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
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				

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

Applicable for AY 2022-23 Onwards

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Computer Technology

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						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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						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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						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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						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**				

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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.

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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

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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

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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

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

		June 2021	1.00	Applicable for AY 2021-22 Onwards
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

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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

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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).

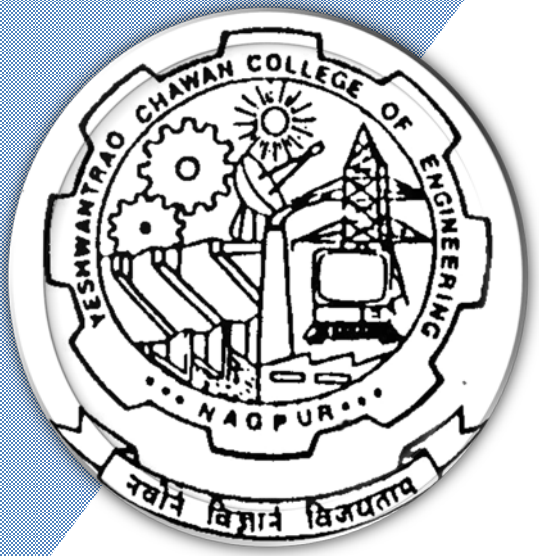
Nagar Yuwak Shikshan Sanstha's

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)

Hingna Road, Wanadongri, Nagpur - 441 110



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

Yeshwantrao Chavan College of Engineering

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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

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

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.