Elective•III)	(I). Students will be able to formulate the mathematical models by CFD equations for various applications in the field of fluid dynamics and heat transfer. (II). Students will be able to apply the various CFD equations and basics of discretisation to analyze various applications in fluid dynamics and heat transfer (III). Students will be able to select proper numerical methods and solve
24	ME•1924 Design Optimization Techniques(Professional El	The students will be able to: (I). Select and apply suitable optimization technique. (II).Interpret the results for decision making to optimize the system. (III). Optimally design various mechanical components.
25	ME•1925 Rapid Prototyping (Professional Elective•III)	Students will be able to • (I). Demonstrate the use of R.P. for product development. (II)Demonstrate the knowledge of R.P. process. (III).Demonstrate the knowledge of construction, working and applications of R.P. machines. (IV). Demonstrate the knowledge of rapid tooling and rapid manufacturing.
26	ME•1926 Design for Manufacturing and Assembly (Professional Elective•III)	Students will be able to: (I).To learns general rules of manufacturability, criteria's for material selection for various processes. (II). To learn methods of casting, joining, different welding techniques, different forging processes. (III). To apply the knowledge of design of manufacturing and assembly in industries and on the field.

Second Year: Semester IV:

Course Name: Project Phase •II	**Course Code:** ME•1931
CO1	Identify all possible solution.
CO2	Analyze various solutions to identify best solution.
CO3	Work on the solution for validation and validate.
CO4	Prepare a detailed report and present before the committee.

B.E. – Electrical Engineering

Vision of the Department
To emerge as a leading centre of learning to groom aspiring electrical engineers into successful professionals by providing contemporary education and intellectual rigor.

Mission of the Department Attract top talent and mould them with right scholarship through quality education, innovation and research in an inclusive environment.BE (ELECTRICAL ENGINEERING)

Programme Educational Objectives (PEO)

Program Educational Objective for UG program are:

PEO1 Graduate will be able to demonstrate technical competency and leadership to become successful professionals

PEO2 Our graduates will have solid technical foundation for solving engineering problems associated with multidisciplinary field in general and electrical engineering in particular

PEO3 Our graduates will be able to innovate, create and design novel systems to contribute for sustainable development to real life problems

PEO4 Our graduates will have successful professional carriers in industry, government and academic as electrical Engineer

PEO5 Our graduate will continue to learn and advance their careers through participation in professional organizations, attainment of professional certification and seeking higher education

PROGRAMME OUTCOMES (POs) Undergraduate engineering programmes are designed to prepare graduates to attain the following program outcomes:

PO1- Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2- Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3- Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4- Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5- Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6- The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7- Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8- Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9- Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10- Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11- Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12- Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO

PSO1 Interpret, identify, analyse and evaluate problems in power system operation, control and design.

PSO2 Demonstrate knowledge to develop, control and assess electrical and electronic systems.

MTECH

Programme Educational Objectives OF PG Programme (PEO IPS)

PEO1 To prepare students to succeed in employment, profession and/or pursue doctoral research in electrical engineering discipline.

PEO2 To provide students with scholarly knowledge so as to formulate, analyze and design novel systems for solving power system problems.

PEO3 To inculcate in students professional and ethical attitude, effective communication skills and teamwork to become successful professional in global perspective.

PEO4 To provide students with academic environment that make them aware of excellence and to enable them to understand the significance of life-long learning in global perspective.

Programme Outcomes (PO IPS)Students will have an ability

A. To demonstrate in-depth knowledge of power system and allied fields.

B. To carry out research work with independent and introspective learning
C. To apply appropriate modern engineering and software tools to power system.
D. To think critically to identify, conceive, analyse and solve complex engineering problems in power and energy sector.
E. To communicate effectively and acquire professional, ethical and responsible attitude towards sustainable development of the society.
F. To accept and adapt to the technological changes for lifelong learning with enthusiasm and commitment to improve knowledge and competence continuously.
G. To demonstrate capacity for self-management, project & finance management and decision making to achieve common goals.

Yeshwantrao Chavan College of Engineering, Nagpur

PO/PSO and CO's of all courses of the UG Programme

Name of the Department: Electrical Engineering

Name of the UG Programme: B.E. in Electrical Engineering

Programme Outcomes (PO)

Undergraduate engineering programmes are designed to prepare graduates to attain the following program outcomes:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

PSO1: Interpret, identify, analyse and evaluate problems in power system operation, control and design.

PSO2: Demonstrate knowledge to develop, control and assess electrical and electronic systems.

Course Outcomes (CO)

Important Note

In case of combine CO's for Theory & Practical Couse include:
Course Name: *Complete Course Name* (T/P), **Course Code:** *Code of Theory /Code of Practical*
In case of Exclusive CO's for Theory Couse include:
Course Name: *Complete Course Name* (T), **Course Code:** *Code of Theory Course*
In case of exclusive CO's for Practical Couse (eg. Project etc.) include:
Course Name: *Complete Course Name* (P), **Course Code:** *Code of Practical/Project Course*

Every Engineering Department should get first year courses related CO data from First Year Coordinator Prof. Thatere and include in their respective department file.

Do not change the format.

Include complete course name, do not use short forms.

Use case sensitive PO/PSO & CO statements, in Times Roman with Font Size 12 only.

First Year: Semester I and II:

Course Name: Engineering Mathematics I (T)	**Course Code: GE2101**
CO1	Apply the knowledge of differentiation to develop the Mathematical equations and compute geometrical measures
CO2	Determine the expansion and derivatives of functions of Multiple variables and use it to find extreme values of functions.
CO3	Evaluate the integrals of single, multiple variables and use it to find the dimensions of various geometrical figures.
CO4	Discuss Calculus of Scalar and vector point function and use appropriate theorems to evaluate integrals of functions of single, multiple variables.

Course Name: Engineering Mathematics II (T)	Course Code: GE2102
CO1	Use appropriate Methods to solve first order and higher order differential equations and apply it to find solutions of engineering problems
CO2	Analyse the functions of complex numbers and variables, prove Mathematical equations and evaluate the complex integrals
CO3	Use Matrix method to solve linear equations , evaluate eigen values - eigen vectors and its applications.
CO4	Measure the statistical parameters and derive the equations of best fit curves

Course Name: Communication Skill (T)	Course Code: GE2107
CO1	Explain the basics of communication process as well as identify the barriers in communication.
CO2	Classify and describe the different Speech Sounds of English Language.
CO3	Apply different strategies and techniques of presentations, interviews and group communication.
CO4	Drafting reports, memos and emails, considering the professional etiquettes and ethics with appropriate content and context.

Course Name: Social Science (T)	Course Code: GE2108
CO1	Explain the basic concepts of Social Sciences.
CO2	Describe the development of various Civilizations and their Culture.
CO3	Analyze the Impact of Industrialization on society and discuss the Fundamental Concepts of Society.
CO4	Explain Industrial Organization and Management.

Course Name: Engineering Physics (T/P)	Course Code: GE2105/ GE 2106
CO1	Examine the intensity variation of light due to interference, diffraction and its applications.
CO2	Explain fundamentals of quantum mechanics and its application to problems dealing with quantum particle.
CO3	Develop ability to classify and analyze the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands for device applications.
CO4	Analyze the motion of charged particle in electric and magnetic fields and its applications to electron optic devices.
CO1	Illustrate working principle of lasers, ultrasonic waves and its properties for useful applications in the field of industry.

Course Name: Engineering Chemistry (T/P)	Course Code: GE2103/ GE 2104
CO1	Assess qualitative and quantitative aspects of water as a conventional material for industrial and domestic applications.
CO2	Apply the knowledge of basic electrochemistry to understand battery technology, corrosion process and preventive techniques.
CO3	Know the basics and assess analytical aspects of industrial materials like fuels and lubricants for efficient utilization.
CO4	Recognize the significance of cement and advanced engineering materials in technological applications.
CO5	Analyze and generate analytical and instrumental techniques.

Course Name: Engineering Mechanics (T/P)	Course Code: CV2101/CV2102
CO1	An ability to apply the concept of applied mechanics and can solve problems on planar force system for friction as well as frictionless surfaces.
CO2	An ability to analyze pin jointed truss frame structure and beam structure analytically and graphic
CO3	An ability to understand centroid, moment of inertia, product of inertia and mass moment of inertia and can find properties of surfaces.
CO4	An ability to determine the dynamic variables of moving body, understand working principle of simple lifting machine.

Course Name: Basic Electronics (T)	Course Code: EE 2101
CO1	Characterize Number systems, semiconductors, diodes, transistors and operational amplifiers.

CO2	Design simple analog circuits
CO3	Design simple combinational and sequential logic circuits
CO4	Identify functions of digital multimeter, Bridges and transducers in the measurement of physical variables

Course Name: Introduction to Computer Programming (T/P)	**Course Code: IT2101/IT2102**
CO1	Understand computer system, basics of algorithm & flowchart, and demonstrate straight line program using basic 'C' programming language constructs.
CO2	Design & Develop programs using different loop control structures, user defined functions, and Pointers.
CO3	Analyze and apply concepts of different dimensional Arrays as a data structure & development of programs using the same.
CO4	Design and develop programs using basics of Strings, Structures, union and Files in 'C' language.

Course Name: Electrical Engineering (T/P)	**Course Code: EL 2101/EL2102**
CO1	Reproduce fundamentals of dc circuits, single phase, and three phase ac circuits.
CO2	Analyse dc circuits, single phase and three phase ac circuits for basic electrical quantities such as current, voltage, power etc.
CO3	Explain construction, working, testing, and applications of various electrical machines.
CO4	Analyse performance of various electrical machines.
CO5	Perform laboratory experiments and demonstrate competency in collecting, interpreting, analysing data, communicate and present effectively through laboratory journals.

Course Name: Engineering Graphics (T/P) Engineering Graphics Lab.	**Course Code: ME2101/ME2102**
CO1	Transform orthographic projections into isometric projections and vice versa.
CO2	Evaluate Projections of various One Dimensional, Two dimensional, Three dimensional objects.
CO3	Built the development of lateral surfaces of various solids and their cut section.
CO4	Predict the intersections and intersections of various solid objects.
CO5	Justify the use of software tools used for Two dimensional drawings.

Course Name: Workshop Practice (P)	Course Code: ME 2103
CO1	Understand the carpentry tools, joints, machineries and its applications
CO2	Understand the fitting tools, measuring instruments, machineries and its applications
CO3	Understand the smithy tools furnaces and hand and power forging equipment's
CO4	Understand Gas and Electric welding processes, utility, tools and its applications

Second Year: Semester III:

Course Name: Engineering Mathematics III (T)	Course Code: GE2201
CO1	Estimate the Calculus of Numerical Function.
CO2	Determine the transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations.
CO3	Discuss the nature of periodic function and express it in terms of series.
CO4	Use appropriate method/s to solve partial differential equations.

Course Name: Analog Electronics (T)	Course Code: EL2201
CO1	To identify the basic structure, characteristics and various operating modes of BJT
CO2	To Explain and Describe the various small signal parameters and its applications.
CO3	To demonstrate the knowledge to develop various power amplifier and oscillator circuit.
CO4	To analyse and evaluate the basic concept of Op-Amp circuit and its various applications.

Course Name: Electronics Engineering Workshop (P)	Course Code: EL2202
CO1	Explain the basics of electronic hardware system and to identify the active and passive electronic components.
CO2	Build hands-on training with familiarization, identification, testing, assembling, and dismantling of various components.
CO3	Test the electronic components like resistors, capacitors, transistors, UJT, JFET, different IC's, etc. using analog and digital meters.
CO4	Design various systems and develop PCB fabrication skills making use of the various tools and instruments available in the Electronics Engineering Workshop.

Course Name: Electrical Machines (T/P)	Course Code: EL2203/EL2204
CO1	Explain and apply the basic fundamentals of Electromagnetism.

CO2	Develop phasor diagrams, classify 3 phase transformers, analyse and evaluate performance indices theoretically and experimentally and examine the need of parallel operation of transformers.
CO3	Explain and examine principle, construction, types, operation, speed control, characteristic and applications of DC machines and evaluate performance parameters of d.c. machines theoretically and experimentally.
CO4	Explain and examine principle, construction, operation, starting, speed control, applications and evaluate the performance indices of induction motors theoretically and experimentally.

Course Name: Network Analysis (T)	**Course Code: EL2205**
CO1	Define basic concepts related to the course of network analysis.
CO2	Select best possible method of circuit analysis for a given situation.
CO3	Apply a variety of circuit analysis methods including theorems and Laplace transform.
CO4	Design circuits for a given voltage, power, as well as for critical frequencies and two port parameters.

Course Name: Computer Programming (P)	**Course Code: EL2206**
CO1	
CO2	
CO3	
CO4	

Course Name: Electrical Measurement & Instrumentation (T/P)	**Course Code: EL2207/EL2208**
CO1	Explain the working of Electrical instruments and compute the value of Resistances, inductance and capacitance by using bridges.
CO2	Evaluate electrical power and energy in single phase and three phase circuits.
CO3	Explain and illustrate the concept of instrumentation system with different Transducers and Sensors.
CO4	Explain the construction, working principle and applications of Transducers.
CO5	Evaluate Power calculations and applications of Transducers.

Second Year: Semester IV:

Course Name: Advance Mathematical Techniques (T)	**Course Code: GE2204**
CO1	Utilize numerical techniques to obtain approximate solutions of mathematical equations
CO2	Design and determine the solution of linear programming problems.
CO3	Measure the Statistical parameters for random variables.
CO4	Explain the basic concept of fuzzy sets, Relations and fuzzy logic.

Course Name: Electrical Machines in Power System (T/P)	Course Code: EL2251/EL2252
CO1	Explain constructional features, develop phasor diagram and winding layout, examine steady state performance of synchronous machines theoretically and experimentally.
CO2	Illustrate the need and method of parallel operation of alternators, analyse and evaluate the behaviour of synchronous machine connected to infinite bus and understand the process of Synchronisation in laboratory.
CO3	Interpret behaviour & determine time constant and equivalent circuit parameters under transient conditions of synchronous machines and evaluate various transient parameters experimentally.

Course Name: Electrical Energy Generation System (T)	Course Code: EL2253
CO1	Classify types of renewable energy sources and relate different factors associated with a generating station.
CO2	Explain various parameters related to selection and application of Solar and Wind Energy.
CO3	Make use of design parameters and develop a model for various Power generating Systems.
CO4	Apply the knowledge to understand the applications of various renewable energy sources.

Course Name: Renewable Energy System (P)	Course Code: EL2254
CO1	Summarize, classify types of renewable energy sources, outline as per Global and Indian context.
CO2	Utilize ,analyze solar energy for various applications.
CO3	Classify, analyze wind energy conversion systems and estimate its parameters.

Course Name: Electric & Magnetic Fields (T)	Course Code: EL2255
CO1	Remember, Understand and analyse the properties of electrostatic field.
CO2	Apply electrostatics on different mediums and analyse the boundary characteristics.
CO3	Remember and Understand and apply the properties of electromagnetic field.
CO4	Understand the electromagnetic waves and analyse them over different medium.

Course Name: Electrical Engineering Workshop (P)	Course Code: EL2256
CO1	Describe the basic concept of various electrical components.
CO2	Demonstrate, formulate and solve the basic maintenance and troubleshooting of household equipment, energy saving etc.
CO3	Outline the fundamentals of major electrical devices and actual operation of devices like induction motor.

Course Name: Microprocessor (T/P)	Course Code: EL2257/EL2258
CO1	List, select and explain types of memory devices and architecture of 8085 microprocessor.
CO2	Recall, experiment with and make use of assembly language instructions of 8085.
CO3	Demonstrate and test microprocessors and its interfacing devices.
CO4	Illustrate and make use of DMA controller and timer.
CO5	Experiment with the real time implementation of programs along with interfacing demonstration.

Course Name: Signals and Systems (T)	Course Code: EL2259
CO1	Determine and Classify signals and systems in continuous and discrete time domain.
CO2	Solve and determine signals in time and frequency domain using Fourier series and Fourier transform.
CO3	Apply sampling and show the character tics of system in time and frequency domain
CO4	Solve and Determine Laplace and Z-transform for analysis of signals and system.

Third Year: Semester V:

Course Name: Fundamentals of Economics (T)	Course Code: GE2312
CO1	Recognize consumer's behaviour and analyse Market price
CO2	Extrapolate operations in market with production constraints
CO3	Describe the national income accounting and public finance.
CO4	Analyse international trade and institutions.

Course Name: Power Electronics (T/P)	Course Code: EL2301/EL2302
CO1	Demonstrate the learnings of various power semiconductor devices with their protection and apply them for various applications.
CO2	Analyse different Power Electronics Converter circuits and choose them for suitable applications.
CO3	Demonstrate the knowledge of chopper circuits, analyse and utilise them for different applications.
CO4	Analyse inverter circuits with different modulation techniques and identify their applications.

Course Name: Fundamentals of Power System (T)	Course Code: EL2303
CO1	Define and explain basic components of power system and representation of its elements in terms of per unit.
CO2	Analyze and evaluate the transmission line parameters which limits the transmission capacity of a line.
CO3	Classify, evaluate and determine the performance of distribution and transmission system.

CO4	Choose, Compare and select the type of insulators and underground cables and improve the performance of system.

Course Name: Electrical Drives (T/P)	**Course Code: EL2304/EL2305**
CO1	CO1: Classify and compare characteristics of AC and DC motors to interpret application of motors in electrical drives.
CO2	CO2: Apply Selection criteria for electrical drives by adapting electrical and mechanical characteristics of motor.
CO3	CO3: Categorize and compare contactors and relays for application of control circuit.
CO4	CO4: Explain the applications of PLCs in electrical drives and compare and assess control of electrical drive.
CO5	CO5: Estimate and adapt different motors for traction work.

Course Name: OEI: Renewable Energy Generation System (T)	**Course Code: EL2311**
CO1	Summarize, classify and compare types of renewable energy sources, outline as per Global and Indian context.
CO2	Utilize solar energy for various applications, estimate solar radiation geometry and classify types of wind turbine generator.
CO3	Demonstrate, Classify and utilize geothermal and biomass energy.
CO4	Compare, classify and apply energy from ocean, tide, wave and hydro for power generation, explain storage methods for renewable energy sources.

Course Name: OEI: Electrical Machines and their Applications (T)	**Course Code: EL2312**
CO1	Explain speed-torque characteristics, need for starters, starting and braking of AC and DC motors.
CO2	Apply criterion for selection of drives.
CO3	Illustrate and develop the principle, operation and construction of transformers.
CO4	Classify and identify special machines used in industry.

Course Name: OEI: Testing and Maintenance of Electrical Machines (T)	**Course Code: EL2313**
CO1	Classify, the causes of hazards, accidents, shock and the remedial action taken against the electrical shock.
CO2	Demonstrate, apply and evaluate different types of tests and the various maintenance techniques to be employed on various electrical machines and it installation.
CO3	Demonstrate, apply and estimate the factors affecting the life of insulation, its testing and maintenance.
CO4	Explain, develop and determine the various tests to be conducted on distribution transformer, I.S. Standards.

Course Name: OEII: Electrical Energy Audit and Safety (T)	**Course Code: EL2321**

CO1	Classify, the consumption pattern, conservation of electrical energy and Electricity Act 2001.
CO2	Demonstrate, apply and evaluate different forms of energy to optimize the use for maximizing the efficiency of system.
CO3	Demonstrate, apply and estimate the use energy and its impact on the Environment.
CO4	Explain, develop and determine the hazards, risk associated with unsafe action and the safety.

Course Name: OEII: Utilization of Electrical Energy (T)	**Course Code: EL2322**
CO1	Demonstrate and utilize electrical energy for various purposes including heating and traction system. Students will also be able to classify illumination, its types and purpose.
CO2	Demonstrate and apply electric energy to different types of welding
CO3	Explain how refrigeration system and air condition system works.
CO4	Analyse, determine and estimate proper economic generation.

Course Name: OEII: Power System Engineering (T)	**Course Code: EL2323**
CO1	Articulate types of load and power system concepts required to engineering problems.
CO2	Develop the ability to implement the appropriate safety equipment for design of electrical power system with enhancing the efficiency of the transmission and distribution system with environment friendly technology.
CO3	Formulate A.C and D.C distribution networks for necessary variable calculation.
CO4	Ability to design and analyze switchgear protection system with respect to various electrical parameters which is required in substation.

Third Year: Semester VI:

Course Name: Fundamentals of Management (T)	**Course Code: GE2311**
CO1	Explain the Legal provision and Functions of Management.
CO2	Analyze the role of Human Resource and Financial Management in the organization.
CO3	Analyze the project life cycles.
CO4	Identify tools and techniques for the marketing of goods and services.

Course Name: Control System (T/P)	**Course Code: EL2351/EL2352**
CO1	Classify, select types of control systems, interpret transfer function of the system and compare and evaluate electrical and mechanical systems.
CO2	Illustrate the time response, develop and evaluate the controller.

CO3	Demonstrate, apply and evaluate stability using transfer function and state variable approach.
CO4	Demonstrate, construct and select design parameters using root locus and frequency domain methods.
CO5	Experiment, demonstrate and simulate time domain and frequency domain methods using control system components.

Course Name: Power System Analysis (T)	**Course Code: EL2353**
CO1	Classify, analyze and evaluate different types of faults in power system.
CO2	Explain, apply and evaluate different types of system stability
CO3	Illustrate, examine and estimate economic operation of power system
CO4	Classify and interpret types of neutral grounding and compensation circuits

Course Name: Simulation of Power Electronics & Power System (P)	**Course Code: EL2354**
CO1	To provide a detailed understanding of the basic concepts involved in the simulation and analysis of single phase & three phase circuit.
CO2	Develop SIMULATION circuit in MATLAB to assess the performance of short, medium and long transmission lines.

Course Name: Substation Design (P)	**Course Code: EL2355**
CO1	Illustrate and Explain, single line diagram of substation with rating of different equipment's, types of relays required and their settings.
CO2	Construct plan of equipment's and panels mounted in a substation.
CO3	Design earthing system of a substation.

Course Name: PEI: Advanced Power Electronics (T)	**Course Code: EL2361**
CO1	Identify and recall various power semiconductor devices and their effects produced in electrical system
CO2	Explain and compare various power electronic converters and inverters used for various applications
CO3	Apply knowledge of modulation techniques to various converters
CO4	Demonstrate knowledge related to effects of harmonics, their measurement and elimination from the system

Course Name: PEI: Electrical Distribution in Power System (T)	**Course Code: EL2362**
CO1	Define, explain and illustrate various components in distribution System network.
CO2	Experiment with distribution network for voltage drop, reactive power compensation, power loss, fault analysis for better supply to consumers.

CO3	Classify and inspect the substation and plan metering for consumers.
CO4	Compare and develop distribution systems for distribution automation and SCADA.

Course Name: PEI: Illumination Engineering (MOOC) (T)	**Course Code: EL2363**
CO1	Identify the criteria for the selection of lamps and lighting systems for an indoor or outdoor space
CO2	Explain the different parameters in designing an illumination system for a particular application.
CO3	Apply different illumination systems for different applications.
CO4	Design proper illumination model for a specific application.

Course Name: PEI: Electric Vehicles (T)	**Course Code: EL2364**
CO1	Understand the history, vehicle mechanics, laws of motion, dynamics and propulsion power of electric vehicles.
CO2	Analyse energy storage methodologies used in electric vehicles.
CO3	Analyse the topologies of power electronics and drive-train used in electric vehicles.
CO4	Understand the types, design, size, capacity of hybrid electric vehicle.

Course Name: PEI: Electric Power Utilization (T)	**Course Code: EL2365**
CO1	Classify, Types of electric heating technique, electric welding technique, their Field of application, relative advantage and limitation.
CO2	Illustrate the Basic concept of illumination, various types of lamps along their characteristics and application. They will be able to design illumination system for various criterion.
CO3	Illustrate basic refrigeration cycle, Vapour compression and Vapour absorption refrigeration system. Various types of air conditioning system and its use as per requirement.
CO4	Classify, difference between fans and blowers, various energy saving methods to be used, they can classify pumps, compressors and DG sets, application of compressor as per requirement of compressed air, selection and installation factors of DG system. Energy saving methods for DG sets.

Course Name: OEIII: Renewable Energy Generation System (T)	**Course Code: EL2371**
CO1	Summarize, classify and compare types of renewable energy sources, outline as per Global and Indian context.
CO2	Utilize solar energy for various applications, estimate solar radiation geometry and classify types of wind turbine generator.
CO3	Demonstrate, Classify and utilize geothermal and biomass energy.

CO4	Compare, classify and apply energy from ocean, tide, wave and hydro for power generation, explain storage methods for renewable energy sources.

Course Name: OEIII: Electrical Machines and their Applications (T)	**Course Code: EL2372**
CO1	Explain speed-torque characteristics, need for starters, starting and braking of AC and DC motors.
CO2	Apply criterion for selection of drives.
CO3	Illustrate and develop the principle, operation and construction of transformers.
CO4	Classify and identify special machines used in industry.

Course Name: OEIII: Testing and Maintenance of Electrical Machines (T)	**Course Code: EL2373**
CO1	Classify, the causes of hazards, accidents, shock and the remedial action taken against the electrical shock.
CO2	Demonstrate, apply and evaluate different types of tests and the various maintenance techniques to be employed on various electrical machines and it installation.
CO3	Demonstrate, apply and estimate the factors affecting the life of insulation, its testing and maintenance.
CO4	Explain, develop and determine the various tests to be conducted on distribution transformer, I.S. Standards.

Course Name: OEIV: Electrical Energy Audit and Safety (T)	**Course Code: EL2381**
CO1	Classify, the consumption pattern, conservation of electrical energy and Electricity Act 2001.
CO2	Demonstrate, apply and evaluate different forms of energy to optimize the use for maximizing the efficiency of system.
CO3	Demonstrate, apply and estimate the use energy and its impact on the Environment.
CO4	Explain, develop and determine the hazards, risk associated with unsafe action and the safety.

Course Name: OEIV: Utilization of Electrical Energy (T)	**Course Code: EL2382**
CO1	Demonstrate and utilize electrical energy for various purposes including heating and traction system. Students will also be able to classify illumination, its types and purpose.
CO2	Demonstrate and apply electric energy to different types of welding
CO3	Explain how refrigeration system and air condition system works.
CO4	Analyse, determine and estimate proper economic generation.

Course Name: OEIV: Power System Engineering (T)	**Course Code: EL2383**

CO1	Articulate types of load and power system concepts required to engineering problems.
CO2	Develop the ability to implement the appropriate safety equipment for design of electrical power system with enhancing the efficiency of the transmission and distribution system with environment friendly technology.
CO3	Formulate A.C and D.C distribution networks for necessary variable calculation.
CO4	Ability to design and analyze switchgear protection system with respect to various electrical parameters which is required in substation.

Fourth Year: Semester VII:

Course Name: High Voltage Engineering (T/P)	**Course Code: EL1401/EL1402**
CO1	Understand Breakdown of various dielectrics and calculate their breakdown voltage.
CO2	Analyze causes of overvoltages due to lightning and switching overvoltages due to protective devices used for the same.
CO3	Implement propagation of travelling waves along with insulation coordination.
CO4	Evaluate generation and measurement of high voltage and current.
CO5	Demonstrate various experimental result of high voltage engineering lab & classify Non-destructive and high voltage testing of electrical apparatus.

Course Name: Computer Applications in Electrical Engineering (T/P)	**Course Code: EL1403/EL1404**
CO1	Explain and define the basics of Graph theory, find and Illustrate the different types of Matrices.
CO2	Apply different method, Build & Develop the Bus Impedance Matrix.
CO3	Classify, Compare, Make use of different methods and analyze Load Flow studies .
CO4	Analyze and inspect the system for different types of faults.
CO5	Analyze and make use of different methods for transient stability studies.

Course Name: PE II: FACTS Devices (T)	**Course Code: EL1410**
CO1	Define FACTS Concept, various FACTS Controllers, its classification and explain its applications in Transmission system.
CO2	Explain, show, implement and design different shunt and series compensators and its control schemes
CO3	Demonstrate, examine and apply voltage and phase angle regulators in power system

CO4	Extend, apply and analyze the FACTS concept using combine series-shunt and series-series controllers to evaluate the improved transmission system performance

Course Name: PE II: Artificial Intelligence based Systems (T)	**Course Code: EL1427**
CO1	Recall, explain, solve and analyse the principles of fuzzy logic and control.
CO2	Explain and discuss adaptive fuzzy control.
CO3	Explain, analyse and solve problems in basic neural networks and associative memories
CO4	Explain, analyse and solve problems on recurrent networks and neural control.

Course Name: PE II: Advanced Control System (T)	**Course Code: EL1431**
CO1	Explain concept of lag and lead compensator design in time and frequency domain, theory of PI, PD and PID control in time domain and frequency domain.
CO2	Illustrate and apply state variable approach with solution of state models and concepts of controllability, observability and state variable feedback.
CO3	Classify and analyse non-Linear Control System, types of non-linearities, its characteristics. Students will also be able to demonstrate and apply different methods of evaluating non-linear control like describing function method and phase plane method for stability analysis.
CO4	Explain sample data control system, Stability analysis with Z-transforms and solution of discrete time systems.

Course Name: Electrical Distribution Power System (T)	**Course Code: EL1432**
CO1	Define, explain and illustrate various components in distribution System network.
CO2	Experiment with distribution network for voltage drop, reactive power compensation, power loss, fault analysis for better supply to consumers.
CO3	Classify and inspect the substation and plan metering for consumers.
CO4	Compare and develop distribution systems for distribution automation and SCADA.

Course Name: Simulations in Power System (P)	**Course Code: EL1405**
CO1	To provide a detailed understanding of the basic concepts involved in the simulation and analysis of single phase & three phase circuit.
CO2	Develop SIMULATION circuit in MATLAB to assess the performance of short, medium and long transmission lines.

Course Name: Industrial Training / CRT (T)	Course Code: EL1406
CO1	Analytical skill improvement of logical reasoning for professional responsibilities.
CO2	Develop communication, overall personality.

Course Name: Project Phase I (T)	Course Code: EL1407
CO1	Identify the research area of project work in Electrical Engineering.
CO2	Summarize the literature review in the area identified, propose the objectives of project work.
CO3	Organize requisite components with specifications for the project software/hardware prototype and apply suitable software/hardware tool in project work
CO4	Compile, discuss and conclude the results in project report and give presentation by effective communication

Fourth Year: Semester VIII:

Course Name: Switchgear and Protection (T/P)	Course Code: EL1416/EL1417
CO1	Explain and define the various basic principles of protection system
CO2	Compare & apply overcurrent protection Principle
CO3	Develop , Compare & Solve the problems of distance protection.
CO4	Explain , Justify and Compare the types of circuit breaker
CO5	Explain, Determine and decide the Equipment Protection

Course Name: Substation Design (P)	Course Code: EL1418
CO1	Illustrate and Explain, single line diagram of substation with rating of different equipment's, types of relays required and their settings.
CO2	Construct plan of equipment's and panels mounted in a substation.
CO3	Design earthing system of a substation.

Course Name: Renewable Energy Sources (T/P)	Course Code: EL1433/EL1434
CO1	Summarize, classify types of renewable energy sources, outline as per Global and Indian context.
CO2	Estimate solar radiation geometry, and categorize types of solar energy collectors.
CO3	Utilize solar energy for various applications, function of dc-dc converters and Grid converters.
CO4	Classify, analyze wind energy conversion systems and estimate its parameters.
CO5	Demonstrate various experimental result of renewable energy sources lab & Compare, formulate and estimate energy from ocean, tide, wave and hydro for power generation.

Course Name: PE III: Advanced Electrical Drives (T)	Course Code: EL1411

CO1	Analyse and determine the converter parameters of bridge and chopper controlled DC drives.
CO2	Analyse the various schemes for Induction motor control and estimate the parameters of converters for Induction motor drives.
CO3	Explain synchronous motor, stepper motor and switched reluctance motor drives.
CO4	explain and compare the various drives used in electrical traction and explain solar and battery powered drives.

Course Name: PE III: Power System Operation and Control (T)	**Course Code: EL1422**
CO1	Explain, analyse reserve requirement & load forecasting methods.
CO2	Analyse optimal scheduling of generating units, determine with the help of flowcharts.
CO3	Expounds and develop optimal unit commitment problem & its solution methods.
CO4	Explain & discuss various methods of voltage control, reactive power compensation equipment used for transmission line & Load Frequency Control.

Course Name: PE III : Fundamentals of Power Quality (T)	**Course Code: EL1435**
CO1	Illustrate power quality disturbances and typical problems associated with it.
CO2	Analyse and evaluate the voltage sag.
CO3	Appraise the fundamentals of harmonics and develop solutions through filters to minimise the harmonic distortion.
CO4	Plan of mitigating the power quality events through custom power and network configuring devices with applying suitable control strategies

Course Name: PE IV: EHVAC-HVDC Transmission (T)	**Course Code: EL1424**
CO1	Design and analyse Power handling capacity of EHVAC Transmission systems.
CO2	Explain and analyse Corona, the concept of Electrostatic and electromagnetics, Electrical safety.
CO3	Demonstrate , Classify HVDC Transmission system , Analyse the methods of HVDC Control.
CO4	Design of Harmonic filters and reactive power configuration, HVDC Circuit breaker and Types and applications.

Course Name: PE IV: Electrical Power Utilization (T)	**Course Code: EL1425**
CO1	Classify, Types of electric heating technique, electric welding technique, their Field of application, relative advantage and limitation.

CO2	Illustrate the Basic concept of illumination, various types of lamps along their characteristics and application. They will be able to design illumination system for various criterion.
CO3	Illustrate basic refrigeration cycle, Vapour compression and Vapour absorption refrigeration system. Various types of air conditioning system and its use as per requirement.
CO4	Classify, difference between fans and blowers, various energy saving methods to be used, they can classify pumps, compressors and DG sets, application of compressor as per requirement of compressed air, selection and installation factors of DG system. Energy saving methods for DG sets.

Course Name: PE IV: Fundamentals of Smart Grid (T)	**Course Code: EL1436**
CO1	To compare existing & smart grid and illustrate the various aspects of the smart grid.
CO2	To explain the various functions in the smart grid and identify components for functioning of smart grid.
CO3	To assess the performance of smart grid based on congestion, security and contingency studies for optimal solutions.
CO4	To evaluate sustainable energy options for smart grid.

Course Name: PE IV: Electric Vehicles (T)	**Course Code: EL1437**
CO1	Understand the history, vehicle mechanics, laws of motion, dynamics and propulsion power of electric vehicles.
CO2	Analyse energy storage methodologies used in electric vehicles.
CO3	Analyse the topologies of power electronics and drive-train used in electric vehicles.
CO4	Understand the types, design, size, capacity of hybrid electric vehicle.

Course Name: Project Phase II (P)	**Course Code: EL1420**
CO1	Develop and inspect the prototype of the project work
CO2	Analyze and conclude the results on proposed work on project
CO3	Compile project work to prepare a thesis report and present a research paper on project

Yeshwantrao Chavan College of Engineering, Nagpur

PO/PSO and CO's of all courses of the PG programme

Name of the Department: Electrical Engineering

Name of the PG Programme: M.Tech. in Intergrated Power System

Programme Outcomes (PO)

A. To demonstrate in-depth knowledge of power system and allied fields.
B. To carry out research work with independent and introspective learning
C. To apply appropriate modern engineering and software tools to power system.
D. To think critically to indentify, conceive, analyse and solve complex engineering problems in power and energy sector.
E. To communicate effectively and acquire professional, ethical and responsible attitude towards sustainable development of the society.
F. To accept and adapt to the technological changes for lifelong learning with enthusiasm and commitment to improve knowledge and competence continuously.
G. To demonstrate capacity for self-management, project & finance management and decision making to achieve common goals.

Programme Specific Outcomes (PSO)

PSO1:

PSO2:

Course Outcomes (CO):

Important Note

In case of combine CO's for Theory & Practical Couse include:
Course Name: *Complete Course Name* (T/P), **Course Code:** *Code of Theory /Code of Practical*
In case of Exclusive CO's for Theory Couse include:
Course Name: *Complete Course Name* (T), **Course Code:** *Code of Theory Course*
In case of exclusive CO's for Practical Couse (eg. Project etc.) include:
Course Name: *Complete Course Name* (P), **Course Code:** *Code of Practical/Project Course*

First Year: Semester I:

Course Name: Advanced Power Electronics (T/P)	**Course Code: EL3901/EL3902**
CO1	Apply knowledge of the power semiconductor devices, to select them for a range of applications.
CO2	Demonstrate and analyze techniques to design and assess the performance of thyristor-based converters, as well as, switch-mode DC/DC power electronic converters, resonant and DC/AC inverters.
CO3	Assess power quality specially, power factor and harmonic issues of various power electronic converters/inverters.

CO4	Analyze different modulation techniques for bridge as well as multilevel inverters.5.Design,simulate, and test various converter/inverter circuits in the laboratory.(Lab component)

Course Name: Analog & Digital Protection (T/P)	**Course Code: EL3903/EL3904**
CO1	Explain & design protection scheme for Relay Coordination
CO2	Develop, Compare & Solve the problems of over current and distance protection
CO3	Explain and define the basics terms of Digital Protection
CO4	Compare and solve the different methods and techniques of digital protection
CO5	Explain and justify the recent advances in digital protection

Course Name: Digital Control System (T)	**Course Code: EL3905**
CO1	Recall and explain the basics of discrete time signals.
CO2	Apply and solve Z transforms method for discrete systems and analyse the stability of digital control system.
CO3	Understand the preliminary concept of state variable analysis of discrete time control systems, pole placement and design through state feedback.
CO4	Select the PID parameters through tuning and make use of optimal control for design.

Course Name: HVDC Power Transmission (T)	**Course Code: EL3906**
CO1	Recall the principles, advantages and applications of a HVDC link.
CO2	Explain the operation of converters in a classical HVDC link and modern VSCHVDC technology.
CO3	Model valve and converter for simulation.
CO4	List various methods of control and protection, various faults, stability aspects relevant to HVDC system.

Course Name: Power System Modelling (T)	**Course Code: EL3907**
CO1	Understand the general construction and relationship between the various fluxes of various electrical machines and its impact on induced emf during the small and transient disturbances.
CO2	Analyze the electrical machines in stationary and rotary frame of reference in per unit for stability analysis.
CO3	Evaluate the electrical machine parameters for various power system components under static and dynamic load conditions.
CO4	Create mathematical models for stationary and rotating machines under steady state and transient conditions.

Course Name: PE I: Electrical Drives and Controls (T/P)	**Course Code: EL3908/EL3909**
CO1	Explain the working of DC motor, Induction motor, synchronous motor, brushless DC motor and Switched reluctance motors

CO2	Analyse operation of DC motor, Induction motor, synchronous motor, brushless DC motor and Switched reluctance motors.
CO3	Choose suitable converters for DC motor, Induction motor, synchronous motor, brushless DC motor and Switched reluctance motors.
CO4	Solve numericals on DC motor, Induction motor, synchronous motor.

Course Name: PE I: Renewable Energy System (T/P)	**Course Code: EL3910/EL3911**
CO1	Apply knowledge of renewable energy sources to various solar, wind and other systems
CO2	Demonstrate and analyze techniques to design and assess the performance of solar PV panels and solar based energy converters
CO3	Assess the output of renewable energy systems under different environmental conditions
CO4	Analyze the performance of different renewable energy sources like solar, wind, geothermal and hybrid sources

First Year: Semester II:

Course Name: Power System Planning (T)	**Course Code: EL3915**
CO1	Illustrate various regulations by state and central government for energy generation and supply and apply them for planning integrated power system.
CO2	Develop and examine the role of investors in a power plant portfolio for sustainable development
CO3	Interpret the load forecasting and recommend the generation, transmission, and distribution capacities for integrated power system considering economical, reliable and optimal usage for sustainable development.
CO4	Predict the behavior of integrated power system for secure and reliable operation.

Course Name: Application of Power Electronics to Power System (T)	**Course Code: EL3916**
CO1	Demonstrate the knowledge of AC transmission constraints and decide the power electronics-based solutions.
CO2	Design and assess the performance of shunt and series thyristor-based controllers.
CO3	Interpret and compare the performance of various converter –based controllers
CO4	Analyze different control techniques for shunt/series/shunt-series and series-series controllers.

Course Name: Power Quality (T)	**Course Code: EL3917**
CO1	Define, discuss and analyse the various power quality problem, their causes and effects in distribution system

CO2	Identify, discuss and analyse the different non-linear loads.
CO3	Define, explain, apply various measurements and transforms to analyse the power quality problems.
CO4	Describe, analyse and calculate the powers, harmonics indices and sequence components.
CO5	Explain, apply the various indices and develop load balancing algorithms.
CO6	Discuss, analyse, apply the various custom power devices, their reference generation algorithms and their applications.

Course Name: PE II: Advanced Digital Signal Processing (T)	**Course Code: EL3918**
CO1	
CO2	**SUBJECT NOT OFFERED**
CO3	
CO4	

Course Name: PE II: EHV Power Transmission (T)	**Course Code: EL3919**
CO1	List various aspects of EHVAC Transmission.
CO2	Develop knowledge to calculate various parameters related to EHV Transmission line.
CO3	Explain voltage gradient concept pertaining to conductors of the EHV Transmission line.
CO4	Discuss various effects of EHVAC Transmission related to human life.

Course Name: PE II: Restructuring of Power System (T)	**Course Code: EL3920**
CO1	Discuss deregulation of electricity market.
CO2	Classify, illustrate different processes and operations in deregulation.
CO3	Explain, apply solution techniques for optimal power flow.
CO4	Discuss automation in energy management and communication technologies in power system.

Course Name: PE III: Power System Stability and Control (T)	**Course Code: EL3921**
CO1	
CO2	**BYB**
CO3	
CO4	

Course Name: PE III: Electrical Distribution Systems (T)	**Course Code: EL3922**

CO1	**SSG**
CO2	
CO3	
CO4	

Course Name: PE III: Power System Operation (T)	**Course Code: EL3923**
CO1	
CO2	**SUBJECT NOT OFFERED**
CO3	
CO4	

Course Name: PE III: Transients in Power Systems (T)	**Course Code: EL3924**
CO1	
CO2	**SUBJECT NOT OFFERED**
CO3	
CO4	

Course Name: PE IV: Distribtuted Automation (T)	**Course Code: EL3925**
CO1	
CO2	**SUBJECT NOT OFFERED**
CO3	
CO4	

Course Name: PE IV: Power Electronics for Renewable Energy Systems (T)	**Course Code: EL3926**
CO1	Describe the impact and significances of different renewable energy sources.
CO2	Explain solar thermal and solar photovoltaic applications
CO3	Describe and analyse the various solar photovoltaic inverters topologies and configurations, and characteristics.
CO4	Discuss and categorize wind energy conversion systems based on the generators, controls and operation.
CO5	Examine and apply various power converters for Wind energy systems and its controls.
CO6	Define and explain the need of hybrid systems, discuss its various configurations and various power quality issues in grid integrations.

Course Name: PE IV: Control System Design (T)	**Course Code: EL3927**

CO1	Recall and explain the basics of conventional design method in time and frequency domain.
CO2	Apply and solve problems for design of discrete systems and analyse the stability of digital control system.
CO3	Understand the preliminary concept of discrete time state variable analysis pole placement and design through state feedback.
CO4	Explain the concepts of optimal control formulation of optimal control.

Course Name: Power System Simulation (P)	**Course Code: EL3928**
CO1	Solve and design the power system problems.
CO2	Explain, compare various pulse width modulations and apply to different converter topologies
CO3	Use and evaluate the load balancing for compensation.
CO4	Design and analyse the renewable energy sources.
CO5	Design the various controls and its application in power system.
CO6	Apply and infer the performance of compensators in power system.

Course Name: Power System Design (P)	**Course Code: EL3929**
CO1	Identify and explain the various aspects AC and DC power transmission systems.
CO2	Design and assess the performance of AC transmission system
CO3	Develop optimized and robust HVDC transmission systems and evaluate the significance of the various parameters.

Second Year: Semester III:

Course Name: Project Phase -I	**Course Code: EL3939**
CO1	Identify research topic
CO2	Carryout literature survey
CO3	Analyze and solve the research problem
CO4	Learn and use the suitable software tool
	To communicate effectively with proper presentation methods

Second Year: Semester IV:

Course Name: Project Phase -II	**Course Code: EL3940**
CO1	Analyze the system and achieve desired results using software/hardware tools
CO2	Write and present the research paper based on project work
CO3	Acquire in-depth knowledge of the subject for the benefit of the society

B.E. – Electronics Engineering

Vision of the Department
"To be hub of academic excellence providing effective teaching-learning and research towards generating competent professionals."

Mission of the Department"To chisel electronics engineering professionals through analysis, synthesis of electronic system's using hardware and simulation in a fostering environment."

Program Educational Objectives of the program (PEO)PEOs for UG

PEO1 Graduates will be successful in pursuing higher studies in engineering and management or will pursue career path in teaching, research or entrepreneurship.

PEO2 Graduates will formulate, analyze and solve engineering problems critically with profound scientific and engineering knowledge and research capabilities so as to comprehend, design, create novel systems and solve collaborative multidisciplinary problems in Electronics Engineering.

PEO3 Graduates will be engineering professionals with ethical attitude, effective communication skills and an ability to relate engineering to global issues in social context.

PEO4 IV.Graduates will be able to develop attitude in lifelong learning towards career advancement and respond to changing social needs in a conducive academic milieu.

Program Outcomes(PO)

Engineering Graduates will be able to:

PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6 **The engineer and society:**Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes(PSO)

PSO1 An ability to analyze & design electronic applications using Electronic Design Automation (EDA) tools & related softwares.

PSO2 An ability to develop and test electronics systems in the areas related to analog and digital electronics, signal processing, embedded systems and VLSI Design.

Program Educational Objectives (PEOs)(PG)

To prepare students to succeed in employment, profession and/or to pursue research, in electronics engineering discipline.
a) To provide students with scholarly knowledge so as to formulate, analyze and design novel systems for solving electronics engineering problems. b) To inculcate in students professional and ethical attitude, effective communication skills, resource management & teamwork to become successful professional. c) To provide students with academic environment to work independently through reflective and life-long learning in global perspective.

Yeshwantrao Chavan College of Engineering, Nagpur

PO/PSO and CO's of all courses of the UG Programme

Name of the Department: Electronics Engineering

Name of the UG Programme: B.E. in Electronics Engineering

Programme Outcomes (PO)

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PO4: Conduct investigations of complex problems: Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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PSO1:An ability to analyze & design electronic applications using Electronics Design Automation (EDA) tools & related softwares.

PSO2: An ability to develop and test electronics systems in the areas related to analog and digital electronics, signal processing, embedded systems and VLSI Design.

First Year: Semester I

Course Name:Engineering Mathematics-I	Course Code:GE-2101
GE-2101 CO-1	Apply the knowledge of differentiation to develop the Mathematical equations and compute geometrical measures
GE-2101 CO-2	Determine the expansion and derivatives of functions of Multiple variables and use it to find extreme values of functions.
GE-2101 CO-3	Evaluate the integrals of single, multiple variables and use it to measure the dimensions of various geometrical figures.
GE-2101 CO-4	Discuss Calculus of Scalar and vector point function and use appropriate theorems to evaluate integrals of functions of single, multiple variables.

Course Name:Engineering Mathematics-II	Course Code:GE-2102
GE-2102 CO-1	Use appropriate Methods to solve first order and higher order differential equations and apply it to find solutions of engineering problems
GE-2102 CO-2	Analyse the functions of complex numbers and variables, prove Mathematical equations and evaluate the complex integrals
GE-2102 CO-3	Use Matrix method to solve linear equations , evaluate eigen values - eigen vectors and its applications.
GE-2102 CO-4	Measure the statistical parameters and derive the equations of best fit curves

Course Name:Communication Skill	Course Code:GE-2107
GE-2107 CO-1	Explain the basics of communication process as well as identify the barriers in communication.
GE-2107 CO-2	Classify and describe the different Speech Sounds of English Language.
GE-2107 CO-3	Apply different strategies and techniques of presentations, interviews and group communication.
GE-2107 CO-4	Drafting reports, memos and emails, considering the professional etiquettes and ethics with appropriate content and context.

Course Name:Social Science	Course Code:GE-2108
GE-2108 CO-1	Explain the basic concepts of Social Sciences.
GE-2108 CO-2	Describe the development of various Civilizations and their Culture.
GE-2108 CO-3	Analyze the Impact of Industrialization on society and discuss the Fundamental Concepts of Society.
GE-2108 CO-4	Explain Industrial Organization and Management.

Course Name:Engineering Physics Course Name: Engineering Physics (Lab.)	Course Code:GE-2105 and GE 2106
GE 2105 & GE2106 CO1	Examine the intensity variation of light due to interference, diffraction and its applications.
GE 2105 . CO2	Explain fundamentals of quantum mechanics and its application to problems dealing with quantum particle.
GE 2105 & GE2106 CO3	Develop ability to classify and analyze the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands for device applications.
GE 2105 & GE2106 CO4	Analyze the motion of charged particle in electric and magnetic fields and its applications to electron optic devices.
GE 2105 & GE2106 CO1	Illustrate working principle of lasers, ultrasonic waves and its properties for useful applications in the field of industry.

Course Name:Engineering Mechanics Engineering Mechanics (Lab.)	Course Code:CV-2101 - CV2102
CV-2101- CO 1	An ability to apply the concept of applied mechanics and can solve problems on planar force system for friction as well as frictionless surfaces.
CV-2101- CO 2	An ability to analyze pin jointed truss frame structure and beam structure analytically and graphic
CV-2101- CO 3	An ability to understand centroid, moment of inertia, product of inertia and mass moment of inertia and can find properties of surfaces.
CV-210- 1CO 4	An ability to determine the dynamic variables of moving body, understand working principle of simple lifting machine.

Course Name:Introduction to Computer Programming Introduction to Computer Programming (Lab.)	Course Code:IT2101 Course Code: IT-2102
IT2101, IT2102 CO1	Understand computer system, basics of algorithm & flowchart, and demonstrate straight line program using basic 'C' programming language constructs.
IT2101 IT2102 CO2	Design & Develop programs using different loop control structures, user defined functions, and Pointers.
IT2101 IT2102 CO3	Analyze and apply concepts of different dimensional Arrays as a data structure & development of programs using the same.
IT2101 IT2102 CO4	Design and develop programs using basics of Strings, Structures, union and Files in 'C' language.

Course Name:Electrical	Course Code:EL 2101

Engineering Elect. Eng. Lab	EL-2102 (Lab.)
EL 2101 & EL 2102- CO-1	Reproduce fundamentals of dc circuits, single phase, and three phase ac circuits.
EL 2101 & EL 2102- CO-2	Analyse dc circuits, single phase and three phase ac circuits for basic electrical quantities such as current, voltage, power etc.
EL 2101 & EL 2102- CO-3	Explain construction, working, testing, and applications of various electrical machines.
EL 2101 & EL 2102- CO-4	Analyse performance of various electrical machines.
EL 2101 & EL 2102- CO-5	Perform laboratory experiments and demonstrate competency in collecting, interpreting, analysing data, communicate and present effectively through laboratory journals.

Course Name:Engineering Graphics Engineering Graphics Lab.	Course Code:ME2101 ME-2102
ME2101 ME-2102 CO1	Transform orthographic projections into isometric projections and vice versa.
ME2101 ME-2102 CO2	Evaluate Projections of various One Dimensional, Two dimensional, Three dimensional objects.
ME2101 ME-2102 CO3	Built the development of lateral surfaces of various solids and their cut section.
ME2101 ME-2102 CO4	Predict the intersections and intersections of various solid objects.
ME2101 ME-210 2CO5	Justify the use of software tools used for Two dimensional drawings.

Course Name:Workshop Practice	Course Code:ME 2103
CO1	Understand the carpentry tools, joints, machineries and its applications
CO2	Understand the fitting tools, measuring instruments, machineries and its applications
CO3	Understand the smithy tools furnaces and hand and power forging equipment's
CO4	Understand Gas and Electric welding processes, utility, tools and its applications

First Year: Semester II:

Course Name:Engineering Mathematics-I	Course Code:GE-2101
GE-2101 CO-1	Apply the knowledge of differentiation to develop the Mathematical equations and compute geometrical measures
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GE 2105 & GE2106 CO3	Develop ability to classify and analyze the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands for device applications.
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Course Name:Electrical Engineering Elect. Eng. Lab	Course Code:EL 2101 EL-2102 (Lab.)
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EL 2101 & EL 2102- CO-2	Analyse dc circuits, single phase and three phase ac circuits for basic electrical quantities such as current, voltage, power etc.
EL 2101 & EL 2102- CO-3	Explain construction, working, testing, and applications of various electrical machines.
EL 2101 & EL 2102- CO-4	Analyse performance of various electrical machines.
EL 2101 & EL 2102- CO-5	Perform laboratory experiments and demonstrate competency in collecting, interpreting, analysing data, communicate and present effectively through laboratory journals.

Course Name:Engineering Graphics Engineering Graphics Lab.		Course Code:ME2101 ME-2102
ME2101 ME-2102 CO1	Transform orthographic projections into isometric projections and vice versa.	
ME2101 ME-2102 CO2	Evaluate Projections of various One Dimensional, Two dimensional, Three dimensional objects.	
ME2101 ME-2102 CO3	Built the development of lateral surfaces of various solids and their cut section.	
ME2101 ME-2102 CO4	Predict the intersections and intersections of various solid objects.	
ME2101 ME-210 2CO5	Justify the use of software tools used for Two dimensional drawings.	

Course Name:Workshop Practice	Course Code:ME 2103
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CO2	Understand the fitting tools, measuring instruments, machineries and its applications
CO3	Understand the smithy tools furnaces and hand and power forging equipment's
CO4	Understand Gas and Electric welding processes, utility, tools and its applications

Second Year: Semester III:

Course Name: Electronic Devices (T/P)	Course Code:EE2201/EE2202
CO1	Students will be able to understand the concepts of Energy Bands, Charge Carriers and various semiconductor devices like diodes and BJT
CO2	Students will be able to be familiarized with semiconductor device fabrication processes.
CO3	Students will be able to understand various configurations and their characteristics for BJT and MOSFET amplifiers
CO4	Students will be able to understand the concepts of Stabilization and operating points of BJT and MOSFET amplifiers

Course Name: Signals & Systems	Course Code:EE2203
CO1	Students will be able to classify continuous time signals and systems, transformation of independent variable.
CO2	Students will be able to analyze Fourier series, Fourier transform representation of continuous-time periodic and aperiodic signals.
CO3	Students will be able to determine and evaluate Laplace Transform of continuous time signals.
CO4	Students will be able to analyze time & frequency characterization of Signals and Systems & Sampling Theorem

Course Name: Lab : Computing using Python	Course Code: EE2204
CO1	Students will be able to understand syntax and semantics of language
CO2	Students will be able to understand and apply the basics of the programming language
CO3	Students will be able to understand and apply special language features
CO4	Students will be able to develop any application

Course Name:Digital Logic Design (T/P)	Course Code:EE2205/EE2206
CO1	Students will be able to simplify combination logic circuits using Boolean algebra and exhibit the methods to solve logical functions using K-map and Quine-Mc-Clauskey methods.
CO2	Students will be able to understand and apply the concept of combinational logic circuits in various digital systems.
CO3	Students will be able to understand and demonstrate the various codes and illustrate concept of logic family with their characteristics.
CO4	Students will be able to understand the working of Flip-flops and its use to design Synchronous counters and Design and demonstrate finite state machines.

Course Name:Network Analysis (T/P)	Course Code:EE2207/EE2208
CO1	Students should be able to apply and analyze nodal and mesh analysis on circuits
CO2	Students should be able to apply network theorems, initial and final conditions to analyze circuits
CO3	Students should be able to understand, apply and analyze circuits in

	transform domain
CO4	Students should be able to apply the concept of two – port networks to find different two-port parameters.

Second Year: Semester IV:

Course Name: Electronic Circuits (T/P)	Course Code:EE2251/2252
CO1	Students will be able to know the low frequency parameters and analysis of BJT, MOSFET and its configuration.
CO2	Students will be able to know the high frequency parameters and analysis of BJT, MOSFET and its configuration.
CO3	Students will be able to analyze amplifiers with and without feedback.
CO4	Students will be able to analyze Power amplifier and Oscillators.

Course Name: Microcontroller & its Applications(T/P)	Course Code: EE2253/2254
CO1	Students will be able to understand & Learn concept of Architecture of 8051 µc
CO2	Students will be able to apply the concept of programming language to interface I/O Devices
CO3	Students will be able to establish the serial communication between the I/O Devices.
CO4	Students will be able to design Data Acquisition System related to Industries

Course Name: Analog Communication (T/P)	Course Code:EE2255/EE2256
CO1	Students will be able to demonstrate and analyze various amplitude, angle modulation techniques.
CO2	Students will be able to understand various types of receivers & noise in communication system and investigate noise parameters.
CO3	Students will be able to understand pulse modulation & multiplexing techniques.
CO4	Students will be able to apply the concept of Radiation & Propagation of waves to design communication system

Course Name: Electromagnetic Fields	Course Code:EE2257
CO1	Students will be able to define and recognize different co-ordinate systems, apply different techniques of vector calculus to understand concepts of electromagnetic field theory.
CO2	Students will be able to determine the electromagnetic force exerted on charged particles, current elements, working principle of various electric and magnetic fields.
CO3	Students will be able to explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields in different media using the fundamental laws.
CO4	Students will be able to deduce and justify the concepts of electromagnetic waves, means of transporting energy or information, in the form of radio waves.

Course Name: Lab : Electronics Workshop	Course Code: EE2258
CO1	Students will be able to identify different Electronics Components.
CO2	Students will be able to do mini project to enhance their practical Knowledge.
CO3	Students will be able to artwork, printing, Etching & drilling of PCB
CO4	Students will be able to work in a teamwork

Third Year: Semester V:

Course Name: Fundamentals of Management	Course Code:GE2311
CO1	Students will be able to explain the Legal provision and Functions of Management.
CO2	Students will be able to analyze the role of Human Resource and Financial Management in the organization.
CO3	Students will be able to analyze the project life cycles.
CO4	Students will be able to identify tools and techniques for the marketing of goods and services.

Course Name: DigitalSignal Processing (T/P)	Course Code:EE2351/EE2302
CO1	Apply DFT and Z transform for the analysis of signals and systems
CO2	Construct and optimize structures for the realization of discrete Time system
CO3	Design of Analog and Digital Filters for given specifications
CO4	Understand fundamentals and architecture of DSP processor.

Course Name: Analog Integrated Circuits and its Application (T/P)	Course Code:EE2302/EE2304
CO1	Student will acquire knowledge of the fundamentals, the different Parameters and internal structure of the operational amplifier.
CO2	Student will analyze and design the linear applications of the operational amplifier.
CO3	Students will analyze and design active Butterworth filters using operational amplifier.
CO4	Student will analyze and design the non-linear applications of the operational amplifier.

Course Name: PE I : Computer Communication Network(T/P)	Course Code:EE2311/EE2312
CO1	Students will be able to Describe various protocols, models in Computer Networks
CO2	Students will be able to Compare Connectors, Network hardware,Media Types (cables, Wireless)
CO3	Students will be able to Design, implement and analyze simple computer networks.
CO4	Students will be able to Apply the different strategies and Operations of TCP/UDP, FTP, HTTP protocols

Course Name: PE I : Embedded System(T/P)	Course Code:EE2313/EE2314
CO1	Students will be able to understand & Learn concept of Architecture & organization of ARM.
CO2	Students will be able to understand & Learn concept of RTOS Architecture.
CO3	Students will be able to apply the concept of programming language to interface I/O Devices.
CO4	Students will be able to establish the communication between the different Devices.

Course Name: PE I : Algorithm & Data Structure (T/P)	Course Code:EE2315/EE2316
CO1	Students will be able to study the trade-off method Demonstrate and analyze various techniques.
CO2	Students will be able to demonstrate various operation on data Structure
CO3	Students will be able to understand various types Data Structure
CO4	Students will be able to implement various types algorithm and analyze performance of system.

Course Name: PE I : Applied Machine Learning (T/P)	Course Code:EE2317/EE2318
CO1	Students will be able to develop an appreciation for what is involved in learning from data, machine learning techniques that are suitable for the different applications
CO2	Students will be able to design an appropriate learning model from set of samples to meet the desired needs
CO3	Students will be able to compare different machine learning techniques and demonstrate the comprehension of the trade-offs involved in design choices
CO4	Students will be able to integrate machine learning algorithms with ensembling methods and explain modern technologies like deep and shallow learning

Course Name: OE I : Fuzzy Logic & Neural Network	Course Code:EE2331
CO1	Students will be able to apply the concepts of mathematics and fuzzy logic to define, and analyze uncertainty.
CO2	Students will be able to find solution for real time control problems using concepts of fuzziness.
CO3	Students will be able to compare the Artificial neurons to biological neurons and solve classification using ANN.
CO4	Students will be able to design and solve pattern recognition and classification problems using different learning methods

Course Name:OE I : Basics of Analog and Digital Communication Systems	Course Code:EE2332
CO1	Students will be able to understand different modulation and demodulation schemes for analog communication with the concept of noise.
CO2	Students will be able to understand different pulse analog and digital modulation techniques.
CO3	Students will be able to understand different digital modulation schemes.

CO4	Students will be able to understand the different coding techniques for communication systems.

Course Name:OE I : Biomedical Instrumentation	Course Code:EE2333
CO1	Students will be able to describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation.
CO2	Students will be able to explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram .
CO3	Students will be able to identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care.
CO4	Students will be able to recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.

Course Name: OE II : Data Acquisition & Signal Conditioning	Course Code:EE2341
CO1	Students will be able to describe the basic model of data acquisition system and the various methods and attributes of signal conditioning
CO2	Students will be able to Identify the various types of data acquisition hardware and the serial data communication standards.
CO3	Students will be able to distinguish different standards for connection of different programmable instruments like GPIB and SCPI
CO4	Students will be able to define use of Ethernet, Medium Access control and USB

Course Name: OE II : Fundamentals of Microprocessor	Course Code:EE2342
CO1	Students will be able to understand the architecture of 8085 and 8051.
CO2	Students will demonstrate the ability to identify, Formulate and design program for an assigned task.
CO3	Students will be able to interface Peripheral devices.
CO4	Students will apply the knowledge of microprocessor and microcontroller in their respective field

Course Name: OE II : Consumer Electronics	Course Code:EE2343
CO1	Students will be able to understand the knowledge of the safety aspects in the field of Electrical and Electronics products.
CO2	Students will be able to analyze the basics of Audio and Video Systems.
CO3	Students will be able to know about recent trends in Processors and computer peripherals, mobile and wireless technologies.
CO4	Students will be able to understand the basics of refrigeration cycle and cooling system

Third Year: Semester VI:

Course Name: Fundamentals of Economics	Course Code:GE2312
CO1	Relate their buyer behavior to particular product and the pricing in the market.
CO2	Examine and classify various market structure and factors of production and its role in production process.
CO3	Analyse the national income accounting and the various issues related to banking, taxation, and inflation.
CO4	Elaborate about international economics, foreign trade and its agreement, export, foreign exchange and the various international financial institutions.

Course Name: Control System Engineering	Course Code:EE2351
CO1	Students will be able to understand the use of block diagram and signal flow graph as a modeling tool and the role of feedback in control systems.
CO2	Students will be able to understand the response characteristics of basic first- and second-order dynamic systems. Be able to use Routh's criterion for absolute and relative stability analysis.
CO3	Students will be able to construct and recognize the properties of root-locus and its role in the analysis of control systems.
CO4	Students will be able to obtain frequency response indices. Be able to draw frequency response plots such as polar plot, Bode plot etc.

Course Name: Transmission Lines and Wave Guides	Course Code:EE2352
CO1	Students will be able to explain fundamental parameters of transmission line and its constraints in high frequency transmission of information.
CO2	Students will be able to make use of Transmission line to develop impedance matching networks and any communication system.
CO3	Students will be able to relate the propagation characteristics of electromagnetic waves in various wave guide structures.
CO4	Students will be able to analyze transmission line using Smith Chart and Design Impedance Matching network.

Course Name: Digital Communication (T/P)	Course Code:EE2353
CO1	Students will be able to learn pulse modulation & discuss the process of sampling, quantization & coding that is fundamental to the digital transmission of analog signals.
CO2	Students will be able to understand fundamental concepts & limits in information theory in the context of digital communication theory/
CO3	Students will be able to analyze mathematical model of digital communication systems.
CO4	Students will be able to apply error control coding techniques at the receiver.

Course Name: PE- II Internet of Things (T/P)	Course Code:EE2361/EE2362
CO1	Students will be able to understanding of IoT value chain structure (device, data cloud), application areas and technologies involved

CO2	Students will be able to understand IoT sensors andtechnological challenges faced by IoT devices, with a focus on wireless, energy, power, RF and sensing modules
CO3	Students will be able to market forecast for IoT devices with a focus on sensors
CO4	Students will be able to explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi

Course Name: PE- II Digital CMOS Circuits (T/P)	Course Code:EE2363/EE2364
CO1	Students will be able to describe and interpret the basic concepts of MOS transistors
CO2	Students will be able to construct the ability to design a system, component or process as per needs and specifications.
CO3	Students will be able to analyze inverter design, characteristics and applications and Evaluate circuits using different CMOS
CO4	Students will be able to design arithmetic circuit blocks

Course Name: PE- II Digital Image Processing (T/P)	Course Code:EE2365/EE2366
CO1	Students will be able understand the basic concepts of digital image processing and f digital image geometry.
CO2	Students will be able implement the image enhancement and restoration techniques in spatial and frequency domain.
CO3	Students will be able apply and implement image segmentation techniques using edge detection and merging.
CO4	Students will be able apply different Image processing algorithms.

Course Name:PE IV : Object Oriented Programming (T/P)	Course Code:EE2367/EE2368
CO1	Students will be to understand the concept of concepts of Object Oriented Programming.
CO2	Students will be to analyze the using the concept of Inheritance, Polymorphism, Overloading
CO3	Students will be to choose the appropriate data structure and algorithm design method for a specified application.
CO4	Students will be to develop and use linear and non linear data structures and advanced features.

Course Name: OE III : Fuzzy Logic & Neural Network	Course Code:EE2381
CO1	Students will be able to apply the concepts of mathematics and fuzzy logic to define, and analyze uncertainty.
CO2	Students will be able to find solution for real time control problems using concepts of fuzziness.
CO3	Students will be able to compare the Artificial neurons to biological neurons and solve classification using ANN.
CO4	Students will be able to design and solve pattern recognition and classification problems using different learning methods

Course Name:OE III : Basics of Analog and Digital Communication Systems	Course Code:EE2382
CO1	Students will be able to understand different modulation and

	demodulation schemes for analog communication with the concept of noise.
CO2	Students will be able to understand different pulse analog and digital modulation techniques.
CO3	Students will be able to understand different digital modulation schemes.
CO4	Students will be able to understand the different coding techniques for communication systems.

Course Name:OE III : Biomedical Instrumentation	Course Code:EE2383
CO1	Students will be able to describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation.
CO2	Students will be able to explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram .
CO3	Students will be able to identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care.
CO4	Students will be able to recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.

Course Name: OE IV : Data Acquisition & Signal Conditioning	Course Code:EE2391
CO1	Students will be able to describe the basic model of data acquisition system and the various methods and attributes of signal conditioning
CO2	Students will be able to Identify the various types of data acquisition hardware and the serial data communication standards.
CO3	Students will be able to distinguish different standards for connection of different programmable instruments like GPIB and SCPI
CO4	Students will be able to define use of Ethernet, Medium Access control and USB

Course Name: OE IV : Fundamentals of Microprocessor	Course Code:EE2392
CO1	Students will be able to understand the architecture of 8085 and 8051.
CO2	Students will demonstrate the ability to identify, Formulate and design program for an assigned task.
CO3	Students will be able to interface Peripheral devices.
CO4	Students will apply the knowledge of microprocessor and microcontroller in their respective field

Course Name: OE IV : Consumer Electronics	Course Code:EE2393
CO1	Students will be able to understand the knowledge of the safety aspects in the field of Electrical and Electronics products.
CO2	Students will be able to analyze the basics of Audio and Video Systems.
CO3	Students will be able to know about recent trends in Processors and computer peripherals, mobile and wireless technologies.
CO4	Students will be able to understand the basics of refrigeration cycle and cooling system

Fourth Year: Semester VII:

Course Name: Digital System Design (T/P)	Course Code:EE2401/EE2402
CO1	Students will be able to understand hardware description language and able to design and simulate digital systems using different abstraction levels
CO2	Students will be able to design and analyse combinational and sequential logic circuits.
CO3	Students will be able to understand and apply timing issues in multiple contexts and design the circuit.
CO4	Students will be able to understand programmable devices and able to design digital systems using modern design tools

Course Name:PE III : Switching Theory & Finite Automata	Course Code:EE2411
CO1	Students will be able to design and analyze multilevel logic Network and Threshold logic for nanotechnologies.
CO2	Students will be able to analyze testing of combinational circuits, Fault Models
CO3	Students will be able to design and analyze the synchronous and asynchronous sequential circuits.
CO4	Students will be able to identify and test the sequential machines with experiments.

Course Name:PE III : Power Electronics	Course Code:EE2412
CO1	Students will be able to understand basic semiconductor physics and properties of power devices for circuit analysis using linear and non -linear operations.
CO2	Students will be able to design and Analyze power invertor circuits and learn to select suitable power electronic devices by assessing the requirements of application fields.
CO3	Students will be able to formulate analyze and design the converters for various load types.
CO4	Students will be able to identify the critical areas in application levels and derive typical alternative solutions, select suitable power converters to control Electrical Motors and other industry grade apparatus.

Course Name:PE III : Wireless Sensor Network	Course Code:EE2413
CO1	Students will be able to study basic wireless sensor technology and different types of sensor protocol
CO2	Students will be able to understand different routing challenges and design issue in wireless sensor
CO3	Students will to able to understand wireless sensor network management and traffic management issues
CO4	Students will to able to study basic wireless sensor technology and different types of sensor protocol

Course Name:PE III : VLSI Signal Processing	Course Code:EE2414
CO1	Students will be able to design architectures for DSP algorithms.
CO2	Students will be able to apply the optimisation concept in terms of area, speed and power on DSP systems.
CO3	Students will be able to optimize DSP arithmetic

CO4	Students will be able to design of algorithm structure for DSP algorithms based on algorithm transformation.

Course Name:PE IV : Wireless Communication (T/P)	Course Code:EE2421/EE2422
CO1	Students will be able to describe generations of wireless standard and understand cellular concepts to evaluate the signal reception performance in a cellular network and traffic analysis with given quality of service constraints.
CO2	Students will be able to determine the type and appropriate model of wireless fading channel based on the system parameters and the property of the wireless medium.
CO3	Students will be able to describe Equalization & Diversity techniques, compare various wireless systems standards.
CO4	Students will be able to understand the importance of wireless networking and its applications.

Course Name:PE IV : RF and Microwave (T/P)	Course Code:EE2423/EE2424
CO1	Students will be able to apply concepts of Fields and Networks to study working principles of specific microwave active/passive devices, transmission lines/microwave devices.
CO2	Students will be able to analyze microwave networks and components using S-parameters.
CO3	Students will be able to design of microwave filters by various methods, Microwave solid state devices.
CO4	Students will be able to apply concepts of instrumentation and measurements to study microwave measurement of power, frequency and VSWR , impedance for the analysis and design of circuits

Course Name:PE IV : Analog VLSI Design (T/P)	Course Code:EE2425/EE2426
CO1	Students will be able to understand small signal model of MOS transistor and design using SPICE modeling
CO2	Students will be able to analyze single stage and differential amplifier with frequency response.
CO3	Students will be able to analyze and Design basic analog circuits such as current mirrors, active load, biasing circuits.
CO4	Students will be able to illustrate performance parameter of operational amplifier.

Course Name:PE IV : Operating Systems (T/P)	Course Code:EE2429/EE2430
CO1	Students will be able to understand the concepts of operating systems and processes
CO2	Students will be able to learn processes, threads and memory management and storage structures
CO3	Students will be able to evaluate the algorithms and solutions for operating system management
CO4	Students will be able to analyze the security issues in operating systems

Course Name:PE V : Industrial Automation	Course Code:EE2431
CO1	Students will be able to describe working of various blocks of basic industrial

	automation system
CO2	Students will be able to connect the peripherals with the PLC iii. Use various PLC functions and develop small PLC programs iv. Summarize Distributed control system and SCADA system
CO3	Students will be able to connect the peripherals with the PLC iii. Use various PLC functions and develop small PLC programs iv. Summarize Distributed control system and SCADA system
CO4	Students will be able to connect the peripherals with the PLC iii. Use various PLC functions and develop small PLC programs iv. Summarize Distributed control system and SCADA system

Course Name:PE V : Nano Electronics	Course Code:EE2432
CO1	Students will be to understand describe the fundamentals of classical CMOS technology and the issue in scaling MOSFET in the sub100nm regime
CO2	Students will be to understand explain ideal , nonideal capacitor voltage characteristics MOS transistor and quantum physics of nanomaterials
CO3	Students will be to understand demonstrate frabrication technology for MOS transistors with new device structure and nano materials
CO4	Students will be to understand illustrate Chemical process for nano materials used in semiconductor industry to produce thin films.

Course Name:PE V : Optical Communication	Course Code:EE2433
CO1	Students will be to understand the fundamental principles of optics and light wave to design optical fiber communication systems
CO2	Students will be to differentiate the types of losses in optical fiber link.
CO3	Students will be to analyze different types of sources & detectors in fiber optics.
CO4	Students will be to explore different methods of loss measurement in fiber optics.

Course Name:PE V : RF Circuit Design	Course Code:EE2434
CO1	Students will have an ability to demonstrate in- depth knowledge of general RF circuits, components, fundamental parameters of transmission line and its constraints in high frequency transmission of information
CO2	Students will be able to understand and use Smith Chart for developing circuits in RF applications.
CO3	Students will be able to design impedance matching networks.
CO4	Students will be able to design passive RF filters and RF power amplifiers.

Course Name:PE VI : E-Commerce & Data Analytics	Course Code:EE2441
CO1	Students will be able to understand of contemporary ecommerce concepts and terminology, and the processes and management decisions that are involved in launching, operating and managing business activity on the World Wide Web.
CO2	Students will be able to analyze and understand the human, technological and business environment associated with e-commerce.

CO3	Students will be able to define and analyze the concept of electronic data interchange and its legal, social and technical aspects.
CO4	Students will be able to define and analyze the security issues over the web, the available solutions, future aspects of e-commerce security, concept of E-commerce and electronic payment system

Course Name:PE VI : MEMS	Course Code:EE2442
CO1	Students will be able to understand working principles of MEMS technology.
CO2	Students will be able to learn the basic principles and applications of Micro fabrication and micromachining processes.
CO3	Students will be able to discuss various applications of RF MEMS.
CO4	Students will be able to classify types of microsensors and micro actuators used in Micro systems

Course Name:PE VI : Biomedical Instrumentation	Course Code:EE2443
CO1	Students will be able to understand the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation
CO2	Students will be able to understand cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram
CO3	Students will be able to understand various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care.
CO4	Students will be able to understand concept of Telemedicine, its applications and use of internet resource for hospital management system.

Course Name:PE VI : Computer Organization	Course Code:EE2444
CO1	Students will be able to understand design levels of a computer system, System organization, memory hierarchy and virtual memory concept
CO2	Students will be able to understand the operation of fixed- and floating-point arithmetic units.
CO3	Students will be able to analyze hierarchical design of processor and control unit modules.
CO4	Students will be able to apply the concepts of pipelining and multiprocessing for computer system design.

Course Name: Mini Project	Course Code:EE2409
CO1	Students will be able to identify, formulate and analyze complex engineering problems through literature survey.
CO2	Students will be able to apply knowledge to assess health, social, safety and environmental issues.
CO3	Students will be able to implement core /multidisciplinary/ industry-based electronics projects in cost effective manner.
CO4	Students will be able to communicate technical details effectively

Fourth Year: Semester VIII:

Course Name: Major Project	Course Code:EE2451
CO1	Students will be able to identify, formulate and analyze complex engineering problems through literature survey.
CO2	Students will be able to apply knowledge to assess health, social, safety and environmental issues.
CO3	Students will be able to implement core /multidisciplinary/ industry-based electronics projects in cost effective manner.
CO4	Students will be able to communicate technical details effectively

B.E. – Electronics & Telecommunication Engineering

Vision of the Department"
To evolve as center of excellence through innovative pedagogy, research and holistic development of aspiring professionals ".

Mission of the Department"
To prepare Electronics and Telecommunication professionals by creating, imparting and disseminating contemporary knowledge through Electronic Design, analysis tools and project based learning in a conducive research milieu".

Programme Educational Objectives

PEO1 Graduates will be successful in pursuing higher studies in engineering and management or will pursue career path in teaching, research or entrepreneurship.

PEO2 Graduates will formulate, analyze and solve engineering problems critically with profound scientific and engineering knowledge and research capabilities so as to comprehend, design, create novel systems and solve collaborative multidisciplinary problems in Electronics and Telecommunication Engineering.

PEO3 Graduates will be engineering professionals with ethical attitude, effective communication skills and an ability to relate engineering to global issues in social context.

PEO4 Graduates will be able to develop attitude in lifelong learning towards career advancement and respond to changing social needs in a conducive academic milieu.

Programme Outcomes

PO1 **Engineering knowledge** : Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSO

PSO1 Knowledge of Thrust Areas: Apply knowledge and hands on competence in the areas of circuit analysis & design, communication systems, signal & image processing and embedded system.

PSO2 CAD Tool Usage: Create an environment to design and analyze electronics and Telecommunication systems using computer aided design (CAD) tools.

M.Tech-Communication Engineering

PROGRAM EDUCATIONAL OBJECTIVES

PEO1 To prepare students to analyze complex Engineering problems critically with profound scientific and engineering knowledge and research capabilities so as to comprehend, design, create novel systems and solve collaborative multidisciplinary problems.

PEO2 To inculcate in students professional and ethical attitude, effective communication skills, teamwork and an ability to relate engineering to global perspective issues and social context.

PEO2 To provide student with an academic environment that fosters excellence, ethics, transparency, leadership and promote awareness of lifelong learning.

PROGRAM OUTCOMES

PO1 The Communication Engineering Post Graduate students will have an ability to acquire in depth knowledge of specific discipline, to evaluate, analyze and synthesize complex engineering problems to give optimal solutions for public health and safety, cultural, social and environmental factors.

PO2 An ability to develop research skills through appropriate research methodologies, techniques and modern engineering tools.

PO3 An ability to function on collaborative and multidisciplinary terms to manage project efficiency with consideration of economical and financial factors.

PO4 An ability to communicate effectively with engineering community and society.

PO5 Recognize the need for and an ability to encourage in lifelong learning with an understanding of professional, ethical and social responsibilities.

PO6 An ability to observe and examine the outcomes of one's actions and make corrective measures without external feedback.

First Year: Semester I: Group A/Semester II Group B

Course Name: Engineering Mathematics-I	**Course Code: GE-2101**
CO1	Apply the knowledge of differentiation to develop the Mathematical equations and compute geometrical measures
CO2	Determine the expansion and derivatives of functions of Multiple variables and use it to find extreme values of functions.
CO3	Evaluate the integrals of single, multiple variables and use it to measure the dimensions of various geometrical figures.
CO4	Discuss Calculus of Scalar and vector point function and use appropriate theorems to evaluate integrals of functions of single, multiple variables.

Course Name: Engineering Physics (T/P)	**Course Code: GE-2105 /GE 2106**
CO1	Examine the intensity variation of light due to interference, diffraction and itsapplications.
CO2	Explain fundamentals of quantum mechanics and its application to problems dealing with quantum particle.
CO3	Develop ability to classify and analyze the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands for device applications.
CO4	Analyze the motion of charged particle in electric and magnetic fields and its applications to electron optic devices.
CO1	Illustrate working principle of lasers, ultrasonic waves and its properties for useful applications in the field of industry.

Course Name: Communication Skill	**Course Code: GE-2107**
CO1	Explain the basics of communication process as well as identify the barriers in communication.
CO2	Classify and describe the different Speech Sounds of English Language.
CO3	Apply different strategies and techniques of presentations, interviews and group communication.
CO4	Drafting reports, memos and emails, considering the professional etiquettes and ethics with appropriate content and context.

Course Name: Engineering Mechanics (T/P)	**Course Code: CV2101/ CV2102**
CO 1	An ability to apply the concept of applied mechanics and can solve problems on planar force system for friction as well as frictionless surfaces.
CO 2	An ability to analyze pin jointed truss frame structure and beam structure analytically and graphic
CO 3	An ability to understand centroid, moment of inertia, product of inertia and mass moment of inertia and can find properties of surfaces.
CO 4	An ability to determine the dynamic variables of moving body, understand working principle of simple lifting machine.

Course Name: Introduction to Computer Programming (T/P)		Course Code: IT2101/ IT2102
CO1	Understand computer system, basics of algorithm & flowchart, and demonstrate straight line program using basic 'C' programming language constructs.	
CO2	Design & Develop programs using different loop control structures, user defined functions, and Pointers.	
CO3	Analyze and apply concepts of different dimensional Arrays as a data structure & development of programs using the same.	
CO4	Design and develop programs using basics of Strings, Structures, union and Files in 'C' language.	

Course Name: Workshop Practice	Course Code: ME 2103
CO1	Understand the carpentry tools, joints, machineries and its applications
CO2	Understand the fitting tools, measuring instruments, machineries and its applications
CO3	Understand the smithy tools furnaces and hand and power forging equipment's
CO4	Understand Gas and Electric welding processes, utility, tools and its applications

First Year: Semester II: Group A/Semester I Group B

Course Name: Engineering Mathematics-II		Course Code: GE-2102
CO1	Use appropriate Methods to solve first order and higher order differential equations and apply it to find solutions of engineering problems	
CO2	Analyse the functions of complex numbers and variables, prove Mathematical equations and evaluate the complex integrals	
CO3	Use Matrix method to solve linear equations , evaluate eigen values - eigen vectors and its applications.	
CO4	Measure the statistical parameters and derive the equations of best fit curves	

Course Name: Engineering Chemistry (T/P)		Course Code: GE2103 /GE 2104
CO1	Assess qualitative and quantitative aspects of water as a conventional material for industrial and domestic applications.	
CO2	Apply the knowledge of basic electrochemistry to understand battery technology, corrosion process and preventive techniques.	
CO3	Know the basics and assess analytical aspects of industrial materials like fuels and lubricants for efficient utilization.	
CO4	Recognize the significance of cement and advanced engineering materials in technological applications.	
CO5	Analyze and generate analytical and instrumental techniques.	

Course Name: Social Science	Course Code: GE-2108

CO1	Explain the basic concepts of Social Sciences.
CO2	Describe the development of various Civilizations and their Culture.
CO3	Analyze the Impact of Industrialization on society and discuss the Fundamental Concepts of Society.
CO4	Explain Industrial Organization and Management.

Course Name: Basic Electronics	**Course Code: EE 2101**
CO1	Characterize Number systems, semiconductors, diodes, transistors and operational amplifiers.
CO2	Design simple analog circuits
CO3	Design simple combinational and sequentiallogic circuits
CO4	Identify functions of digital multimeter, Bridges and transducers in the measurement of physical variables

Course Name:Electrical Engineering (T/P)	**Course Code: EL 2101/ EL-2102**
CO1	Reproduce fundamentals of dc circuits, single phase, and three phase ac circuits.
CO2	Analyse dc circuits, single phase and three phase ac circuits for basic electrical quantities such as current, voltage, power etc.
CO3	Explain construction, working, testing, and applications of various electrical machines.
CO4	Analyse performance of various electrical machines.
CO5	Perform laboratory experiments and demonstrate competency in collecting, interpreting, analysing data, communicate and present effectively through laboratory journals.

Course Name: Engineering Graphics(T/P)	**Course Code: ME2101/ME2102**
CO1	Transform orthographic projections into isometric projections and vice versa.
CO2	Evaluate Projections of various One Dimensional, Two dimensional, Three dimensional objects.
CO3	Built the development of lateral surfaces of various solids and their cut section.
CO4	Predict the intersections and intersections of various solid objects.
CO5	Justify the use of software tools used for Two dimensional drawings.

Second Year: Semester III:

Course Name: : Engineering Mathematics-III	**Course Code: GE-2201**
CO1	Estimate the Calculus of Numerical Function.
CO2	Determine the transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations.
CO3	Discuss the nature of periodic function and express it in terms of series.
CO4	Use appropriate method/s to solve partial differential equations.

Course Name: Electronic Devices and Circuits (T/P)		Course Code:ET2201/ET2202
CO1	Apply the knowledge of semiconductor diodes in circuit analysis.	
CO2	Identify the operating conditions of bipolar junction transistors.	
CO3	Design and analyze transistor circuit with suitable biasing and stabilization techniques. And analyze the operation of MOSFET in various regions.	
CO4	Analyze the response of transistors at low and high frequency	
CO5	Analyze the Characteristics of different power amplifier	

Course Name:Digital Circuits and Fundamentals of Microprocessor(T/P)		Course Code:ET2203/ET2204
CO1	Explain and compare the digital logic families	
CO2	Simplify Boolean expressions using k-map & tabulations method.	
CO3	Identify, formulate, and solve combinational logic design problems.	
CO4	Describe and Design sequential logic circuits.	
CO5	Describe the concept of 8085 and develop programs for it	
Course Name: Electronic Measurement & Instrumentation(T/P)		Course Code: ET2205/ET2206
CO1	Describe basic measurement system and analyze errors	
CO2	Analyze the behavior of bridge circuits for the measurement of different electrical quantities	
CO3	Demonstrate the working of measuring instrument, display devices, generators, spectrum analyzers along with sensors and transducers	
CO4	Elaborate application of data conditioning and acquisition	

Course Name: Network Analysis		Course Code: ET2207
CO1	Analyze electrical circuits using nodal and mesh analysis	
CO2	Design and analyze electrical circuits using network theorems.	
CO3	Analyze steady state and transient response of electrical circuits	
CO4	Characterize the transfer function for two – port networks.	

Second Year: Semester IV:

Course Name: : Advance Mathematical Techniques		Course Code: GE-2204
CO1	Utilize numerical techniques to obtain approximate solutions of mathematical equations	
CO2	Design and determine the solution of linear programming problems.	
CO3	Measure the Statistical parameters for random variables	
CO4	.Explain the basic concept of fuzzy sets, Relations and fuzzy logic.	

Course Name:Electromagnetic Fields		Course Code:ET2251
CO1	Compare different types of co-ordinate systems for electromagnetic fields	
CO2	Apply the concepts of electric field and magnetic field to solve engineering problems.	

CO3	Analyze static and time varying fields using Maxwell's equations
CO4	Analyze wave propagation in different medium.

Course Name: Microcontroller and Interfacing (T/P)	**Course Code: ET2252 / ET2253**
CO1	Explain 8051 microcontroller architecture.
CO2	Develop assembly language program.
CO3	Develop embedded C language program.
CO4	Interface 8051 microcontroller to solve real life problems.

Course Name:Analog Communication (T/P)	**Course Code: ET2254 / ET2255**
CO1	Analyze different analog modulation techniques.
CO2	Evaluate different parameters of communication receivers.
CO3	Analyze and comprehend concept of television transmission and reception.
CO4	Describe and analyze Pulse modulation techniques, noise and wave propagation of signals

Course Name: Microcontroller and Interfacing (T/P)	**Course Code: ET2252 / ET2253**
CO1	Explain 8051 microcontroller architecture.
CO2	Develop assembly language program.
CO3	Develop embedded C language program.
CO4	Interface 8051 microcontroller to solve real life problems.

Course Name:Control Systems(T/P)	**Course Code: ET2256 / ET2257**
CO1	Apply block diagram reduction technique and signal flow graph for transfer function
CO2	Analyze the characteristic of feedback control system
CO3	Explain and analyze time response of first and second order control systems for different standard test signals
CO4	Determine the stability of linear control system
CO5	Perform frequency domain analysis of linear control system using bode plot and nyquist stability criterion

Third Year: Semester V:

Course Name: Fundamentals of Economics	**Course Code: GE2312**
CO1	Recognize consumer's behavior and analyze Market price
CO2	Extrapolate operations in market with production constraints
CO3	Describe the national income accounting and public finance.
CO4	Analyze international trade and institutions.

Course Name:Analog Integrated Circuits(T/P)	Course Code:ET 2301/ET 2302
CO1	Describe, Design and analyze OP-AMP circuits.
CO2	Parametric analysis and Design of error compensation network.
CO3	Design and analyze linear and non- linear OP-AMP applications.
CO4	Explain special function ICs and design circuits using it.

Course Name: Fields & Radiating Systems	Course Code: ET 2303
CO1	Analyze transmission lines and perform its parametric analysis.
CO2	Analyze parallel plane waveguides
CO3	Analyze and design rectangular waveguides
CO4	Design antenna arrays

Course Name: Signals & Systems (T/P)	Course Code: ET 2304/ ET 2305
CO1	Classify systems based on their properties and determine the response of LTI system.
CO2	Analyze system properties based on impulse response and Fourier analysis.
CO3	Apply sampling and interpolation to sample and reconstruct signals.
CO4	Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems

Course Name: Lab: Electronics Workshop(P)	Course Code: ET 2306
CO1	Identify and test passive and active electronic components and devices.
CO2	Identify and Test wires, cables, connectors and interconnected components.
CO3	Construct mini project and troubleshoot it.

Course Name: OE I/ OE III: Microcontroller & Embedded Systems	Course Code: ET 2311/ET 2381
CO1	Explain 8051 microcontroller architecture.
CO2	Develop assembly language program.
CO3	Develop embedded C language program.
CO4	Interface 8051 microcontroller to solve real life problems

Course Name: OE I/ OE III: Principles Of Communication Engineering	Course Code: ET 2312/ET 2382
CO1	Classify systems based on their properties and determine the response of LTI system.
CO2	Analyze system properties based on impulse response and Fourier analysis.
CO3	Apply sampling and interpolation to sample and reconstruct signals.
CO4	Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems

Course Name: OE I/ OE III: Fundamentals Of Image Processing	Course Code: ET 2313/ET 2383

CO1	Apply basic image processing algorithms for image enhancement.
CO2	Apply filtering techniques in spatial and frequency domain.
CO3	Describe and analyze various image transform techniques.
CO4	Apply segmentation and compression algorithms on images

Course Name: OE II/ OE IV: Soft Computing	**Course Code: ET 2321/ET 2391**
CO1	Describe and apply genetic operators and genetic algorithms for problem solving
CO2	Apply Neural Network algorithms in pattern classification
CO3	Apply fuzzy logic and arithmetic to handle uncertainty and solve engineering problems
CO4	Describe and analyze fuzzy implications and fuzzy controller

Course Name: OE II/ OE IV: Industrial Instrumentation	**Course Code:ET 2322/ET 2392**
CO1	Describe instrumentation system using various transducers.
CO2	Measure and analyze various parameters using transducers.
CO3	Explain and Identify automation system components

Course Name: OE II/ OE IV: Medical Electronics	**Course Code:ET 2323/ET 2393**
CO1	Describe various parameters of human anatomy and physiology.
CO2	Explain the functioning of different measuring and recording instruments
CO3	Describe radiography equipments
CO4	Explain Biomedical computer application

Course Name: OE II/ OE IV: Display Technology & Applications	**Course Code:ET 2324/ET 2394**
CO1	Identify and describe different display technologies, their working, Luminescence materials and manufacturing processes.
CO2	Characterize and analyze specifications of display technology, light emission process and analyze matrix addressing.
CO3	Explain the fundamentals of backplane and backlight unit technologies.
CO4	Elaborate materials and applications of displays.

Course Name: OE II/ OE IV: PLCs and SCADA	**Course Code:ET2325 /ET2400**
CO1	Identify and describe different display technologies, their working, Luminescence materials and manufacturing processes.
CO2	Characterize and analyze specifications of display technology, light emission process and analyze matrix addressing.
CO3	Explain the fundamentals of backplane and backlight unit technologies.
CO4	Elaborate materials and applications of displays.

Third Year: Semester VI:

Course Name: Fundamentals of Management	Course Code: GE2311
CO1	Explain the Legal provision and Functions of Management.
CO2	Analyze the role of Human Resource and Financial Management in the organization.
CO3	Analyze the project life cycles.
CO4	Identify tools and techniques for the marketing of goods and services.

Course Name:Digital Signal Processing(T/P)	Course Code:ET2351/ET2352
CO1	Apply discrete Fourier transform and verify its properties.
CO2	Implement digital filters in a variety of structures.
CO3	Design and analyze digital IIR and FIR filter.
CO4	Analyze the effects of finite word length on discrete time system
CO5	Analyze multi-rate discrete time system with unequal sampling rates

Course Name:PE I : Object Oriented Programming(T/P)	Course Code:ET2361/ ET2362
CO1	Describe the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects.
CO2	Demonstrate the use of various OOPs concepts with the help of C++ programs.
CO3	Design and develop C++ programs for implementing data structures using array and linked list.
CO4	Implement the concept of file handling, template and exception handling to develop the software.

Course Name:PE I : Discrete Structures (T/P)	Course Code: ET2363/ET2364
CO1	Analyze the concept of logic and proofs.
CO2	Apply discrete mathematics to develop recursive algorithms.
CO3	Design and Solve various problems of discrete probability theory.
CO4	Analyze graphs, tree, group theory concepts used in computer science
CO5	Design and analyze network models related to transport network and pumping network

Course Name: PE I : Microprocessors and Peripherals(T/P)	Course Code: ET2365/ET2366
CO1	Explore architecture of 8085 microprocessor and utilize the instruction set of 8085 to develop assembly language programs
CO2	Analyse timing details, develop delay programs & interface memory ICs with 8085
CO3	Interface various off chip peripherals with 8085 & develop programs for the same
CO4	Explore architecture of 8086 microprocessor & compare it with 8088
CO5	Develop programs using 8086 instruction set.

Course Name: PE I : Electronic Instrumentation(T/P)		Course Code: ET2367/ET2368
CO1	Design instrumentation system using various transducers and its calibration process.	
CO2	Analyze pressure and temperature using measuring instruments and its calibration process.	
CO3	Measure and analyze flow and level using flow transducers.	
CO4	Measure and analyze various parameters like level, thickness speed, ph value etc.	
CO5	Develop PLC programs by using ladder diagram	

Course Name:PE I : Fundamentals of Computing(T/P)		Course Code: ET2371/ET2372
CO1	Describe and develop Pythonprogramming using data types, operators and control structures.	
CO2	Develop python programs using loops and decision statements.	
CO3	Describe and apply strings, lists, tuples, Numpy and dictionaries in Python programs.	
CO4	Develop python programs using functions and recursions	

Course Name: PE I : Algorithms and data structures(T/P)		Course Code: ET2373/ ET2374
CO1	Describe fundamental concepts of Object Oriented Programming	
CO2	Develop programs for Various types of data structures.	
CO3	Analyze Skip-list, hashing and search trees.	

Course Name: PE II : Antenna Theory & Design (T/P)		Course Code: ET2377/ ET2378
CO1	Evaluate various parameters of antennas.	
CO2	Analyze performance parameters of various antennas & antenna array	
CO3	Perform of antenna measurements by using different antenna measurement techniques.	
CO4	Design and Analyze various antennas	

Course Name: PE II : Digital System Design (T/P)		Course Code: ET2379/ET2380
CO1	Compare and contrast different FPGA and CPLD architectures.	
CO2	Design, develop and analyze combinational circuits.	
CO3	Design, develop and analyze sequential circuits.	
CO4	Implement digital system using CAD tool.	

Course Name:PE II : Internet of Things (IoT) (T/P)		Course Code: ET2381/ET2382
CO1	Explore the physical and Logical design of IoT.	

CO2	Explore the M2M and NETCONF.
CO3	Explore python programming.
CO4	Apply basic skills of IoT to solve real life problems.

Course Name:PE II : Optical Communication(T/P)	**Course Code: ET2383/ET2384**
CO1	Design and analyze an Optical Communication Systems with different types of losses.
CO2	Explore different types of sources and receivers in fiber optics.
CO3	Use different splicing techniques, connectors and coding.
CO4	Explore different methods of loss measurements in fiber optics

Course Name:PE II: Principles of image processing(T/P)	**Course Code: ET2385/ET2386**
CO1	Apply basic image processing algorithms for image enhancement.
CO2	Apply filtering techniques in spatial and frequency domain.
CO3	Understand noise models and degradation process for image restoration
CO4	Implement the algorithms for image segmentation and compression
CO5	Implement the algorithms for image representation and description

Course Name: PE II: TV & Video Engineering (T/P)	**Course Code: ET2387/ET2388**
CO1	Describe basic concept of monochrome and color TV.
CO2	Describe and troubleshoot Video Amplifier & luminance circuits.
CO3	Explain and compare PAL, NTSC and SECAM systems.
CO4	Explain and compare analog and digital television-transmission and reception.

Fourth Year: Semester VII:

Course Name: RF & Microwave(T/P)	**Course Code: ET 1401/ ET 1402**
CO1	Describe and analyze the behavior of linear beam and cross field tubes.
CO2	Apply s-parameters to model and analyze output response of microwave transmission lines.
CO3	Analyze behavior of passive components using s-matrix.
CO4	Measure performance parameters of microwave devices.
CO5	Explain and characterize microwave solid state devices.

Course Name:Principles of Image Processing	**Course Code:ET 1403/ ET 1404**
CO1	Apply basic image processing algorithms for image enhancement.
CO2	Apply filtering techniques in spatial and frequency domain.
CO3	Explain noise models and apply degradation process for image restoration
CO4	Implement the algorithms for image segmentation and compression
CO5	Describe various image transform techniques.

Course Name:PE III : Optical Communication		Course Code:ET 1405/ ET 1406
CO1	Design and analyze an Optical Communication Systems with different types of losses.	
CO2	Explore different types of sources and receivers in fiber optics.	
CO3	Use different splicing techniques, connectors and coding.	
CO4	Explore different methods of loss measurements in fiber optics	

Course Name: PE III : Microwave Integrated circuit		Course Code: ET 1407/ ET 1408
CO1	Identify and describe the different MIC components.	
CO2	Design and analyze Microwave Integrated circuit and various Microstrip antennas	
CO3	Analyze the design of microstrip circuits in low and High Power circuits.	
CO4	Analyze Hybrid MIC's & Monolithic MIC s fabrication techniques.	

Course Name: PE III : Communication Networks		Course Code: ET 1409/ ET 1410
CO1	Apply LAN structure to design data communication system.	
CO2	Detect Data transmission errors in communication networks.	
CO3	Describe and compare data transmission protocols.	
CO4	Describe and compare data and network security protocols.	

Course Name: PE III : Analog VLSI		Course Code:ET 1431/ ET 1432
CO1	Apply mathematical methods to analyze Analog VLSI circuits and design MOS amplifier to improve the gain and operating frequency range.	
CO2	Design single stage amplifier with various loads and analyze the various characteristic.	
CO3	Design and analyze the differential amplifier and Op-AMP with two stage &Cascade stage technique.	
CO4	Explain basics of switch capacitor anddesign layout of analog circuits.	

Course Name:Industrial Training/ CRT		Course Code:ET 1413
CO1	Write effectively in English.	
CO2	Analyze logically and critically on different issues.	
CO3	Solve quantitative problems effectively.	
CO4	Apply fundamentals of Electronics and Telecommunication for practical applications.	

Course Name:Project phase -I		Course Code:ET 1414
CO1	Identify, formulate and analyze complex engineering problems through literature survey.	
CO2	Apply knowledge to assess health, social, safety and environmental issues.	

CO3	Implement core /multidisciplinary/ industrybased electronics projects in cost effective manner.
CO4	Communicate technical details effectively

Fourth Year: Semester VIII:

Course Name: Antenna Theory & Design (T/P)	**Course Code:ET 1415/ ET 1416**
CO1	Evaluate various parameters of antennas.
CO2	Analyze performance parameters of various antennas & antenna array
CO3	Perform of antenna measurements by using different antenna measurement techniques.
CO4	Design and Analyze various antennas

Course Name:CMOS VLSI Design(T/P)	**Course Code:ET 1417/ ET 1418**
CO1	Analyze the characteristics of MOSFET
CO2	Analyze the voltage transfer characteristics of MOS inverters.
CO3	Apply the LAMBDA design rules for design of optimized CMOS circuits and describe the process of fabrication for CMOS circuits
CO4	Analyze switching characteristics and interconnection effects of MOS device
CO5	Design and analyze the combinational, sequential and advanced techniques in CMOS logic circuits

Course Name:PE IV : Power Electronics	**Course Code:ET 1419**
CO1	Describe and characterize power electronics devices
CO2	Describe and Analyze 3 Phase rectifier circuit.
CO3	Describe and Analyze converters, cycloconverters and inverters.
CO4	Explain protection circuits.

Course Name:PE IV : Wireless Mobile Communication Systems	**Course Code:ET 1420**
CO1	Describe the evolution of wireless systems & cellular standards.
CO2	Apply the concepts of frequency reuse for design of cellular systems and capacity improvement in cellular systems.
CO3	Quantify causes and effects of path loss and signal fading on received signal characteristics and use various techniques to improve signal quality and link performance.
CO4	Analyze GSM & CDMA systems & understand the fundamentals of wireless networking.

Course Name:PE IV : Satellite Communication & RADAR Engineering		Course Code:ET 1433
CO1	Explain satellite System and Services in propagation of satellite.	
CO2	Describe various systems in Earth Station	
CO3	Analyze the effect of weather conditions on Radar Systems.	
CO4	Describe and apply the Radar range equation and Doppler principle to detect moving targets and cluster.	

Course Name:PE IV : Display Technology		Course Code:ET 1437
CO1	Identify and describe different display technologies, manufacturing process and specifications of display technology.	
CO2	Explain and analyze properties of Luminescence materials	
CO3	Explain design parameters for displays and analyze matrix addressing.	
CO4	Explain backlight unit technologies and elaborate applications of displays.	

Course Name:PE IV : Biomedical Instrumentation		Course Code:ET 1434
CO1	Describe and analyze various parameters using ECG,EEG EMG and phonocardiograph.	
CO2	Describe and analyze various parameters such as -Blood Pressure, Blood flow rate, Pulse rate, Heart rate, respiration rate and temperature and hearing ability.	
CO3	Explain the working principle of radiology equipments	
CO4	Describe working principles of advanced medical imaging systems	

Course Name:PE V : Fuzzy Logic & Neural Networks (T/P)		Course Code:ET 1422/ET 1423
CO1	Analyze computing algorithms in Fuzzy logic and neural network.	
CO2	Describe neural network architecture and apply supervised/unsupervised algorithms for pattern recognition/classification problems.	
CO3	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.	
CO4	Prove and Apply fuzzy arithmetic operations and relations for problem solving.	
CO5	Apply Fuzzy implications and Design Fuzzy logic controller for solving real life problems.	

Course Name:PE V : RF Circuit Design (T/P)		Course Code:ET 1424/ET 1425
CO1	Apply the fundamentals of RF to design and analyze the RLC circuits at high frequency	
CO2	Design and analyze different bandwidth estimation techniques.	
CO3	Apply the knowledge of CMOS technology for design ofsupply independent bias circuit.	
CO4	Design and analyze the parameters of HF power amplifier circuits	
CO5	Describe and analyze Phase detectors.	

Course Name:PE V : Multimedia Communications(T/P)		Course Code:ET 1426/ ET 1427
CO1	Describe and compare different color models and file formats used for video and audio.	
CO2	Analyze and compare digital/ analog video signal and quantization techniques for digital audio signals.	
CO3	Apply different compression scheme used for image and video	
CO4	Describe and compare various multimedia networks communication protocols.	
CO5	Explain content based image retrieval techniques	

Course Name:PE V : Advances in Communication(T/P)		Course Code:ET 1435/ ET 1436
CO1	Apply the knowledge of switching technologies for digital telephony	
CO2	Describe digital subscriber & wireless local loop	
CO3	Apply the concept of random variables to characterize the signal behavior in communication.	
CO4	Apply the concept of density function to analyze the performance of communication system..	

Course Name:Project Phase-II		Course Code:ET 1428
CO1	Design and analyze application based electronic systems.	
CO2	Implement core / multidisciplinary / industrybased electronics projects in cost effective manner.	
CO3	Communicate technical details effectively	

CO M.Tech. Communication Engineering

ET3901–Mathematical Foundations for Communication Engineering

Course Objective	Course Outcome
The student should be able to	**The student will be able to**
1) Understand probability laws. 2) Understand concept of random variable and advanced density functions. 3) Learn various types of distributions and expectation. 4) Understand Random vectors and random processes.	1) Calculate probabilities by applying probability laws. 2) Derive probability distributions of functions of random variables. 3) Identify an appropriate probability distribution for a given discrete or continuous random variable. 4) Determine covariance and spectral density of stationary random processes.

ET3902 –Passive RF Circuits and Systems

Course Objective	Course Outcomes
Students should be able to	Students will be able to
1) Understand various transmission lines and its characteristics. 2) Study various microwave network models and passive components. 3) Learn various switches, phase shifters and MIC filters. 4) Understand various MMIC and MEMS technologies.	1) Analyze various transmission lines and its characteristics. 2) Analyze various microwave network models and passive components. 3) Apply the knowledge of various switches, phase shifters and MIC filters. 4) Explorevarious MMIC and MEMS technologies.

ET3903 –Lab: Passive RF Circuits and Systems

Course Objective	Course Outcomes
Students should be able to	Students will be able to
1) Understand various transmission lines and its characteristics. 2) Study various microwave network models and passive components. 3) Learn various switches, phase shifters and MIC filters. 4) Understand various MMIC and MEMS technologies.	1) Analyze various transmission lines and its characteristics. 2) Analyze various microwave network models and passive components. 3) Apply the knowledge of various switches, phase shifters and MIC filters. 4) Explore various MMIC and MEMS technologies.

ET3904 –Advanced Digital Communication

Course Objective	Course Outcomes
Students should be able to	Students will be able to
1) Learn Baseband representation, reception and probability of error 2) Understand the transmission errors in digital communication systems 3) Understand the concept of spread spectrum modulation, its types and applications. 4) Understand the practical applications of Multichannel and multicarrier communication systems	1) Distinguish various digital modulation techniques. 2) Analyze the probability of errors in digital communication systems. 3) Apply spread spectrum modulation for various applications of communication systems. 4) Distinguish Multichannel and multicarrier communication systems

ET3905 – Lab: Advanced Digital Communication

Course Objective	Course Outcomes
Students should be able to	Students will be able to
1) Learn Baseband representation, reception and probability of error 2) Understand the transmission errors in digital communication systems 3) Understand the concept of spread spectrum modulation, its types and applications.	1) Distinguish various digital modulation techniques. 2) Analyze the probability of errors in digital communication systems. 3) Apply spread spectrum modulation for various applications of communication systems.

4) Understand the practical applications of Multichannel and multicarrier communication systems	4) Distinguish Multichannel and multicarrier communication systems

ET3906 –Adaptive Signal Processing

Course Objective	**Course Outcomes**
Students should be able to	Students will be able to
1) Introduce the concept and need of wiener filters 2) Learn the fundamentals of adaptive filters and application e.g noise cancellation, interference cancelling etc. 3) Understand basic principles transform domainadaptive filters by using mathematical perspective. 4) Study adaptive signal processing algorithms (e.g., the LMS algorithm). 5) Study Recursive least squares algorithms & FTRLS algorithm.	1) Devise filtering solutions for optimising the cost function using wiener filters. 2) Analyse convergence and stability issues using LMS algorithm and its transform domain. 3) Evaluate the performance Recursive Least-Squares (RLS) techniques to improve convergence behaviour. 4) Devise filtering solutions for optimising using Kalman Filtering , Adaptive beam forming& FTRLS algorithm.

ET3907 – Lab: Adaptive Signal Processing

Course Objective	**Course Outcomes**
Students should be able to	Students will be able to
1) Introduce the concept and need of wiener filters 2) Learn the fundamentals of adaptive filters and application e.g noise cancellation, interference cancelling etc. 3) Understand basic principles transform domain adaptive filters by using mathematical perspective.	1) Devise filtering solutions for optimising the cost function using wiener filters. 2) Analyse convergence and stability issues using LMS algorithm and its transform domain. 3) Evaluate the performance Recursive Least-Squares (RLS) techniques to improve convergence behaviour.

4) Study adaptive signal processing algorithms (e.g., the LMS algorithm). 5) Study Recursive least squares algorithms & FTRLS algorithm.	4) Devise filtering solutions for optimising using Kalman Filtering , Adaptive beam forming& FTRLS algorithm.

ET3908 – PE I: Error Control Coding

Course Objective	**Course Outcomes**
Students should be able to 1. Understand the need for error correction in data communication and storage systems. 2. Understand numerical operations in finite fields by using both the exponential and polynomial representations of finite field elements. 3. Study an ability to compare and contrast the strengths and weaknesses of various errors correcting code for a given application. 4. Study different error correcting codes in digital communication system.	Students will be able to 1. Apply the knowledge of error correction in data communication and storage systems. 2. Analyze numerical operations in finite fields by using both the exponential and polynomial representations of finite field elements. 3. Analyze an ability to compare and contrast the strengths and weaknesses of various errors correcting code for a given application. 4. Demonstrate competence in analyzing and evaluating the practice of different error correcting coded in digital communication system.

ET3909 – PE I: Embedded Systems & DSP Processor

Course Objective	**Course Outcomes**
Students should be able to 1. Understand basics of embedded systems 2. Understand ARM processor architecture and instruction set 3. Understand basics of DSP processor 4. Understand architectural features and instruction set of C3X DSP processor	Students will be able to 1. Explore different technologies related to embedded systems 2. Effectively utilise the knowledge gained about ARM processor architecture and its instruction set for programming. 3. Explore basics of DSP processor architecture 4. Effectively utilise the knowledge gained about c3x DSP processor and its instruction set for programming

ET3910 – PE I: Pattern Recognition

Course Objective	Course Outcomes
Students should be able to 1) Equip students with basic mathematical and statistical techniques commonly used in pattern recognition. 2) Understand clustering and probability theory to handle uncertainty and solve engineering problems 3) Introduce to the various pattern recognition algorithms for a given problem.	Students will be able to 1) Identify and describe pattern recognition techniques and their roles in building intelligent machines 2) Recognize the feasibility of applying pattern recognition methodology for a particular problem in pattern classification and regression 3) Apply clustering and probability theory to handle uncertainty and solve engineering problems 4) Evaluate and compare solutions by various pattern recognition approaches for a given problem.

ET3911 – PE II: Multimedia Communications

Course Objective	Course Outcomes
Students should be able to 1) Understand basic concept of digital image representation 2) Learn basics of video and digital audio signal 3) Understand the concepts of image compression 4) Understand the concepts of video compression 5) Understand the concepts of audio compression	Students will be able to 1) Describe features of various image file formats and image data type 2) Explain characteristics of video signals like NTSC,PAL,SECAM Implement and describe various image compressiontechniques 3) Explain various video compression techniques 4) Explain various audio compression techniques

ET3912 – PE II: Active RF Devices and Circuits

Course Objective	Course Outcomes
Students should be able to 1) Understand active devices, and their modeling.	Students will be able to 1) Explain different types RF Diodes, Linear &Non linear Diode Models. 2) Design Two Port power gain, Amplifier Stability and for Specified Gain

2) Perform Amplifier Stability ,Stability Circle and Single stage amplifier design for specified gain. 3) An understanding amplifier design unilateral and bilateral cases and for maximum gain. 4) Learn detector and power amplifiers. 5) Understand theory and characteristics of mixer, oscillator, PLL.	3) Devise Characteristics and equivalent circuit of detector and power amplifier. 4) Perform measurements on mixer, Oscillator and PLL

ET3913 – PE II: Soft Computing

Course Objective	**Course Outcomes**
Students should be able 1) To have general understanding of soft computing methodologies including artificial neural networks, genetic algorithms, fuzzy sets and fuzzy logic systems. 2) To elaborates the basic concept of Genetic algorithm, genetic inheritance operator, the performance of algorithm and applications. 3) To introduce the fundamentals and explore the architecture of supervised and unsupervised neural networks. 4) To discuss the basic concept of fuzzy set theory and understand the hybrid architectures, fuzzy logic and fuzzy interface	Students will be able to 1) Identify and describe soft computing techniques and their roles in building intelligent machines 2) Recognize the feasibility of applying a soft computing methodology for a particular problem andApply genetic algorithms to optimization problems. 3) Identify supervised/unsupervised neural networks algorithms to solve pattern classification problems 4) Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems

II Semester

ET3915 –Advanced Antenna Theory

Course Objective	Course Outcome
The student should be able to	**The student will be able to**
1) Learn the basic principles and of antenna parameters. 2) Design and analyze antennas & Arrays. 3) Design and Analyze Planer antenna 4) Design &Analyze aperture, Reflector Antennas 5) Study different Smart antenna techniques	1) Evaluate various parameters of antennas. 2) Analyze performance parameters of various antennas & antenna array. 3) Understand smart antenna measurement techniques. 4) Design and analyze various antenna

ET3916 –Lab: Advanced Antenna Theory

Course Objective	Course Outcome
The student should be able to	**The student will be able to**
1) Learn the basic principles and of antenna parameters. 2) Design and analyze antennas & Arrays. 3) Design and Analyze Planer antenna 4) Design &Analyze aperture, Reflector Antennas 5) Study different Smart antenna techniques	1) Evaluate various parameters of antennas. 2) Analyze performance parameters of various antennas & antenna array. 3) Understand smart antenna measurement techniques. 4) Design and analyze various antenna

ET3917 –VLSI Signal Processing

Course Objective	Course Outcome
The student should be able	**The student will be able to**
1) To understand basic concepts of implementing DSP algorithms in VLSI circuits 2) To learn about the concept of pipelining and parallel processing in VLSI. 3) To understand the analysis of VLSI system with high speed and low power.	1) Design parallel and pipelining processing systems for speed, power and area optimization. 2) Implement the pipelined and parallel architectures using folding and unfolding techniques. 3) Analyse Systolic Design for Space Representations containing Delays

4) To equip the students with knowledge of Systolic Design for Space Representations containing Delays 5) To learn the algorithms for numeric and algorithmic strength reduction.	4) Apply algorithmic strength reduction techniques such as Fast Convolution algorithms and FDCT algorithms for increasing the speed of computation. 5) Design DSP algorithms with reduced numerical strength by subexpression sharing techniques.

ET3918- Digital Image Processing

Course Objective **The student should be able**	**Course Outcome** **The student will be able to**
1) Learn the fundamentals of digital image processing algorithms and filtering methods. 2) Study the performance of digital images in frequency domain. 3) Learn restoration, compression and segmentation of digital images through various algorithms 4) Understand the process of image representation and description	1) Apply basic image processing algorithms for image enhancement. 2) Interpret the digital images in frequency domain by using various transform techniques. 3) Understand noise models and degradation process for image restoration 4) Implement the algorithms for image compression and segmentation. Implement the algorithms for image representation and description

ET3918–Lab : Digital Image Processing

Course Objective **The student should be able**	**Course Outcome** **The student will be able to**
1) Learn the fundamentals of digital image processing algorithms and filtering methods. 2) Study the performance of digital images in frequency domain. 3) Learn restoration, compression and segmentation of digital images through various algorithms 4) Understand the process of image representation and description	1) Apply basic image processing algorithms for image enhancement. 2) Interpret the digital images in frequency domain by using various transform techniques. 3) Understand noise models and degradation process for image restoration 4) Implement the algorithms for image compression and segmentation. Implement the algorithms for image representation and description

ET3920 –Wireless Communications & Networks

Course Objective	Course Outcome
The student should be able to	**The student will be able to**
1) Understand the concept of radio propagation , fading and different techniques to improve signalquality and link performance. 2) Understand various Multicarrier Modulation and Multiple access techniques for wireless communication 3) Learn Wireless Systems and Standards 4) Know various generations of mobile communication systems	1) Quantify causes and effects of path loss and signal fading on received signal characteristic and used various technique to improve signal quality and link performance. 2) Analyze various Multicarrier Modulation and Multiple access techniques for wireless communication 3) Analyze GSM & CDMA systems andunderstand the fundamentals of wireless networking. 4) Elaborate and compare various generations of mobile communication systems

ET3921 –PE III: Selected Topics in Communication Systems

Course Objective	Course Outcome
The student should be able to	**The student will be able to**
1) Make the students understand the fundamentals physical modeling of channels in free space along with time varying systems. 2) Understand the working of time diversity detection in a Rayleigh fading channel and to analyze orthogonal frequency division multiplexing. 3) Understand the modeling of MIMO,SIMO,MISO along with time varying channels and selective fading. 4) Understand and compare parallel and scalar channels.	1) Understand and design physical modeling of channels in free space along with time varying systems. 2) Compare and analyze Non-coherent and Coherent detection Time diversity. 3) Elaborate key features of various standards related to modeling of MIMO,SIMO,MISO 4) Understand and analyze V-BLAST and D-BLAST architecture 5) Design and understand multiplexing tradeoff - Universal code design for scalar channels, parallel channels

ET3922 –PE III: Speech Processing

Course Objective	Course Outcome
The student should be able to	**The student will be able to**
1) Learn speech production mechanism. 2) Understand time and frequency domain method for speech processing. 3) Learn linear predictive coding analysis of speech. 4) Understand various speech and speaker recognition methods.	1) Identify digital speech productionmodel. 2) Process speech using time and frequency domain method. 3) Analyze speech by linear predictive coding method. 4) Recognize speech and speaker.

ET3924 –PE III: Real Time Operating System

Course Objective	Course Outcome
The student should be able to	**The student will be able to**
1) Understand real time systems with reference model 2) Know functional parameters, resources and scheduling. 3) Study Faults and error containment. 4) Learn Memory management and I/O system process management.	1) Analyzethevarious real time systems with reference model 2) Discuss the various functional parameters , resources and scheduling. 3) Detect multiple Faults and reduce error containment. 4) Explore the various Memory management and Input/Output system process management

ET3925 –PE IV: High Speed Networks

Course Objective	Course Outcome
The student should be able to	**The student will be able to**
1) Understand different networks and network topologies	1) analyze different networks and network topologies

2) Know protocols used in high speed networks 3) Study Network design issues 4) Study optical sensors and Networks	2) Compare different protocols used in high speed networks 3) Solve Network design issues 4) Compare optical sensors and Networks

ET3926 –PE IV: Wireless Sensor Networks

Course Objective **The student should be able to**	**Course Outcome** **The student will be able to**
1) To Understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology 2) Understand the medium access control protocols and address physical layer issues 3) Learn key routing protocols for sensor networks and main design issues 4) Learn transport layer protocols for sensor networks, and design requirements 5) Understand the Sensor management, sensor network middleware, operating systems.	1) Understand and explain common wireless sensor node architectures. 2) Carry out simple analysis and planning of WSNs. 3) Demonstrate knowledge of MAC protocols developed for WSN. 4) Demonstrate knowledge of routing protocols developed for WSN. 5) Understand and explain mobile data-centric networking principles. 6) Be familiar with WSN standards.

ET3928 –Seminar

Course Objective **The student should be able to**	**Course Outcome** **The student will be able to**
1) Gain profound knowledge about English language. . 2) Learn logical and critical reasoning skills 3) Know mathematical formulae for quantitative reasoning 4) Acquire sound technical knowledge	1) Write effectively in English. 2) Analyze logically and critically on different issues. 3) Solve quantitative problems effectively. 4) Apply fundamentals of Electronics and Telecommunication for practical applications.

III Semester

ET3939 - Project Phase-I

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students the academic environment to carry out literature survey of advanced topics in structural engineering 2. To motivate the students to use the modern tools and software. 3. To provide the students the understanding of various aspects like effective communication skills, working independently and in a team and the importance of lifelong learning etc. to carry out project.	1. An ability to understand the advances in structural engineering. 2. An ability to understand the use of modern tools. 3. An ability to work independently and in a team for effective communication 4. An ability to understand the importance of lifelong learning.

IV Semester

ET3940 - Project Phase-II

COURSE OBJECTIVE	COURSE OUTCOMES
1. To provide the students the academic environment to carry out literature survey of advanced topics in structural engineering. 2. To provide the students the understanding of real world structural engineering problems and their solution. 3. To motivate the students to use the modern tools and software. 4. To provide the students the understanding of various aspects like effective communication skills, working independently and in a team and the importance of lifelong learning etc. to carry out project.	1. An ability to understand the advances in structural engineering. 2. An ability to solve real world structural engineering problems. 3. An ability to understand the importance of lifelong learning and the use of modern tools. 4. An ability to work independently and in a team for effective communication.

B.E. – Computer Technology

Vision of the Department
To be a well-known center for pursuing computer education through innovative pedagogy, value-based education and industry collaboration.

Mission of the Department To establish learning ambience for ushering in computer engineering professionals in core and multidisciplinary arena by developing problem-solving skills through emerging technologies.

Program Educational Objectives of the program (PEO)

PEO1 **Preparation:** To prepare students to succeed in employment/profession and/or to pursue post graduate and research educations in Computer Technology discipline in particular and allied engineering disciplines in general. (**Preparation**)

PEO2 **Core Competence:** To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to formulate, analyse and solve engineering problems requiring knowledge of Computer Technology. (**Core Competence**)

PEO3 **Breadth:** To prepare students with engineering breadth to innovate, design, develop software products and to contribute in providing solutions related to multidisciplinary real life problems. (**Breadth**)

PEO4 **Professionalism:** To inculcate in students professional and ethical attitude, effective communication skills and teamwork to become a successful professional. (**Professionalism**)

PEO5 **Learning Environment:** To provide students with an academic environment that makes them aware of excellence and life-long learning in emerging technologies. (**Learning Environment**)

Program Outcomes(PO)

PO1 **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problems.

PO2 **Problem analysis**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO4 **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling to complex engineering activities, with an understanding of the limitations.

PO6 **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication**: Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 **Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program specific Outcomes(PSO)

PSO1 An ability to acquire skills to design & develop quality software using cutting-edge technologies of Computer Engineering.

PSO2 An ability to use knowledge of various domains as per thrust areas to formulate and implement ideas for providing innovative solutions.

Program Educational Objectives (PEOs) of M. Tech. (CSE)

PEO1 To prepare students to succeed in employment/profession and/or to pursue doctoral research in Computer Science discipline.(***Preparation***).

PEO2 To provide students with scholarly knowledge to innovate, design, analyze, develop engineering problems related to Computer Science and to contribute in providing solutions to multidisciplinary real life problems (**Core &*Breadth***).

PEO3 To inculcate in students professional and ethical attitude, effective communication skills and teamwork to become a successful professional (***Professionalism***).

PEO4 To provide students with an academic environment that makes them aware of excellence and life-long learning in emerging technologies (***Learning Environment***).

Program outcomes (POs)of M. Tech. (CSE)After successful completion of M.tech Program, Students will have an ability to :

PO1 Demonstrate in depth knowledge of computer hardware and software.

PO2 Think critically to identify, conceive, design, analyze and solve complex engineering problems in the area of computer science and allied fields.

PO3 Carry out research work with independent and introspective learning and to get associated with multidisciplinary team.

PO4 Communicate effectively and acquire professional, ethical and responsible attitude towards sustainable development of the society.

PO5 Accept and adapt to the technological changes for lifelong learning with enthusiasm and commitment to improve knowledge and competence continuously.

PO6 Demonstrate capacity for self-management, decision making, project & finance management to achieve common goals.

PO7 Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Yeshwantrao Chavan College of Engineering, Nagpur

PO/PSO and COs of all courses of the UG Programme

Name of the Department: Computer Technology

Name of the UG Programme: B.E. in Computer Technology

Course Outcomes (CO)

First Year: Semester I:

Course Name: Engineering Mathematics-I (T)	**Course Code:GE-2101**
GE-2101 CO-1	Apply the knowledge of differentiation to develop the Mathematical equations and compute geometrical measures
GE-2101 CO-2	Determine the expansion and derivatives of functions of Multiple variables and use it to find extreme values of functions.
GE-2101 CO-3	Evaluate the integrals of single, multiple variables and use it to measure the dimensions of various geometrical figures.
GE-2101 CO-4	Discuss Calculus of Scalar and vector point function and use appropriate theorems to evaluate integrals of functions of single, multiple variables.

Course Name: Engineering Mathematics-II (T)	**Course Code:GE-2102**
GE-2102 CO-1	Use appropriate Methods to solve first order and higher order differential equations and apply it to find solutions of engineering problems
GE-2102 CO-2	Analyze the functions of complex numbers and variables, prove Mathematical equations and evaluate the complex integrals
GE-2102 CO-3	Use Matrix method to solve linear equations, evaluate eigen values - eigen vectors and its applications.
GE-2102 CO-4	Measure the statistical parameters and derive the equations of best fit curves

Course Name: Communication Skill (T)	**Course Code:GE-2107**
GE-2107 CO-1	Explain the basics of communication process as well as identify the barriers in communication.
GE-2107 CO-2	Classify and describe the different Speech Sounds of English Language.
GE-2107 CO-3	Apply different strategies and techniques of presentations, interviews and group communication.
GE-2107 CO-4	Drafting reports, memos and emails, considering the professional etiquettes and ethics with appropriate content and context.

Course Name:Social Science (T)	Course Code:GE-2108
GE-2108 CO-1	Explain the basic concepts of Social Sciences.
GE-2108 CO-2	Describe the development of various Civilizations and their Culture.
GE-2108 CO-3	Analyze the Impact of Industrialization on society and discuss the Fundamental Concepts of Society.
GE-2108 CO-4	Explain Industrial Organization and Management.

Course Name:Engineering Physics Course Name: Engineering Physics (Lab.) (T/P)	Course Code:GE-2105 and GE 2106
GE 2105 & GE2106 CO1	Examine the intensity variation of light due to interference, diffraction and its applications.
GE 2105 CO2	Explain fundamentals of quantum mechanics and its application to problems dealing with quantum particle.
GE 2105 & GE2106 CO3	Develop ability to classify and analyze the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands for device applications.
GE 2105 & GE2106 CO4	Analyze the motion of charged particle in electric and magnetic fields and its applications to electron optic devices.
GE 2105 & GE2106 CO1	Illustrate working principle of lasers, ultrasonic waves and its properties for useful applications in the field of industry.

Course Name:Engineering Chemistry /Engineering Chemistry (Lab.) (T/P)	Course Code:GE2103 and GE 2104
GE2103 and GE 2104 CO1	Assess qualitative and quantitative aspects of water as a conventional material for industrial and domestic applications.
GE2103 and GE 2104 CO2	Apply the knowledge of basic electrochemistry to understand battery technology, corrosion process and preventive techniques.
GE2103 and GE 2104 CO3	Know the basics and assess analytical aspects of industrial materials like fuels and lubricants for efficient utilization.
GE2103 and GE 2104 CO4	Recognize the significance of cement and advanced engineering materials in technological applications.
GE2103 and GE 2104 CO5	Analyze and generate analytical and instrumental techniques.

Course Name: Engineering Mechanics/ Engineering Mechanics (Lab.) (T/P)	Course Code:CV2101/ CV2102
CV-2101- CO 1	An ability to apply the concept of applied mechanics and can solve problems on planar force system for friction as well as frictionless surfaces.
CV-2101- CO 2	An ability to analyze pin jointed truss frame structure and beam structure analytically and graphic
CV-2101- CO 3	An ability to understand centroid, moment of inertia, product of inertia and mass moment of inertia and can find properties of surfaces.
CV-210- 1CO 4	An ability to determine the dynamic variables of moving body, understand working principle of simple lifting machine.

Course Name: Basic Electronics (T)	Course Code:EE 2101
EE 2101CO1	Characterize Number systems, semiconductors, diodes, transistors and operational amplifiers.
EE 2101CO2	Design simple analog circuits.
EE 2101CO3	Design simple combinational and sequential logic circuits
EE 2101CO4	Identify functions of digital multimeter, Bridges and transducers in the measurement of physical variables

Course Name:introduction to Computer Programming/ Introduction to Computer Programming (Lab.) (T/P)	Course Code:IT2101 Course Code: IT-2102
IT2101, IT2102 CO1	Understand computer system, basics of algorithm & flowchart, and demonstrate straight line program using basic 'C' programming language constructs.
IT2101 IT2102 CO2	Design & Develop programs using different loop control structures, user defined functions, and Pointers.
IT2101 IT2102 CO3	Analyze and apply concepts of different dimensional Arrays as a data structure & development of programs using the same.
IT2101 IT2102 CO4	Design and develop programs using basics of Strings, Structures, union and Files in 'C' language.

Course Name: Electrical Engineering / Electrical Engineering Lab (T/P)	Course Code:EL 2101/ EL-2102 (Lab.)
EL 2101 & EL 2102- CO-1	Reproduce fundamentals of dc circuits, single phase, and three phase ac circuits.
EL 2101 & EL 2102- CO-2	Analyse dc circuits, single phase and three phase ac circuits for basic electrical quantities such as current, voltage, power etc.
EL 2101 & EL 2102- CO-3	Explain construction, working, testing, and applications of various electrical machines.
EL 2101 & EL 2102- CO-4	Analyse performance of various electrical machines.
EL 2101 & EL 2102- CO-5	Perform laboratory experiments and demonstrate competency in collecting, interpreting, analysing data,

	communicate and present effectively through laboratory journals.

Course Name: Engineering Graphics/ Engineering Graphics Lab (T/P)	**Course Code:ME2101/ME-2102**
ME2101 ME-2102 CO1	Transform orthographic projections into isometric projections and vice versa.
ME2101 ME-2102 CO2	Evaluate Projections of various One Dimensional, Two dimensional, Three dimensional objects.
ME2101 ME-2102 CO3	Built the development of lateral surfaces of various solids and their cut section.
ME2101 ME-2102 CO4	Predict the intersections and intersections of various solid objects.
ME2101 ME-210 2CO5	Justify the use of software tools used for Two dimensional drawings.

Course Name: Workshop Practice (P)	**Course Code: ME 2103**
CO1	Understand the carpentry tools, joints, machineries and its applications
CO2	Understand the fitting tools, measuring instruments, machineries and its applications
CO3	Understand the smithy tools furnaces and hand and power forging equipment's
CO4	Understand Gas and Electric welding processes, utility, tools and its applications

Second Year: Semester III:

Course Name:Data Structures/ Data Structures Lab(T/P)	**Course Code:**CT2204/CT2205
CO1	Identify programming constructs needed to solve real world problems.
CO2	Implement programming logic needed for solving given problem.
CO3	To elaborate various abstract data types through implementation.
CO4	To summarize various file handling mechanism

Course Name:Object Oriented Programming/ Object Oriented Programming Lab(T/P)	**Course Code:CT2202/CT2203**
CO1	Reveal the knowledge of basic concepts of object-oriented programming and modelling of the problem in terms of classes
CO2	Apply the concepts of object-oriented concepts like encapsulation, inheritance, polymorphism, and abstraction to the specific problem.
CO3	Use the knowledge of I/O stream and generic components in the object oriented programming
CO4	Formulate the standardized event driven solution for the real life scenarios

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Course Name:Python Programming Lab(P)	**Course Code:CT2206**
CO1	Select suitable framework for python programs as per requirement of application
CO2	Select suitable data structures and control statements

CO3	Demonstrate use of file handling and concepts of classes and objects
CO4	Develop advanced applications using functionalities provided under various packages of python

Course Name:Web Technology Laboratory (P)	**Course Code:CT2207**
CO1	Illustrate various internet technologies
CO2	Design the web pages using some basic techniques
CO3	Implement the XML technology to store the data
CO4	Develop the interactive web pages using the advanced technique

Course Name:Engineering Mathematics-III (T)	**Course Code:GE1201**
CO1	Estimate the Calculus of Numerical Function.
CO2	Determine the transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations.
CO3	Discuss the nature of periodic function and express it in terms of series.
CO4	Use appropriate method/s to solve partial differential equations.

Course Name:Computer Architecture & Organization (T)	**Course Code: CT-2201**
CO1	Relate & Identify the function and design of the various units of computers that process data and store the information.
CO2	Analyze and write control signal for executing machine instructions for different processors.
CO3	Explain & Design the organization of memory, memory hierarchy, other peripheral devices, and estimate the cost of computation.
CO4	Compare among different types of I/O operation

Second Year: Semester IV:

Course Name:Database Management Systems/ Database Management Systems Lab(T/P)	**Course Code:CT2257/CT2258**
CO1	Analyze & compare different levels of abstraction & data independence.
CO2	Design Entity Relationship Diagram for any scenario.
CO3	Solve queries based on relational algebra & SQL.
CO4	Identify functional dependencies & normalize the database and apply ACID properties.
CO5	Analyze transaction management, various concurrency control protocols and crash recovery methods.

Course Name:Mathematical Foundations for Data Analysis/ Mathematical Foundations for Data Analysis Lab (T/P)	**Course Code:CT-2255/CT-2256**
CO1	Find the hidden meaning from the given data and visualize the results
CO2	Solve the real-life problem using the probability theory and use it for decision making
CO3	Analyze the samples from the population and solve the problem to get predictive

	solution using the estimation theory
CO4	Apply the sample data and use it to test the assumptions made for the population parameter

Course Name: Operating Systems/ Operating Systems Lab (T/P)	**Course Code:CT2251/CT2252**
CO1	Demonstrate different OS & its services.
CO2	Apply & make use of different CPU scheduling algorithm & different ways to synchronize the process.
CO3	Compare different methods to handle deadlock.
CO4	Analyze various memory management techniques.
CO5	Choose various disk scheduling algorithms based on their performances.

Course Name: Discrete Mathematics & Graph Theory (T)	**Course Code:GE1206**
CO1	Explain the basic concept of classical sets, fuzzy sets, Relations, functions and logical methods.
CO2	Identify the nature of different algebraic structures such as Group, Ring, field
CO3	Analyze the graphs and spanning of trees
CO4	Determine the probability, Expectations of functions of two random variables

Course Name: Fundamental of Economics (T)	**Course Code:GE1312**
CO1	Recognizes consumer's behaviour and pricing
CO2	Extrapolates an operations in market with productions constrain.
CO3	Describes the national income accounting and public finance.
CO4	Interprets international trade and institutions.

Course Name:Advanced Data Structures / Advanced Data Structures Lab (T/P)	**Course Code:CT-2253CT-2254**
CO1	Implement the concept of linked list, skip lists, disjoint sets, trees, graph data structures for real world problem
CO2	Design suitable hash function for given data set
CO3	Perform different operations on multidimensional trees
CO4	Select appropriate data structure for implementation of real world applications

Third Year: Semester V:

Course Name: Introduction to Geographical Information System/ Introduction to Geographical Information System Lab(T/P)	**Course Code:CT2317/CT2318**
CO1	Demonstrate the fundamental concepts of GIS
CO2	Develop the apprehension of various concepts in GIS
CO3	Design and share maps

Course Name: Soft Computing(T)	**Course Code: CTCT2331**
CO1	Reveal different applications of soft computing to solve problems from different domains.

CO2	Demonstrate Fuzzy logic and its applications.
CO3	Explain Rough Set theory and its usage as soft computing.
CO4	Relate single-objective optimization problems using GAs.
CO5	Describe Artificial neural networks and its applications

Course Name:Advanced Web Technologies/ Advanced Web Technologies Lab(T/P)	**Course Code:CT2315**
CO1	Design Web pages using HTML5, CSS3
CO2	Perform various operations using AJAX
CO3	Use features of Client side programming
CO4	Develop Web pages using JavaScript

Course Name: Computer Graphics/ Computer GraphicsLab(T/P)	**Course Code: CT2319 /CT2320**
CO1	Draw lines and polygons and fill polygons using basic graphics functions
CO2	Select proper imaging technology to be used for image creation
CO3	Handle interactive software with images & text
CO4	Develop animated programs for various applications.

Course Name:Image Processing(T)	**Course Code:CT2327**
CO1	Describe basic relationships between pixels.
CO2	Compare various image enhancement techniques in spatial domain and frequency domain.
CO3	Illustrate different image compression techniques to understand the advantage of image compression
CO4	Demonstrate the applications of similarity based and dissimilarity-based approaches for image segmentation.
CO5	Interpret various representation techniques.

Course Name:Current Trends and Technologies(T)	**Course Code:CT2335**
CO1	Use the basics of internet for deployment of various servers and recourses.
CO2	Design and implement technologies for e-Commerce and e-Learning
CO3	Choose appropriate implementation of Green Computing.
CO4	Make use of Social Networking properly and securely.

Course Name:Multimedia and Animation(T)	**Course Code:CT2334**
CO1	To understand multimedia basics - hardware and software.
CO2	To develop skills in design, illustration, image manipulation, graphic designing, video editing, visual effects and game designing.
CO3	To develop the skills in Animation software.

Course Name:Operating System Concepts(T)	**Course Code: CT2328**
CO1	Use LINUX operating system.
CO2	Write Shell scripts

Course Name:Privacy and Security in Online Social Networks/ Privacy and Security in Online Social Networks Lab(T/P)		Course Code:CT2323/CT2324
CO1	Collect online social networking data using different tools and API's.	
CO2	Review privacy and policies in social media.	
CO3	Categorize e Crimes and Attacks in OSM.	
CO4	Link profiles of user on OSM.	

Course Name:Theoretical Foundation of Computer Science(T)		Course Code:CT2303
CO1	Construct automata, regular expression for any pattern.	
CO2	Write context free grammar for various languages.	
CO3	Design push down automata and Turing Machine for a language.	
CO4	Derive whether a problem is decidable or not.	

Course Name:Randomized Algorithms(T)		Course Code:CT2311
CO1	Apply basic concepts of probability calculus in algorithmic context.	
CO2	Derive good upper bounds for the expected running time of simple randomized algorithms.	
CO3	Design simple randomized algorithms that run fast or that return the correct output with high probability.	
CO4	Apply the probabilistic method to show the existence of certain combinatorial objects.	

Course Name:Software Testing(T)		Course Code:CT2332
CO1	Formulate problem by following Software testing life cycle.	
CO2	Design Manual Test cases for Software testing approaches.	
CO3	Demonstrate utilization of testing automation though testing tool.	
Course Name: Computer Networks/ Computer Networks Lab(T/P)		**Course Code: CT2301/CT2302**
CO1	Identify appropriate design issues and explain network reference model.	
CO2	Select appropriate protocol at various layers for the given application.	
CO3	Solve problems in the networking domain.	
CO4	Analyze the performance of network using different tools	

Course Name: Mobile Operating Systems/ Mobile Operating Systems Lab(T/P)		Course Code: CT2313/CT2314
CO1	Compare different flavours of mobile operating system and their specific features.	
CO2	Create an application using different controls.	
CO3	Prepare a project which can manage data and can communicate with native application	
CO4	Publish the designed applicationwhich can handle multiple devices with different configurations.	

Course Name: Industry Visit and Report(P)		Course Code: CT2310
CO1	Demonstrate the applications of IT concepts and principles learned in classroom.	

CO2	Illustrate Services and products developed in the IT industries.
CO3	Improve interpersonal skill by communicating directly with industrial personnel.
CO4	Aware of the roles and ethics of Software engineers in related industries.

Third Year: Semester VI:

Course Name: Business Intelligence and its Application/ Business Intelligence and its Application Lab(T/P)	**Course Code: CT1349/CT 1350**
CO1	Reveal the knowledge of basic concepts of Business Intelligence and multidimensional modelling and able to compare digital data types.
CO2	Build and operate the multidimensional data model for the specific scenario extract the information.
CO3	Analyze the business information to construct the reports from it.
CO4	Decide the mode / channel to implement the business intelligence solution for the specific problem.

Course Name: Current Trends and Technologies(T)	**Course Code: CT1352**
CO1	Use the basics of internet for deployment of various servers and recourses.
CO2	Design and implement technologies for e-Commerce and e-Learning
CO3	Choose appropriate implementation of Green Computing.
CO4	Make use of Social Networking properly and securely.

Course Name: Digital Image Processing/ Digital Image Processing (T/P)	**Course Code: CT2361/CT2362**
CO1	Describe Basic relationships between pixels.
CO2	Compare various image enhancement techniques in spatial domain and frequency domain.
CO3	Illustrate different image compression techniques to understand the advantage of image compression
CO4	Demonstrate the applications of similarity based and dissimilarity-based approaches for image segmentation.
CO5	Interpret various representation techniques.

Course Name: Essentials of IT (T)	**Course Code: CT2372**
CO1	Develop algorithm and write pseudo code for a given problem statement.
CO2	Construct Entity-Relationship Model and design RDBMS for a given problem statement.
CO3	Design static and dynamic web pages using HTML and Javascript and write simple programs in Javascript.
CO4	Apply software engineering concepts in any software project implementation.

Course Name:Customer Relationship Management(T)	**Course Code:CT1359**
CO1	Apply the knowledge of customer-centred organization and implement the integral processes within an organization that are automated to relate predictability and efficiencies.

CO2	Design a customized CRM application for organization to suit their business needs.
CO3	Analyze the result of developed CRM application from various perspectives for implementing it.

Course Name:Introduction to Natural Language Processing (T)		**Course Code:CT-2367**
CO1	Describe linguistic phenomena with formal grammars.	
CO2	Illustrate and test algorithms for NLP problems	
CO3	Examine NLP applications	
CO4	Devise real world NLP applications using NLP techniques	

Course Name:Internet Technology(T)	**Course Code:CT2383**
CO1	Describe the basic concepts for network implementation.
CO2	Comprehend the technologies and effectively deal with programming issues relating to web page creation
CO3	Figure out the various security hazards on the Internet and need of security measures.

Course Name:Internet of Things (T)	**Course Code:CT2363**
CO1	Develop various IOT environments.
CO2	Demonstrate IOT architecture and its enabling technologies.
CO3	Analyze IOT environments using various communication technologies.
CO4	Apply various IOT enabling technologies for creation of IOT environments.

Course Name:Image Processing (T)	**Course Code:CT2323**
CO1	Describe basic relationships between pixels.
CO2	Compare various image enhancement techniques in spatial domain and frequency domain.
CO3	Illustrate different image compression techniques to understand the advantage of image compression
CO4	Demonstrate the applications of similarity based and dissimilarity-based approaches for image segmentation.
CO5	Interpret various representation techniques.

Course Name: Language Processors/ Language Processors Lab(T/P)	**Course Code:CT2353/CT 2354**
CO1	Design lexical analyzer using FLEX tool.
CO2	Implement syntax analyzer using YACC tool.
CO3	Create a syntax-directed definition and an annotated parse tree.
CO4	Demonstrate the use of a symbol table throughout compilation.
CO5	Apply various code optimizing transformations and code generation techniques.

Course Name: Software Engineering / Software Engineering (Lab)(T/P)		**Course Code:CT1345/ CT1346**
CO1	Choose appropriate software engineering process model, requirement engineering principles and software designing fundamentals for a given project.	

CO2	Select appropriate testing strategy and apply testing principles for testing a given application.
CO3	Apply basics of software configuration management, version control and change control in software development.
CO4	Evaluate cost estimation, effort and severity of software risk for given application.
CO5	Perform basic operations on Sub-version for software version control.

Course Name:Design & Analysis of Algorithms/ Design & Analysis of Algorithms Lab(T/P)	**Course Code:CT2351/ CT2352**
CO1	Compare different types of asymptotic notations and find the time complexity in terms of asymptotic notations
CO2	Solve recurrences using various techniques.
CO3	Implement divide and conquer strategy, greedy strategy, dynamic programming algorithms and backtracking strategy
CO4	Identify and differentiate between various types of complexity classes.

Course Name:Soft Computing (T)	**Course Code: CT2381**
CO1	Reveal different applications of soft computing to solve problems from different domains
CO2	Demonstrate Fuzzy logic and its applications
CO3	Explain Rough Set theory and its usage as soft computing
CO4	Relate single-objective optimization problems using GAs.
CO5	Describe Artificial neural networks and its applications

Course Name:Software Testing (T)	**Course Code: CT2382**
CO1	Formulate problem by following Software testing life cycle.
CO2	Design Manual Test cases for Software testing approaches.
CO3	Demonstrate utilization of testing automation though testing tool.

Course Name:Mini Project(P)	**Course Code:CT1329**
CO1	Choose and implement the problem definition using advanced tools
CO2	Compare and contrast the results with existing techniques
CO3	Demonstrate the implemented idea with suitable presentation methods

Fourth Year: Semester VII:

Course Name:Machine Learning Techniques (T)	**Course Code:CT1454**
CO1	Interpret machine learning techniques suitable for a given problem
CO2	Apply machine learning techniques to solve the problems
CO3	Design application using machine learning techniques
CO4	Evaluate different machine learning techniques

Course Name: Ad-hocWirelessNetwork(T)	**Course Code: CT 1407**
CO1	Compare the differences between cellular and ad hoc networks and identify the

	design issues at various layers.
CO2	Summarize the protocols used at different layers of Adhoc network. Also compare the different protocols in each category.
CO3	Identify the various types of attack in ad hoc network.
CO4	Classify QoS approaches and Identify the need of energy management in ad hoc network.

Course Name: Cloud Computing(T)	**Course Code: CT1408**
CO1	Explain software and hardware support for enterprise and cloud computing.
CO2	Perform data modelling for enterprise and cloud knowledge bases.
CO3	Design enterprise and cloud software applications.
CO4	Implement and run distributed and cloud applications.
CO5	Ensure security and privacy in enterprise and cloud application while implementing cloud applications methodologies.

Course Name: Project Phase I(P)	**Course Code: CT 1414**
CO1	Identify real life technical problem, conduct literature survey, and find limitations in existing solutions to address societal and industrial concerns.
CO2	Analyze the problem and identify suitable tools and technologies for finding solution to the problem.
CO3	Communicate proposed solution effectively with proper presentation methods.

Course Name: Network Security(T)	**Course Code: CT1415**
CO1	Identify threats to network security, associated attacks and countermeasures against attack.
CO2	Use appropriate mathematical techniques in cryptography.
CO3	Apply various algorithms/ mechanisms to formulate appropriate solution.
CO4	Use of different security protocols at various networking layers.

Course Name: Probabilistic Statistical Analysis(T)	**Course Code: CT1453**
CO1	Reveal the hidden meaning in the data by applying some basic statistical formulae and probability distribution concepts using the tool 'R'
CO2	Employ the sampling techniques to find the estimates and test its validity using hypotheses testing.
CO3	Analyze and compare sample data to make inference about the population data.
CO4	Design and implement the predictive model using simple and multiple regression technique

Course Name: Neural Network & Fuzzy Logic(T)	**Course Code: CT1406**
CO1	Illustrate the fundamentals of Biological Neural Network and Artificial Neural Network with its working
CO2	Develop the solution for problem based on ANN using feed forward and Feed backward architecture
CO3	Comprehend the various concepts of fuzziness involved in fuzzy set theory and solve the problems based on it

CO4	Formulate fuzzy inference system using fuzzification and defuzzyfication methods

Course Name: Parallel Computing(T)	**Course Code: CT1437**
CO1	Identify areas where parallel computing is applicable
CO2	Implement parallel version of different algorithms using thread programming and OpenMP
CO3	Find the speedup factor by analyzing parallel programs
CO4	Develop real life applications using parallel programming

Course Name: Artificial Intelligence/ Artificial Intelligence Lab (T/P)	**Course Code: CT1451/CT 1452**
CO1	Describe different concepts of AI, and illustrate working of different types of intelligent agents and co-relate them in real life.
CO2	Differentiate between searching algorithms and apply appropriate algorithm to solve real life problems as well as in gaming domain
CO3	Select appropriate knowledge representation technique to represent real life facts
CO4	Demonstratethe working knowledge of reasoning in the presence of incomplete and/or uncertain information.
CO5	Analyze learning approaches and recall AI basics for expert system.

Course Name: Fundamentals of Parallel Computing(T)	**Course Code: CT1457**
CO1	Identify areas where parallel computing is applicable
CO2	Implement parallel version of different algorithms using thread programming and openMp
CO3	Find the speedup factor by analyzing parallel programs
CO4	Develop real life applications using parallel programming

Course Name: Student Training(P)	**Course Code: CT1413**
CO1	Infer the Knowledge about current trends in industry
CO2	Deliver Technical presentation
CO3	Communicate effectively
CO4	Simplify and Evaluate on the basis of question /answer.

Course Name:Project Phase I(P)	**Course Code:CT 1414**
CO1	Identify real life technical problem, conduct literature survey, and find limitations in existing solutions to address societal and industrial concerns.
CO2	Analyze the problem and identify suitable tools and technologies for finding solution to the problem.
CO3	Communicate proposed solution effectively with proper presentation methods.

Fourth Year: Semester VIII:

Course Name:Cyber Forensics/ Cyber Forensics Lab(T/P)	**Course Code:CT1455/CT1456**
CO1	Investigate hardware parts of a computer system for evidences.
CO2	Use different tools for data acquisition and duplication for forensic study.
CO3	Securely store data and evidence collected.

CO4	Create report of forensic investigation made.

Course Name:Numerical Computing/ Numerical Computing Lab(T/P)		**Course Code:CT1445/CT1446**
CO1	Apply appropriate formula to find different types of error in numerical computation and mitigate it.	
CO2	Choose and apply appropriate numerical techniques for problem solving interpret the results and assess accuracy	
CO3	Apply appropriate techniques for numerical integration.	
CO4	Demonstrate basics of conditioning of problems and stability of numerical algorithms	

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Course Name:Digital Image Processing/ Digital Image Processing(Lab) (T/P)		**Course Code:CT1418/CT1419**
CO1	Describe Basic relationships between pixels.	
CO2	Compare various image enhancement techniques in spatial domain and frequency domain.	
CO3	Illustrate different image compression techniques to understand the advantage of image compression	
CO4	Demonstrate the applications of similarity based and dissimilarity-based approaches for image segmentation.	
	Interpret various representation techniques.	

Course Name: Introduction to Internet of Things / Introduction to Internet of Things Lab(T/P)		**Course Code: CT1458/CT1459**
CO1	Design and evaluate various IOT environments.	
CO2	Describe IOT architecture and its enabling technologies.	
CO3	Analysis IOT environments using various communication technologies.	
CO4	Apply various IOT enabling technologies for creation of IOTenvironments	

Course Name: Cyber Laws(T)		**Course Code: GE1408**
CO1	Summarize the laws governing the national/international cyber space, IT Act scope and applications against Cyber Crimes, Data privacy and security (Act & Audits)	
CO2	Outline the importance of digital evidence/licensing regulations and develop a implementation strategy through legal provisions through computer crime investigations	
CO3	Summarize offences and penalties for cybercrimes under IT Act through case studies.	
CO4	Outline implications of cyber laws on issues related to intellectual property rights, commercial transactions and develop a strategy to deal with them.	

Course Name: Object Oriented Modeling(T)		**Course Code: CT1450**
CO1	Analyze the object-oriented modelling technique and able to create & analyze the class model, state diagram and interaction diagram	
CO2	Identify, analyze, and model structural and behavioural concepts of the system.	
CO3	Apply system design, database management, handling global resources etc	
CO4	Implement designed model using the object-oriented language & object-oriented	

	databases concepts

Course Name: Pattern Recognition / Pattern Recognition Lab(T/P)		**Course Code: CT1420 / CT1421**
CO1	Demonstrate the concepts of pattern recognition, probability, random variable, density function, different feature extraction techniques and solve problems for the given data	
CO2	Compute the parameters for different density functions and interpret it	
CO3	Design appropriate pattern recognition solutions to classification, regression, and clustering problems.	
CO4	Evaluate and interpret the results of the applied techniques to solve pattern recognition problem	

Course Name: Major Project Phase II (P)		**Course Code: CT 1426**
CO1	Analyze the solution and achieve desired results	
CO2	Write paper and present the research work in team	
CO3	Acquire in-depth knowledge of subject for benefit of society	

Course Name: Extra Curricular Activities(P)		**Course Code: CT1427**
CO1	Develop their hobbies and interests	
CO2	Communicate and work in team	
CO3	Develop the sense of responsibility	

Course Name: Comprehensive Viva(P)		**Course Code: CT1425**
CO1	Comprehend various subjects applications to computer technology	
CO2	Performance in campus recruitments	

Yeshwantrao Chavan College of Engineering, Nagpur

PO/PEO and COs of all courses of the PG Programme

Name of the Department: Computer Technology

Name of the PG Programme: M.Tech. in Computer Science Engineering

Course Outcomes (CO)

First Year: Semester I:

Course Name: High Performance Computer Architecture(T)		**Course Code: CSE3901**
CO1	Analyse the working of pipelines to achieve parallelism	
CO2	Demonstrate the architectural features in the GPU	
CO3	Apply advanced processor technologies to extract maximum performance in a multicore, shared memory execution environment processor.	

Course Name: Real Time Systems(T)		**Course Code:CSE3902**
CO1	Understand RTS, its characteristics and application in Hard and soft Real time domain.	
CO2	Compare various RTS scheduling algorithms.	
CO3	Choose resource sharing and synchronization techniques in a multiprocessor system.	
CO4	Evaluate Commercial Real time System.	

Course Name: Algorithm Design Techniques (T/P)		**Course Code:CSE3905/CSE3906**
CO1	Apply knowledge of different problem solving techniques	
CO2	Identify suitable algorithm design technique for solving given problem	
CO3	Analyse the given algorithmic technique w.r.t time complexity	

Course Name:PE-I: Advanced Digital Image Processing(T)		**Course Code:CSE3907**
CO1	Identify various Image Enhancement techniques in Spatial Domain and frequency Domain	
CO2	Evaluate the methodologies for image segmentation, restoration, compression and Morphology processing	
CO3	Apply image processing algorithms in practical applications	

Course Name: PE I: Machine Learning(T)		**Course Code: CSE3909**
CO1	Infer the understanding of a learning system.	
CO2	Apply the knowledge of learning to the based on the type of problem	
CO3	Combine the inductive and analytical learning techniques	

Course Name: PEI: Grid and Cloud Computing(T)	**Course Code:CSE3910**

CO1	Identify the software and hardware support for enterprise and cloud computing.
CO2	Analyze datamodelling for enterprise and cloud knowledge bases.
CO3	Design enterprise and cloud software applications.
CO4	Implement and run distributed and cloud applications.

Course Name: PE II: Soft Computing Techniques(T)	**Course Code:CSE3911**
CO1	Describe fuzzy sets using linguistic variables and membership functions
CO2	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
CO3	Analyse appropriate learning method for making decision

Course Name: PE II: Natural Language Processing (T)	**Course Code: CSE 3912**
CO1	Identify various computational models of languages, organization of NLP systems
CO2	Explore relevance of Syntax and Semantics in natural language processing
CO3	Describe use of knowledge representation in Natural language processing
CO4	Analyse various case studies of NLP applications

Course Name: PEII: Wireless Sensor Network(T)	**Course Code:CSE3914**
CO1	Architect sensor networks for various application setups.
CO2	Explore the design space and conduct trade-off analysis between performance and resources
CO3	Assess coverage and conduct node deployment planning..
CO4	Devise appropriate data dissemination protocols and model links cost.

Course Name: Software Lab1 (P)	**Course Code: CSE 3915**
CO1	Explore various operating system commands
CO2	Use suitable advanced data structures
CO3	Compare web technology and networking utilities
CO4	Analyse various open source tools

First Year: Semester II:

Course Name: Data Mining(T)	**Course Code:CSE3916**
CO1	To identify data mining functionality to be applied for a given mining problem and classify unknown data using various classification algorithms.
CO2	To apply association rule mining to find frequent patterns and strong association rules.
CO3	To apply data visualization techniques and solve prediction problems using regression methods.
CO4	Describe various statistical mining methods such as ANOVA, PCA and graph mining.

Course Name: Optimizing Compilers(T/P)	**Course Code:CSE 3918/3919**
CO1	Design lexical analyzer using FLEX tool
CO2	Implement syntax analyzer using YACC tool.
CO3	Create a Coarse-Grained Parallelism and Fine-Grained Parallelism
CO4	Apply various code optimization transformations and code generation techniques.

Course Name: Software Architecture (T/P)	Course Code: CSE 3920/3921
CO1	Choose appropriate Software Process Model for given Project depending on requirements and resources at hand
CO2	Perform requirements analysis and create design for a given case study.
CO3	Explore various design patterns
CO4	Analyse various Architecture description languages and case studies of software architectures of various applications

Course Name: Semantic Web and Social Network(T)	Course Code: CSE 3930
CO1	Exploreintelligent web applications
CO2	Identify various aspects of ontology engineering
CO3	Describe semantic web applications, services and technology
CO4	Analyse various case studies of semantic web and social network

Course Name: PE III: Computer Vision(T)	Course Code:CSE 3923
CO1	Identify basic concepts, terminology, and advancements in the field of computer vision
CO2	Describe basic methods of computer vision related to content-based image retrieval, virtual reality
CO3	Explain the mathematics behind stereo, motion and object recognition

Course Name: PE III: Data Warehousing(T)	Course Code: CSE 3924
CO1	Understand the basic concepts of Data Warehousing, OLAP technology
CO2	Understand the process of data transformation and OLAP operations
CO3	Implement the process of space management in data warehouse and performance tuning
CO4	Understand the concept of Big Data

Course Name: PE III: Research Methodology and Statistics(T)	Course Code:CSE 3925
CO1	Explain the basic concepts of research and its methodologies
CO2	Identify appropriate research topics
CO3	Conduct research in a procedural manner
CO4	Write a research paper and thesis

Course Name: PEIII: Information Retrieval System(T)	Course Code: CSE3926
CO1	Explain the underlined problems and concepts related to IR
CO2	Paraphrase the concepts of vector space and other retrieval models.
CO3	Describe role of clustering and latent indexing
CO4	Discuss the basics of XML and Web search

Course Name: PE IV: Deep Learning(T)	Course Code: CSE 3928
CO1	Explain the basic concepts in Neural Networks and applications
CO2	Implement deep learning algorithms and traverse the layers of data abstraction
CO3	Apply Convolutional Neural Network models to Object Detection and image

	Retrieval

Course Name: PE IV: Fundamentals of Bioinformatics(T)	**Course Code: CSE 3929**
CO1	Describe central dogma of molecular biology
CO2	Analyse different types of biological data using various tools
CO3	Apply computational methods on biological data

Course Name: Software Lab2 (P)	**Course Code: CSE 3931**
CO1	Use various OS administration commands
CO2	Perform operations using open source cloud platforms relevance of Syntax and Semantics in natural language processing
CO3	Analyse various open source applications

Second Year: Semester III:

Course Name: Project Phase-I(P)	**Course Code: CSE 3939**
CO1	Identify real life technical problem, conduct literature survey, and find limitations in existing solutions to address societal and industrial concerns
CO2	Analyse the problem and identify suitable tools and technologies for finding solution to the problem
CO3	Communicate proposed solutions effectively with proper presentation methods.

Second Year: Semester IV:

Course Name: Project Phase – II (P)	**Course Code:CSE3940**
CO1	Analyse the solution and achieve desired results.
CO2	Write paper and present the research work in team
CO3	Acquire in-depth knowledge of subject for benefit of society

B.E. – Information Technology

Vision of the Department
To become a well-recognized destination of academic excellence for pursuing Information Technology.

Mission of the Department
To shape competent, responsible, ethical Information Technology professionals in a facilitative learning environment by inculcating out of box thinking, computational skills and problem- solving abilities.

Program Educational Objectives of the program (PEO)

PEO1 To prepare students to succeed in employment, profession and/or to pursue postgraduate education in Information Technology discipline in particular and allied engineering disciplines in general.

PEO2 To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to formulate, analyse and solve engineering problems related to Information technology in particular and engineering practice in general.

PEO3 To train students with good scientific and engineering breadth so as to innovate, design and create systems and to contribute in providing solutions to real life problems.

PEO4 To inculcate in students professional attitude, effective communication skills and teamwork to become a successful professional in global perspective.

PEO5 To provide student with an academic environment aware of excellence, ethics, transparency, leadership and to promote awareness of life-long learning

Program Outcomes (POs)At the end of Program, Graduate students will have

PO1 Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2 Problem Analysis: Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3 Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

PO4 Conduct investigations of complex problems: use research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

PO5 Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an under- standing of the limitations

PO6 The Engineer and Society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO7 Environment and Sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

PO8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO9 Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multi disciplinary settings.

PO10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

PO11 Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 Life-long Learning: Recognize the need for and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

Program Specific Program Outcomes (PSPOs/PSOs)

PSO1 The students will be able to Explain and apply the core concepts of Information Technology , principles and Tools to implement IT systems effectively.

PSO2 The students will be able to integrate broad engineering and interdisciplinary knowledge into IT systems.

Course Outcomes (CO)

Important Note

In case of combine CO's for Theory & Practical Couse include:
Course Name: *Complete Course Name* (T/P), **Course Code:** *Code of Theory /Code of Practical*
In case of Exclusive CO's for Theory Couse include:
Course Name: *Complete Course Name* (T), **Course Code:** *Code of Theory Course*
In case of exclusive CO's for Practical Couse (eg. Project etc.) include:
Course Name: *Complete Course Name* (P), **Course Code:** *Code of Practical/Project Course*

First Year: Semester I:

Course Name: Engineering Mathematics-I	**Course Code: GE-2101**
GE-2101 CO-1	Apply the knowledge of differentiation to develop the Mathematical equations and compute geometrical measures
GE-2101 CO-2	Determine the expansion and derivatives of functions of Multiple variables and use it to find extreme values of functions.
GE-2101 CO-3	Evaluate the integrals of single, multiple variables and use it to measure the dimensions of various geometrical figures.
GE-2101 CO-4	Discuss Calculus of Scalar and vector point function and use appropriate theorems to evaluate integrals of functions of single, multiple variables.

Course Name: Engineering Mathematics-II	**Course Code: GE-2102**
GE-2102 CO-1	Use appropriate Methods to solve first order and higher order differential equations and apply it to find solutions of engineering problems
GE-2102 CO-2	Analyse the functions of complex numbers and variables, prove Mathematical equations and evaluate the complex integrals
GE-2102 CO-3	Use Matrix method to solve linear equations , evaluate eigen values - eigen vectors and its applications.
GE-2102 CO-4	Measure the statistical parameters and derive the equations of best fit curves

Course Name: Communication Skill	**Course Code: GE-2107**
GE-2107 CO-1	Explain the basics of communication process as well as identify the barriers in communication.

GE-2107 CO-2	Classify and describe the different Speech Sounds of English Language.
GE-2107 CO-3	Apply different strategies and techniques of presentations, interviews and group communication.
GE-2107 CO-4	Drafting reports, memos and emails, considering the professional etiquettes and ethics with appropriate content and context.

Course Name: Social Science	**Course Code: GE-2108**
GE-2108 CO-1	Explain the basic concepts of Social Sciences.
GE-2108 CO-2	Describe the development of various Civilizations and their Culture.
GE-2108 CO-3	Analyze the Impact of Industrialization on society and discuss the Fundamental Concepts of Society.
GE-2108 CO-4	Explain Industrial Organization and Management.

Course Name: Engineering Physics **Course Name: Engineering Physics (Lab.)**	**Course Code: GE-2105 and GE 2106**
GE 2105 & GE2106 CO1	Examine the intensity variation of light due to interference, diffraction and its applications.
GE 2105 . CO2	Explain fundamentals of quantum mechanics and its application to problems dealing with quantum particle.
GE 2105 & GE2106 CO3	Develop ability to classify and analyze the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands for device applications.
GE 2105 & GE2106 CO4	Analyze the motion of charged particle in electric and magnetic fields and its applications to electron optic devices.
GE 2105 & GE2106 CO1	Illustrate working principle of lasers, ultrasonic waves and its properties for useful applications in the field of industry.

Course Name: Engineering Chemistry **Course Name : Engineering Chemistry (Lab.)**	**Course Code: GE2103 and GE 2104**
GE2103 and GE 2104 CO1	1. Assess qualitative and quantitative aspects of water as a conventional material for industrial and domestic applications.
GE2103 and GE 2104 CO2	2.Apply the knowledge of basic electrochemistry to understand battery technology, corrosion process and preventive techniques.
GE2103 and GE 2104 CO3	2. Know the basics and assess analytical aspects of industrial materials like fuels and lubricants for efficient utilization.
GE2103 and GE 2104 CO4	3. Recognize the significance of cement and advanced engineering materials in technological applications.
GE2103 and GE 2104 CO5	**4.** Analyze and generate analytical and instrumental techniques.

Course Name: Engineering Mechanics Engineering Mechanics (Lab.)	Course Code: CV-2101 - CV2102
CV-2101- CO 1	An ability to apply the concept of applied mechanics and can solve problems on planar force system for friction as well as frictionless surfaces.
CV-2101- CO 2	An ability to analyze pin jointed truss frame structure and beam structure analytically and graphic
CV-2101- CO 3	An ability to understand centroid, moment of inertia, product of inertia and mass moment of inertia and can find properties of surfaces.
CV-210- 1CO 4	An ability to determine the dynamic variables of moving body, understand working principle of simple lifting machine.

Course Name: Basic Electronics	Course Code: EE 2101
EE 2101 CO1	Characterize Number systems, semiconductors, diodes, transistors and operational amplifiers.
EE 2101 CO2	Design simple analog circuits
EE 2101 CO3	Design simple combinational and sequential logic circuits
EE 2101 CO4	Identify functions of digital multimeter, Bridges and transducers in the measurement of physical variables

Course Name: Introduction to Computer Programming Introduction to Computer Programming (Lab.)	Course Code: IT2101 Course Code: IT-2102
IT2101, IT2102 CO1	Understand computer system, basics of algorithm & flowchart, and demonstrate straight line program using basic 'C' programming language constructs.
IT2101 IT2102 CO2	Design & Develop programs using different loop control structures, user defined functions, and Pointers.
IT2101 IT2102 CO3	Analyze and apply concepts of different dimensional Arrays as a data structure & development of programs using the same.
IT2101 IT2102 CO4	Design and develop programs using basics of Strings, Structures, union and Files in 'C' language.

Course Name:Electrical Engineering Elect. Eng. Lab	Course Code: EL 2101 EL-2102 (Lab.)
EL 2101 & EL 2102- CO-1	Reproduce fundamentals of dc circuits, single phase, and three phase ac circuits.
EL 2101 & EL 2102- CO-2	Analyse dc circuits, single phase and three phase ac circuits for basic electrical quantities such as current, voltage, power etc.
EL 2101 & EL 2102- CO-3	Explain construction, working, testing, and applications of various electrical machines.

EL 2101 & EL 2102- CO-4	Analyse performance of various electrical machines.
EL 2101 & EL 2102- CO-5	Perform laboratory experiments and demonstrate competency in collecting, interpreting, analysing data, communicate and present effectively through laboratory journals.

Course Name: Engineering Graphics Engineering Graphics Lab.	**Course Code: ME2101 ME-2102**
ME2101 ME-2102 CO1	Transform orthographic projections into isometric projections and vice versa.
ME2101 ME-2102 CO2	Evaluate Projections of various One Dimensional, Two dimensional, Three dimensional objects.
ME2101 ME-2102 CO3	Built the development of lateral surfaces of various solids and their cut section.
ME2101 ME-2102 CO4	Predict the intersections and intersections of various solid objects.
ME2101 ME-210 2CO5	Justify the use of software tools used for Two dimensional drawings.

Course Name: Workshop Practice	**Course Code: ME 2103**
CO1	Understand the carpentry tools, joints, machineries and its applications
CO2	Understand the fitting tools, measuring instruments, machineries and its applications
CO3	Understand the smithy tools furnaces and hand and power forging equipment's
CO4	Understand Gas and Electric welding processes, utility, tools and its applications

Second Year: Semester III:

Engineering Mathematics III	**GE2201**
CO1	1. Estimate the Calculus of Numerical Function.
CO2	2. Determine the transforms and inverse transforms of various functions of variables and use it to solve Mathematical equations.
CO3	3. Discuss the nature of periodic function and express it in terms of series.
CO4	4. Use appropriate method/s to solve partial differential equations.

Digital Circuits & Microprocessors(T/P)	**IT2201/IT2202**
CO1	1. Demonstrate the understanding of Digital Circuits and Microprocessor.

CO2	2. Apply the concepts of digital circuits and microprocessor in switching theory and ARM processor.
CO3	3. Able to analyze problem statement and interface the various programmable ICs.
CO4	4. Design and implement programs to simulate the functioning of 8086 processor.

Object Oriented Programming(T/P)	**IT2203/IT2204**
CO1	1. Demonstrate the understanding of Object oriented concepts.
CO2	2. Apply the programming language JAVA efficiently in object oriented software development
CO3	3. Able to analyze problem statement and identify appropriate objects and methods
CO4	4. Design and implement a small programs using classes

Data Structures and Program Design-I(T/P)	**IT2205/IT2206**
CO1	1. Understand basic data structures like list, stack, queue, tree, graph and hash table.
CO2	2. Apply appropriate data structures in problem solving.
CO3	3. Analyze the performance of sorting and searching algorithms based on data structures.
CO4	4. Design application by using data structures and algorithms for real world problems

Computer Architecture & Organization	**IT2207**
CO1	1. Describe fundamentals of computer architecture and organization and able to design control sequence for instructions.
CO2	2. Apply mathematical techniques and perform computer arithmetic operations along with the understanding of processor design.
CO3	3. Design memory organization and understand the concept of cache mapping techniques, Input/output subsystem interfaces and buses

Software Lab(P)	**IT2208**

CO1	1. explain the basic data types, built in data structures, control statements and loops in Python
CO2	2. explain the concepts of functions and modules and write simple programs in Python
CO3	3. demonstrate use of classes, modules and packages by writing useful programs.
CO4	4. develop a useful application in Pyth0n

Second Year: Semester IV:

Discrete Mathematics and Probability Theory	**GE2206**
CO1	1. Explain the basic concept of classical sets, fuzzy sets, Relations, functions and logical methods.
CO2	2. Identify the nature of different algebraic structures such as Group, Ring, field
CO3	3. Determine the probability functions of one and two random variables
CO4	4. Measure the Statistical parameters for random variables

Data Structures and Program Design-II(T/P)	**IT2251/IT2252**
CO1	1. Understand data structures like Tree, Graph, Set, Hash table.
CO2	2. Apply appropriate data structures in problem solving.
CO3	3. Analyze the performance of operations performed on data structures.
CO4	4. Design application by using data structures for real world problems.

Computer Networks(T/P)	**IT2253/IT2254**
CO1	1. explain and **visualize t**he different aspects of networks, protocols and network design models.
CO2	2. **illustrate** the different of hardware, software and types of transmission media used in computer networks.
CO3	3. **analyze** various Data Link layer design issues and select appropriate routing algorithms for a network.
CO4	4. **analyze** the important aspects and functions of transport layer, application layer and Cryptography in computer networking.

Operating Systems(T/P)	**IT2255/IT2256**

CO1	1. explain fundamental concepts of operating system and its functions.
CO2	2. explain various algorithms and techniques for managing OS resources
CO3	3. apply and evaluate the performance of algorithms for managing various OS resources based on the given data about processes and resources.
CO4	4. simulate algorithms/techniques for managing various OS resources using computer programs.

Theory of Computation	**IT2257**
CO1	1. Demonstrate the understanding of basic properties and concepts of formal languages, and Recursive Language,
CO2	2. Apply formal mathematical methods to prove properties of languages, grammars and automata.
CO3	3. Analyze and design finite automata, pushdown automata, Turing machines, formal languages, and grammars.

Third Year: Semester V:

Data Base Management Systems(T/P)	**IT2301/IT2302**
CO1	1) To obtain sound knowledge in the theory, principles and applications of database management system concepts, its structures and query language.
CO2	2) Apply various techniques of SQL Query writing, Normalization techniques, query processing and techniques involved in query optimization useful in transaction.
CO3	3) To Analyse the given problem statement and give robust and cost effective solution.
CO4	4) To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modelling, designing, and implementing a DBMS

Software Engineering	**IT2303**
CO1	1. Understand different software process, models and appropriate architectural style in software development cycle
CO2	2. Analyze the different software process model and appropriate architectural style to develop software
CO3	3. Apply the software testing techniques in a variety of ways to test the software.
CO4	4. Design and analyze software development process with the help of UML.

PE I: Web Programming(T/P)		IT2311/IT2312
CO1	1.Understand the internet communication technologies & Web browser tools, XML application and ASP.NET.	
CO2	2. Apply all the above concepts of web programming for creating a dynamic web site.	
CO3	3. Design & develop of web sites by using html and dynamic web sites by using DHTML and design JavaScript WebPages through HTML.	
CO4	4. Design interactive websites & promote it online	

PE I: Data Analysis and Statistics(T/P)		IT2313/IT2314
CO1	1.Demonstrate an understanding of fundamental concepts of statistics and probability	
CO2	2. Apply probability concepts and appropriate statistical methods on simple datasets for data analysis	
CO3	3.Formulate and solve problems in a systematic manner and Interpret output obtained from statistical analysis on datasets.	
CO4	4. Obtain hands on experience with some popular software (like R)for analysis and visualization of data	

PE I: Customer Relationship Management		IT2315/IT2316
CO1	1. Understand Features of Salesforce CRM(T/P)	
CO2	2. Apply the Advanced Features in Salesforce CRM for development of software	
CO3	3. Analyze and Evaluate the security concepts, Automated Business Process and Approval Process of Salesforce CRM	
CO4	4. Develop modules using Salesforce CRM	

Third Year: Semester VI:

Design & Analysis of Algorithms(T/P)		IT2351/IT2352
CO1	1. Understand asymptotic analysis of iterative and recursive algorithms, complexity of algorithms	
CO2	2. Apply important algorithmic design techniques for problem solving	
CO3	3. Analyze the performance of algorithms	
CO4	4. Synthesize and design efficient algorithms for real world problems	

Principles of Compiler Design(T/P)	IT2353/IT2354
CO1	1. Understand different phases of compilation process, lexical analyzer tool "Lex" OR "Flex" and YACC or Bison tool
CO2	2. Apply parsing techniques, Syntax directed translation schemes and optimization techniques for recognition of programming language statements
CO3	3. Design and Implement a Compiler for a Small Programming Language Source Program

PE II::Machine Learning(T/P)	IT2361/IT2362
CO1	1. explain and compare supervised and unsupervised learning .
CO2	2. explain various machine learning algorithms.
CO3	3. identify appropriate machine learning algorithm to solve the given problem.
CO4	4. construct a machine learning model to meet desired outcomes and apply identified machine learning algorithm to solve the problem.
CO4	5. Implement the machine learning algorithms for solving the given problem.

PE II: Business Intelligence(T/P)	IT2363/IT2364
CO1	1. Students will be able to : ★Assemble BI as a Process, identify its application in various domains and functional area, its roles and responsibilities. ★Identify functions of building blocks in N_tier BI ecosystem ★Identify different stages in Lifecycle of a BI project. ★Differentiate between traditional BI and self service BI
CO2	2. Apply SQL as a universal language for BI
CO3	3. Model a business scenario; identify the metrics, indicators, various dimensions, and aggregation strategies and make recommendations to achieve the business goal
CO4	4.Obtain hands on experience with some popular BI software for analysis, reporting on datasets and visualization of results.

PE II: Internet of Things(T/P)	IT2365/IT2366
CO1	1. Describe IoT as a Process, its architecture and Management, compare and contrast old and new challenges in IoT.

CO2	2. Apply various communication protocol and its building blocks in IoT applications.
CO3	3. Illustrate relevance of IoT with cloud and Web and analyze various security challenges and also evaluate various control strategies for the same.
CO4	4. Create, Design and Develop various applications based on IoT concepts.

Fourth Year: Semester VII:

Data Mining(T/P)	**IT1427/IT1428**
CO1	1. Understand basic concepts in data mining, Identify the scope and necessity of Data Mining for the society and for business applications.
CO2	2. Apply different data mining algorithms on given data set.
CO3	3. Analyze alternative data mining implementations and what might be most appropriate for a given data mining task.
CO4	4. Develop algorithm for mining application specific data.
CO5	5. Use popular data mining tool and apply the principle algorithms and techniques used in data mining, on different types of dataset, analyze their results, interpret the results using different visualization techniques.

Principle Of Compiler Design(T/P)	**IT1403**
CO1	1. Understand different phases of compilation process, lexical analyzer tool "Lex" OR "Flex" and YACC or Bison tool
CO2	2. Apply parsing techniques, Syntax directed translation schemes and optimization techniques for recognition of programming language statements
CO3	3. Design and Implement a Compiler for a Small Programming Language Source Program

Cloud Computing	**IT1432**
CO1	1. Understand the different computing paradigm, analyze and apply cloud computing services, deployment model for building cloud
CO2	2. Apply the concepts and techniques in cloud computing
CO3	3. Analyze the problems and apply design considerations for cloud application
CO4	4. Provide the appropriate cloud computing solutions for building cloud application

Real Time Systems	IT1407
CO1	1. Enumerate the need and the challenges in the design of hard and soft real time systems.
CO2	2. Compare different scheduling algorithms and the schedulability criteria.
CO3	3. Determine schedulability of a set of periodic tasks given a scheduling algorithm.
CO4	4. Devise algorithms to decide the admission criterion of sporadic jobs and the schedule of aperiodic jobs.

Network Security	IT1422
CO1	1. Understand different security techniques of network security
CO2	2. Analyze the vulnerabilities in any computing system and identify the security issues
CO3	3. Apply security mechanisms using rigorous approaches in the network and resolve it.
CO4	4. Design a security solution by Comparing different security standards for electronic mail

Neural Network and Fuzzy Logic(T/P)	IT1415/IT1416
CO1	1. To understand the working of Neural Networks as pattern classifier
CO2	2. Comprehend the Neural Networks as means for computational learning and to analyze the basic network architectures and algorithms
CO3	3. Effectively use existing software tools to solve real problems using a neural network approach
CO4	4. Apply the basics of fuzzy sets, its operations, fuzzy logic and fuzzy relation to model linguistic knowledge in human experts and To build systems based on fuzzy control and to understand the basics of fuzzy inference and reasoning

Distributed Systems(T/P)	IT1421/IT1440
CO1	1. Identify the advantages and challenges in designing distributed algorithms for different primitives like mutual exclusion, deadlock detection, agreement, etc.
CO2	2. Differentiate between different types of faults and fault handling techniques in order to implement fault tolerant systems.

CO3	3. Analyze different algorithms and techniques for the design and development of distributed systems subject to specific design and performance constrain
CO4	4. Design and develop distributed programs using sockets and RPC/RMI.

Network Programming(T/P)	**IT1417/IT1418**
CO1	1. Understand the main protocols comprising the Internet.
CO2	2. Apply the client-server model in networking applications.
CO3	3. Analyze the network services such as packages and protocol that communicate through the Internet.
CO4	4. Develop skills in network programming techniques for Network Management .

Fourth Year: Semester VIII:

Major Project/ INTERNSHIP	**IT2451**
CO1	1:Understand the knowledge gained from the various courses undergone in earlier years.
CO2	2: Able to work in team and adapt professional ethics and practice and how to write technical documents in professional style, and to demonstrate the product/software to technical audience.
CO3	3: able to evaluate and analyze critically different sources of data available in the literature and apply the knowledge of tools/Technology.
CO4	4:able to design and develop a system/Software for community or professional use

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V.C.COLLEGE OF ENGINEERING AUTONOUS INSTITUTION SEAL NAGPUR

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Declaration by the Head of the Institution

I hereby declare that the data, information and support documents attached herewith are genuine and correct to my knowledge.

Dr. U.P. Waghe
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Principal
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Y. C. COLLEGE OF ENGINEERING AUTONOMOUS INSTITUTION SEAL NAGPUR