Open Elective-1 & Open Elective-2

Syllabus

Offered by Department

A.Y. 2021-22

Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Enginering

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

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List of Open Elective-1 Offered by deptt in AY 2021-22

List of Open Elective-2 Offered by deptt in AY 2021-22

Department of Civil Engineering

V Semester

CV-2331 OE-I Building Services Engineering

Building services engineering is a professional engineering subject that strives to achieve a safe and comfortable indoor environment while minimizing the environmental impact of a building. Building services are the systems installed in buildings to make them comfortable, functional, efficient and safe. Building services engineers work closely with other construction professionals such as architects, structural engineers, and quantity surveyors. They ensure that a building is functional and safe and play a significant role on the sustainability and energy demand of a building. New roles are emerging, within building services engineering, such as renewable energy, sustainability, low carbon footprint, and energy management. With buildings accounting for around 50% of all carbon emissions, building services engineers play a significant role in combating climate change. As such, a typical building services engineer has a wide-ranging career path.

V Semester
CV2331 – OE-I : BUILDING SERVICES ENGINEERING

COURSE OBJECTIVES	COURSE OUTCOME
Students will be introduced to 1. Basic concepts of various building services. 2. Aspects of natural light and ventilation. 3. Methods of acoustics and sound insulation. 4. Equipments and installations used in building services	Students will be able to 1. Examine relevance of ventilation, acoustics & to understand the methodologies. 2. Understand special installations in buildings such as electrical, air conditioning, heating. 3. Study specifications & usage of mechanical installations like lifts, security systems etc. 4. Analyze causes of fires in buildings & their preventive and protective strategies.
Mapped Program Outcomes : 1,6,7,11	

UNIT–1 : **Lighting**: Day lighting, Fenestration, Daylight Factor. **Ventilation:** Functions of ventilation, Stack effect, wind effect, Air flow through buildings, cross-ventilation.	**[07 Hrs.]**
UNIT–2 : **Acoustics, Sound Insulation and Noise Control:** Basic terminology and definitions, Physics of sound. Behaviour of sound in an enclosed space. Requisites for acoustic environment, Noise and its control.	**[06 Hrs.]**
UNIT–3 : **Electrical Installations:** Different types of wiring need of Earthing, comparison between fuse and MCB, substation, types of lightening fixtures, Building protection against lightening.	**[07 Hrs.]**
UNIT–4 : **Air Conditioning**: Requirement of air conditioning, air conditioning system, Pressure-Enthalpy (heat) diagram of vapour compression cycle, refrigeration effect, Thermodynamics of human body. Psychometric chart.	**[06 Hrs.]**
UNIT–5 : **Mechanical Equipment & Installation**: Installation of lifts and escalators, Hot Water Provision (Solar and Electrical), Special features required for physically handicapped and elderly, Conveyors, Vibrators, Concrete mixers.	**[07 Hrs.]**
UNIT–6 : **Fire protection :** Causes of fire in building, Fire classification, Portable extinguishers, fire escapes, Fire detectors and alarm system.	**[06 Hrs.]**

Text Books :

1. Building services, B.S. Patil, Orient Longman.
2. Building Services Engineering, Fred Hall, Roger Greeno, Butterworth-Heinemann, 2007.
3. Building Services Engineering, David V. Chadderton, Taylor & Francis Group, 2007.

Reference Books :

1. E.R. Ambrose, “Heat Pumps and Electric Heating”, John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. R.G. Hopkinson and J.D. Kay, “The Lighting of buildings”, Faber and Faber, London, 1969.
4. William H. Severns and Julian R. Fellows, “Air-conditioning and Refrigeration”, John Wiley and Sons, London, 1988.
5. A.F.C. Sherratt, “Air-conditioning and Energy Conservation”, the Architectural Press, London, 1980.
6. National Building Code.

Department of Civil Engineering

V Semester

CV 2332-OE-I Construction Techniques

Construction is one of the branches of Civil Engineering that is concerned directly with common people, as everyone wants to have beautiful dwellings. Buildings are built from long ago in history but the difference is of technology as early buildings were simple and just for the purpose of shelter. With the passage of time, revolutionary changes have appeared in construction also and it is all due to the technology that can be defined as practical use of your knowledge. The main Objective of this course is to provide an insight and inculcate the essentials of Civil Engineering discipline to the students of all branches of Engineering and to provide the students an illustration of the significance of the Civil Engineering Profession in satisfying the societal needs. This course is to make the student aware of the various construction techniques, practices and the equipment needed for different types of construction activities. About 5 to 10% of world economy involves in construction activities. Construction industry includes a wide range of constructions suitable for all classes of society i.e. Commercial construction, domestic construction, industrial construction, low cost housing etc. are a few examples that are now displaying master pieces of construction technologies. The students of all Branches will gain knowledge in the implementation of construction materials & Techniques on engineering concepts which are applied in field.

V Semester
CV2332 – OE-I : CONSTRUCTION TECHNIQUES

COURSE OBJECTIVES	COURSE OUTCOME
1. To study fundamentals of cement &concrete. 2. To study and understand the construction Equipment used in Engineering. 3. To study various types of structure. 4. To study new construction techniques and Safety methods.	After completion of course students will able to 1. Explain various constituents of Cement & Concrete. 2. Identify Equipements & Machinery used in Construction. 3. Apply construction methods for various types of structure. 4. Discuss new techniques used in construction, evaluation& safety methods adopted in construction operations
Mapped Program Outcomes : 1,8,9,12	

UNIT–1 : **Introduction to Cement and Concrete :** Introduction to various types of cement, mortar, Ferro cement, Ready mix concrete, pumped concrete, self-compacting concrete, light weight concrete.	**[07 Hrs.]**
UNIT–2 : **Introduction to :** Various construction Equipments with its Advantages, Disadvantages and its Uses.	**[06 Hrs.]**
UNIT–3 : **Type of structure :** Load bearing, Frame & Composite. **Sub Structure Construction:** - Foundation: Necessity and types of foundations, Footings and its Types, and Introduction to Underwater Construction.	**[07 Hrs.]**
UNIT–4 : **Super structure construction** : Introduction to Stone Masonary and Brick Masonary, formwork and its types, pointing and plastering, roofs, painting, varnishing, Partitions, arches, lintels, stairs and distempering etc.	**[06 Hrs.]**
UNIT–5 : **New Construction Techniques :** Fibers and its types, Pre - Engineered Building and its Application & Advantages.	**[07 Hrs.]**
UNIT–6 : **Safety in Construction Operations :** Introduction to various types of Hazards and its Safety measurement on construction site.	**[06 Hrs.]**

Text Books :

1. M.S. Shetty, " Concrete Technology": S Chand & Co., 6th edition, S. Chand & Company, Limited, 2008
2. Rangwala, Building Construction, 32nd Edition, Charotar Publishing House Pvt. Ltd.2014

Reference Books :

1. Construction Planning, Equipment and methods – Peurifoy-Tata McGraw Hill Publication
2. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008
3. Sushil Kumar, Building Construction, 19th Edition, Standard Publisher Distributors 2001, New Delhi, 2001.
4. Elements of Civil Engineering: By S. S. Bhavikatti, Vikas Publishing House Pvt Limited, 2004
5. Basic Civil Engineering: By Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Firewall Media, 2003
6. SP 70 (2001): Handbook on Construction Safety Practices.

Department of Civil Engineering

V Semester

CV2333 : OE-I INTRODUCTION TO ENVIRONMENTAL MANAGEMENT

The Environmental Management is setting up a harmonious relationship between human and ecosystem through environmental impact assessment. The basic aim of EM is to recognize the Environmental problems and given solutions, by accessing the impacts and providing optimum solutions by implementing laws and regulations, also the existing technology are revised to make it eco-friendly. The industries with clear EIA Report are given at most priority in tender selections and gives them a chance for good marketing, industries which follow norms and regulations by EM are successful in managing higher profits with low investments like reduction in waste and usage of waste and raw materials which signifies the utility cost and waste disposal cost. The youth guided with environmental management will be able to think in a sustainable way and develop the technologies for the same, also the youth will become responsible and kind to nature which is going to be a good initiative in long run.

V Semester
CV2333 – OE-I : INTRODUCTION TO ENVIRONMENTAL MANAGEMENT

COURSE OBJECTIVES	COURSE OUTCOME
1. To develop, implement, monitor and maintain environmental strategies, policies, programmes and systems that promote sustainable development 2. To oversee the environmental performance including compliance with environmental legislation across the organization, and coordinating all aspects of pollution control, waste management, environmental health and conservation 3. To lead the implementation of environmental policies and practices and raise awareness, at all levels of an organization, about the emerging environmental issues.	At the end of the course the student will be able to- 1. Identify the scientific and social aspects of environmental issues. 2. Understand the procedure of environmental protection by legislation. 3. Understand the role of environmental management system in protecting the resources.
Mapped Program Outcomes : 6,7,8,10,12	

UNIT–1 : Introduction to Environmental Management: Quality of life, Objectives and components of Environmental Management, Environmental Management in Socio-economic context. Development and Environmental for Sustainable Development.	**[06 Hrs.]**
UNIT–2 : Introduction to Environmental Impact Assessment: Role and Status of EIA in India EIA Procedures, Environmental Impact Statement, Methodologies of EIA.	**[07 Hrs.]**
UNIT–3 : MoEF questionnaire for environmental clearance, critical environmental issues and formulation of strategies of EMP, environmental management plan, development of action plans for critical environmental education programmers. ISO 14001	**[07 Hrs.]**
UNIT–4 : Environmental Laws and legislation –various enactment and their provisions, Role of State & Central boards of pollution control, Cleaner Technology of production.	**[07 Hrs.]**
UNIT–5 : Environmental Audit- Concept of EA, procedural aspects of conducting environmental audit, EMS.	**[06 Hrs.]**
UNIT–6 : Resource Management: depletion of resources – causes & effects, resource utilization, optimal use of resources.	**[06 Hrs.]**

Text Books :

1. Anand Bal, An Introduction to Environmental Management, Himalaya Publishing House.,2009
2. John Rau & Wooten, Environmental Impact Assessment, Mc Graw Hill.
3. Larry Canter, Environmental Impact Assessment, McGraw Hill.
4. Harry W. Gehm, Jacob I. Bregman, handbook on pollution Control Acts, Central Pollution Control Board, New Delhi.
5. R.K. Sapra, S. Bhardwaj, the New Environmental Age, Ashish Pub. House, New Delhi.

References Books :

1. Rosencrannz, S. Divan, M.L. Nobal, Environmental Law and Policy in India, Cases, Materials And Statutes, Tripathi Pvt. Ltd. Bombay.

V Semester

ME2331 - OE I : OPERATION RESEARCH TECHNIQUES

Objective	Course Outcome
The course aims to develop the engineering - analysis capability for engineering-problems using basic statistical tools and techniques. Detailed treatment of various data analysis and handling technique leading to complete understanding and modeling the processes including its optimization is envisaged in this course.	**On completion of this course, the student will be able to** 1) Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method 2) .To Solve Transportation and Assignment Models and analyze the concept of dynamic programming to Solve problems of discreet and continuous variables. 3) Analyze projects for minimum total cost and smooth level of resources. 4) Evaluation of different replacement policies and its application in operation research and analysis of the application of simulation, inventory control model and waiting line model

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PS	PS
CO	Apply basic operations research techniques to formulate given situation as LLP and solving by graphical & simplex method.	3				3	2			1				3	
CO	To Solve transportation and Assignment Models and analyse the concept of dynamic programming to Solve problems of discreet and continuous variables.	3				2	3			3				3	
CO	Analyze projects for minimum total cost and smooth level of resources.	3			2	2	2				2	3		3	
CO	Evaluation of different replacement policies and its application in operation research and analyse of the application of simulation, inventory control model and waiting line mode.	3				2	2	1	1			2	3	3	

V Semester

ME2331 - OE I : OPERATION RESEARCH TECHNIQUES

Unit No.	Contents	Max. Hrs.
1	Introduction to OR & Basic OR Models, Definition Characteristics and limitations of OR. Linear programming solutions (LPP) by graphical methods and simplex method. Sensitivity analysis. **(CO-1)**	7
2	Assignment Model and Transportation Model. **(C0- 2)**	7
3	Dynamic programming - characteristics, approach and its formulations. Application of Dynamic programming in Employment smoothening problem, Resource allocation, Inventory control & Linear programming. (CO- 2)	6
4	Project Management: Network Scheduling by CPM & PERT, Cost considerations in PERT and CPM. (CO- 3)	7
5	Replacement Models: Replacement of Models that deteriorate with time,Concept of equivalence , Interest Rate and Present worth. Replacement of items that fails suddenly considering Individual and Group replacement policy. (CO- 4)	4
6	Queuing Theory: Queuing Systems, Kendelalls for representing queuing models, Classification of queuing models (No derivations expected), Simulations, Monte- Carlo Simulation. Inventory Control with Deterministic models. (CO- 4)	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Introduction to Operation Research: Computer Oriented Algorithmic approach	2007	Billy E.Gillet	Tata McGraw Hill Publishing Co. Ltd. New Delhi.
2	Operations Research	3rd edition 2008	Prem Kumar Gupta & D.S. Hira	S. Chand& Co.
3	Operations Research: Theory and Applications	2nd edition 2002	J.K. Sharma	Mac Millan
4	Introductory Operations Research	2006	S.C. Sharma	Discovery Publishing House
5	Optimization Theory and Application	2nd edition 2010	S.S. Rao	Halsted Press
6	Operations Research - An Introduction	9th Edition 2010	Hamdy A. Taha	Prentice Hall of India Pvt. Ltd., New Delhi.

V Semester

ME2332 OE I : Automobile Engineering

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular automobiles. The modernization in automobile is also included to understand recent trend in the field.	1) Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle. 2) Student will be able to describe various power transmission systems from clutch to wheel in vehicle. 3) Student will be able to evaluate and describe control systems like steering and brakes in vehicle. 4) Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Student will be able to analyze various systems of Engine, its function including fuel supply, cooling and lubrication system in vehicle.	3	2												3
CO2	Student will be able to describe_various power transmission systems from clutch to wheel in vehicle.	3	2												3
CO3	Student will be able to evaluate and describe control systems like steering and brakes in vehicle.	3	2												3
CO4	Student will be able to illustrate and describe the necessary electrical and luxurious systems and safety system in vehicle.	3			2					2					3

V Semester
ME2332 OE I : Automobile Engineering

Unit No.	Contents	Max. Hrs.
1	• Introduction, Automobile history and development and classification. Vehicles layout. • Engine Classification, construction and working 2 stroke and 4-stroke cycle. • Introduction to Fuel supply system: Carburettor and fuel injection.(Only basic) • Engine cooling and lubrication systems. [CO-1]	7
2	Clutch – Necessity, requirements of a clutch system. Types of Clutches: Single & multi plate clutch, Diaphragm clutch and centrifugal clutch. Gear box: Necessity of gear box with gear theory, working principle, Classification: Sliding mesh, constant mesh, synchromesh, and Transfer case gear box, Gear Selector mechanism, Defects and remedies in Gear box. Working of CVT (Continuous variable transmission) [CO-2]	6
3	• Transmission system: Propeller shaft, Universal joint, Hotchkiss drive, torque tube drive. • Differential - Need and working principle and Differential lock. • Rear Axles and Front Axles • Wheel and Tyres: Classification, various constituents of tyres with cross section, specification, factors affecting tyre performance [CO-2]	7
4	• Steering systems, principle of steering, steering linkages, steering geometry and wheel alignment, steering gear box and its types. • Brakes - Need, types: Mechanical, hydraulic (Master and wheel cylinder), Air brakes. Drum and Disc brakes, Comparison • Suspension systems – Function, conventional and Independent suspension System, Telescopic shock absorber. [CO-3]	6
5	• Electrical systems: Battery construction. Specification. Operation and maintenance of Batteries. • Alternator, starter motor, Battery Ignition and magneto ignition systems, Lighting, Horn, Side indicator , wiper.(only basic) • Automobile air-conditioning, • Panel board instruments. [CO-4]	6
6	• Resistance to vehicle motion: Air, Road and gradient resistance and power calculation. • Advances in automobiles such as ABS, Power Steering. • Safety aspect in Automobile. • Overall Vehicle specifications • Servicing, Overhauling and Engine tune up. [CO-4]	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Automotive Technology		H.M.Sethi	Tata McgraHill
2	Automobile Engineering-I & II	First Edition - 2010	P.S.Gill	S.K.Kataria & sons
3	Automotive Mechanics		Joseph Heitner	
4	Motor Vehicle Technology		J.A. Dolan	
5	Automotive Engines		W.H. Crouse	

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chaiperson	Dean (Acad. Matters)	Date of Release	Version	

ME2335	OEI: Robotics and Subtractive Manufacturing	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	MSE-III	TA	ESE	Total	ESE Duration
	15	15	15	10	60	100	3 Hrs

Objective	Course Outcome
• Gain knowledge of Robotics and automation. • Understand the working methodology of robotics and automation. • Write the program for robot for various applications • To understand subtractive manufacturing • To implement CNC programs	On completion of course students will be able to • Understand working of subtractive manufacturing • Implement CNC programs for various product manufacturing • have knowledge of Robotics, automation, robotics motion, sensors, robotic programming and roles of robots in industry • Understand the working methodology of robotics and automation, motion and control, machine vision and programming, application of robots in industry.

Unit 1 **[7 hrs]**

Unit 1

Concepts of NC, CNC, DNC. Classification of CNC machines, MCU architecture and functionality, Machine Configurations, Types of control, CNC controller's architecture and characteristics, Interpolators.

Unit 2 **[8 hrs]**

Positioning system, Cutter offset compensation, Word address format, Introduction to G and M codes Manual part programming for CNC turning, milling and drilling.

Unit 3 **[8 hrs]**

Tooling system for Machining center and Turning center, work holding devices, of CNC Machines. APT part programming, CAD/CAM programming, Simulation and Verification of CNC programs, Adaptive CNC control techniques. Integration of CNC machines for CIM.

Unit 4

FUNDAMENTALS OF ROBOT [7 hrs]

Robot – Definition – Robot anatomy – Co-ordinate systems, work envelope, types and classification – Specifications – Pitch, yaw, roll, joint notations, speed of motion and pay load – Robot parts and their functions – Need for robots – Different applications..

Unit 5 [8 hrs]

ROBOT KINEMATICS

Forward kinematics – Inverse kinematics – Differences: Forward kinematics and Reverse kinematics of manipulators with two and three degrees of freedom (In 2 dimensional), four degrees of freedom (In 3 dimensional) – Deviations and problems ,Introduction to DH notations

Unit 6 [7 hrs]

ROBOT PROGRAMMING

Teach pendant programming – Lead through programming – Robot programming languages – VAL programming – Motion commands – Sensor commands – End effecter commands – Simple programs.

IMPLEMENTATION

Implementation of robots in industries – Various steps - Safety considerations for robot operations.

Text books:

S.N.	Title of the book	Edition (Year of publication)	Author(s)	Publisher
1	Robot Engineering An Intergrated approach	2004	Klafter R.D., Chmielewski T.A. and Negin M	Springer
2	Industrial Robotics: Technology, Programming and Applications,	2012	Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta	2nd Edition, Tata McGraw Hill, 2012.
3	Automation in Production system	2002	Mikell P. Groover	Prentice-Hall of India Pvt. Ltd., New Delhi, 2002

Reference :				
1	CNC Technology and Programming	2003	Krar, S., and Gill	Industrial Press Inc
2	An Introduction to CNC Machining	1991	Gibbs, D.	Industrial Press
3	Computer Numerical Control Concepts and Programming	1991	Seames, W.S.	Thomson Learning EMEA, Limited
4	Computer Numerical Control for Machining	1993	Lynch, M	McGraw-Hill
5	Computer Control of Manufacturing Systems	2005	Koren Y	Tata McGraw-Hill Education
6	Robotics control, sensing, vision, and intelligence	2004	Fu K.S., Gonzalez R.C., and Lee C.S.G.	Tata McGraw-Hill Education
7	*Robotics Technology and Flexible Automation*	2001	*Deb S.R*	Tata McGraw-Hill Education
8	Introduction to Robotics Mechanics and Control	2008	Craig J.J	Pearson Education India

1.

V Semester

EL2311 - OE I : Renewable Energy Generation Systems

Objective	Course Outcome
This subject introduce the different renewable energy sources to the students. Students get knowledge of Electric Power generation by wind, solar, small hydro.	**On completion of this course, the student will be able to** 1) Summarize, classify and compare types of renewable energy sources, outline as per Global and Indian context. 2) Utilize solar energy for various applications, estimate solar radiation geometry and classify types of wind turbine generator. 3) Demonstrate, Classify and utilize geothermal and biomass energy. 4) Compare, classify and apply energy from ocean, tide, wave and hydro for power generation, explain storage methods for renewable energy sources.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Summarize, classify and compare types of renewable energy sources, outline as per Global and Indian context.	1		1			1	1							
CO2	Utilize solar energy for various applications, estimate solar radiation geometry and classify types of wind turbine generator.	1	2	1	1	1		2	1			1			
CO3	Demonstrate, Classify and utilize geothermal and biomass energy.	1		1		1	1	2	1			1			1
CO4	Compare, classify and apply energy from ocean, tide, wave and hydro for power generation, explain storage methods for renewable energy sources.	1		1		1		1				1		1	1

V Semester

EL2311 - OE I : Renewable Energy Generation Systems

Unit No.	Contents	Max. Hrs.
1	**Introduction** Fundamentals of Renewable / Non-renewable Energy Sources, Renewable Energy sources, Renewable Energy Potential in India, Renewable Energy Sources and their sustainable development. Storage methods for renewable energy sources.	6
2	Solar Energy Principles, scope and applications, solar radiation, its measurement & prediction, flat plate collectors-design & theory, solar water heating, solar dryers, solar stills, solar cooling and refrigeration. Solar cells, thermal storage, street lighting, solar power generation.	5
3	Wind Energy Introduction, Historical development, Wind energy resources, sites identification, blade element theory, aero-foil design, component of wind energy conversion system, wind turbine generator classification, and windmill and wind electrical generator, Advantages, disadvantages, economics and present status of wind energy generation systems, grid connection of wind energy.	5
4	Geothermal Energy and Biomass Energy Introduction, history of geothermal resources, basics of geological process, dry rock and hot aquifer analysis, geothermal exploration, geothermal well drilling and fluid extraction, utilization of geothermal resources, geothermal heat pump, site of geothermal energy in India. Biomass energy resources and conversion processes, urban waste to energy conversion.	5
5	Mini & Micro hydro-plants Introduction, Classification of water turbines, hydroelectric system, essential components of hydroelectric system, system efficiency, advantages and disadvantages of hydroelectric system, present Indian power scenario of mini- micro hydro.	6
6	Ocean Energy Ocean thermal energy conversion (OTEC), Open cycle and closed cycle OTEC, Ocean wave energy conversion, tidal energy conversion. Introduction of Fuel cells.	6

V Semester

EL2311 - OE I : Renewable Energy Generation Systems

Text Books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Non Conventional Sources of Energy	**4th edition**	G.D.Rai	Khanna Publisher
2	Energy Technology:Nonconventional Renewable and Conventional	,	S. Rao and B.B Parulekar	Khanna Publisher New Delhi

Reference books				
S.N	**TITLE**	**EDITION**	**AUTHOR**	**PUBLICATION**
1	Solar Energy : Principles of Thermal collection and storage	**3rd edition,1994**	S.P.Sukhatme,J.K.Nayak	Tata McGraw Hill
2	Wind and Solar Power System		M. R. Patel	CRC Press, New York
3	Renewable Energy Sources Basic Principles and Applications		G. N. Tiwari and M. K. Ghoshal	Narosa Publishing House,New Delhi

V Semester

EL2312 - OE I : Electrical Machines and their Applications

Objective	Course Outcome
The student should be able to This subject introduce the applications of different machines and commonly used drives	**On completion of this course, the student will be able to** 1) To explain speed-torque characteristics, need for starters, starting methods and braking of AC and DC motors. 2) To build/apply criterion for selection of motors, duty cycle, enclosures, transmission system and insulation classes. 3) To illustrate/interpret/explain the principle, operation and construction of 1-phase and 3-phase transformers and autotransformers. 4) To show/define the principle. Construction, types, characteristics and performance of special machines like BLDC, Stepper motor and Universal motor

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	To explain speed-torque characteristics, need for starters, starting methods and braking of AC and DC motors	3													1
CO2	To build/apply criterion for selection of motors, duty cycle, enclosures, transmission system and insulation classes	3	1					1							1
CO3	To illustrate/interpret/explain the principle, operation and construction of 1-phase and 3-phase transformers and autotransformers	2	1												2
CO4	To show/define the principle. Construction, types, characteristics and performance of special machines like BLDC, Stepper motor and Universal motor	3													1

V Semester

EL2312 - OE I : Electrical Machines and their Applications

Unit No.	Contents	Max. Hrs.
1	Introduction to Drives and Speed Control: Classification of Drives, brief idea about commonly used drives (AC and DC) drives in industry, speed- torque characteristics of different drive motors, their behaviour under starting and running conditions.	6
2	Need of starter, Starting methods, Braking and Speed Control of AC and DC motors.	5
3	Selection Criterion for Drive Motors: Criterion for selection of motors, Duty Cycle, Power Rating for Continuous and Intermittent Duty Cycles, Environment and Enclosures, Transmission System, Insulation Classes.	5
4	Single Phase transformer Review of Principle, constant flux machine, losses, efficiency etc., Operation on load (Phasor diagrams), Voltage regulation, effect of load power factor on regulation, Application of Single phase transformer in Electronic circuitry, autotransformer, welding transformer, furnace transformer.	5
5	Three Phase Transformer. Concept of three phase transformer, Comparison between unit and bank of single phase transformer, connections, All Day Efficiency, application in power system.	6
6	Special Machines: Brushless DC motor: - Principle, construction , operation, converter for BLDC, rotor position sensor (Hall Sensor), Stepper motor: types, slewing, torque-speed characteristics, stepper motor converter, Universal motor, applications Applications of three phase and single phase induction motors in cement industry, steel rolling mill, textile mill, etc.	6

V Semester

EL2312 - OE I : Electrical Machines and their Applications

Text books				
S.N	**Title**	**Year/Edition**	**Author**	**Publisher**
1	A Course in Electrical Power	First-2005	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Fundamentals of Electric Drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

Reference Books:

Sr. No.	Title	Year/Edition	Author	Publisher
1	A Course in Electrical Power	First-2005	Soni, Gupta, Bhatnagar	Dhanpat Rai and Company
2	Fundamentals of Electric drives	2nd Edition	G. K.Dubey	Narosa Publications
3	Electric Machines	2nd Edition	Ashfaq Husain	Dhanpat Rai and Company

V Semester

EL2313 - OE I : Testing and Maintenance of Electrical Equipment's

Objective	Course Outcome
The student should be able to To adopt various testing and maintenance procedures for electrical equipments by providing effective insulation to enhance their life and working condition	**On completion of this course, the student will be able to** 1) Classify, the causes of hazards, accidents, shock and the remedial action taken against the electrical shock. 2) Demonstrate, apply and evaluate different types of tests and the various maintenance techniques to be employed on various electrical machines and it installation. 3) Demonstrate, apply and estimate the factors affecting the life of insulation, its testing and maintenance. 4) Explain, develop and determine the various tests to be conducted on distribution transformer, I. S. Standards.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify, the causes of hazards, accidents, shock and the remedial action taken against the electrical shock.	1					2	1	3				3		1
CO2	Demonstrate, apply and evaluate different types of tests and the various maintenance techniques to be employed on various electrical machines and it installation	1					2		1				1	2	
CO3	Demonstrate, apply and estimate the factors affecting the life of insulation, its testing and maintenance.	1					2								
CO4	Explain, develop and determine the various tests to be conducted on distribution transformer, I. S. Standards.	1					1		1				1	2	

V Semester

EL2313 - OE I : Testing and Maintenance of Electrical Equipment's

Unit No.	Contents	Max. Hrs.
1	Safety & Prevention of Accidents Definition of terminology used in safety; safety, hazards, accident, major accident hazard, responsibility, authority, accountability, monitoring, I.E. Act & statutory regulations for safety of persons & equipments working with electrical installation, Dos & don"ts for substation operators as listed in IS Meaning & causes of electrical accidents factors on which severity of shock depends, Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration, Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers.	6
2	General Introduction Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests, Methods of testing a) Direct, b) Indirect, c) Regenerative. Concept of routine, preventive & breakdown maintenance, advantages of preventive maintenance, procedure for developing preventive maintenance schedule, Factors affecting preventive maintenance schedule. Introduction to total productive maintenance.	5
3	Testing & maintenance of rotating machines Type tests, routine tests & special tests of 1 & 3 phase Induction motors, Routine, Preventive, & breakdown maintenance of 1 & 3 phase Induction motors as per IS 9001:1992. Parallel operation of alternators, Maintenance schedule of alternators & synchronous machines as per IS 4884-1968. Brake test on DC Series motor.	5
4	**Testing & maintenance of Insulation** Classification of insulating materials as per I.S. 8504(part III) 1994, factors affecting life of insulating materials, measurement of insulation resistance & interpretation of condition of insulating. Methods of measuring temperature of internal parts of windings/machines & applying the correction factor when the machine is hot.	5
5	**Testing & maintenance of Transformer** Listing type test, routine test & special test as per I.S. 2026-1981. Procedure for conducting following tests: Measurement of winding resistance, no load losses, & no load current, Impedance voltage, load losses, Insulation resistance, Induced over voltage withstand test, separate source voltage withstand test, Impulse voltage withstand test, Temperature rise test of oil & winding, Different methods of determining temp rise- back to back test, short circuit test, open delta (delta – delta) test. Preventive maintenance & routine maintenance of distribution transformer as per I.S. 10028 (part-III): 1981, Periodic checks for replacement of oil, silica gel, parallel operation of 1 & 3 phase transformer, load sharing calculations (numerical).	6
6	**Installation** Factors involved in designing the machine foundation, Requirement of different dimension of foundation for static & rotating machines procedure for levelling & alignment of two shafts of directly & indirectly coupled drives, effects of misalignment. Installation of rotating machines as per I.S. 900-1992. Use of various devices & tools in loading & unloading, lifting, carrying heavy equipment.	6

V Semester

EL2313 - OE I : Testing and Maintenance of Electrical Equipment"s

Text Books:			
S. N.	**Author**	**Title**	**Publisher**
01.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol – I	Media Promotors & Publisher Ltd. Mumbai
02.	B. V. S. Rao	Operation and Maintenance of Electrical machines Vol – II	Media Promotors & Publisher Ltd. Mumbai

Reference Books:			
S. N.	**Author**	**Title**	**Publisher**
01.	B. L. Theraja	Electrical Technology Vol I to IV	S. Chand & Co., New Delhi
02.	C. J. Hubert	Preventive Maintenance Hand Books & Journals	----------

EE2331 OE 1: Fuzzy logic and Neural Networks

This elective course is an integral part of Soft computing techniques. Soft computing is an important branch of computational intelligence, where fuzzy logic, probability theory, neural networks, and genetic algorithms are synergistically used to mimic the reasoning and decision making of a human. Approaches that are useful in the development of intelligent machines, which have great significance in industries.

The main goal of this subject is to provide us a way to find solution of problems that are too difficult to answer. It is different from hard computing in many aspects as this technique is tolerant to uncertainty as oppose to discriminant results in hard computing

The industry applications of Fuzzy logic and Neural networks approaches have proved two main advantages:

(1) it made solving nonlinear problems, in which mathematical models are not available, possible and

(2) it introduced the human knowledge such as cognition, recognition, understanding, learning, and others into the fields of computing.

Through this subject, students can learn the basic concepts and working principles required to analyse industry related problem statements and provide engineering solutions through development of intelligent solutions. Typical application areas include Medical data analysis, Telecommunications, agro-ecology, bioinformatics, branched fluid-transport network layout design, dam scheduling, data analysis and exploration, detection of phishing attacks, distributed terrestrial transportation, fault detection of motors, fault diagnosis of electronic circuits, fault diagnosis of power distribution systems, flood routing, hazard sensing, health care, industrial chemical processes, knowledge management in software development.

If students opt this subject, they can develop prerequisite concepts for Deep and Machine learning, Artificial Intelligence and Computer vision. Knowledge in and Development of intelligent and smart solutions can make their future journey in industry placement can be more easy.

V Semester

EE2331 – OE I: Fuzzy Logic & Neural Network

Objective	Course Outcome
1. Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory. 2. Introduce students to artificial neural networks and fuzzy theory from an engineering perspective	**On completion of this course, Students will be able to** **CO1:** Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks. **CO2:** Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches **CO3:** Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks **CO4:** Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand and learn the basic concepts, working principles of various soft computing techniques, especially Fuzzy logic and Artificial Neural Networks.	3	2	1	-	1	1	1	2	1	1	-	1	-	-
CO 2	Analyze the problem statements; provide engineering solutions through development of membership functions / membership graphs, Learning & Recognition approaches	3	3	3	2	2	1	1	2	1	1	-	1	3	-
CO 3	Work on Case studies based on Application areas of Soft Computing, Design / Develop and Demonstrate models for Fuzzy controllers, Neural Networks	3	3	3	3	2	2	1	2	2	2	1	3	3	-
CO 4	Get involved in self learning approach for developing models using Soft computing techniques, Reveal different applications of these models to solve engineering and other problems and develop solutions for problems related to society and industry needs, writing Technical reports, presentations.	3	3	3	3	2	2	1	2	2	2	2	3	3	-

V Semester

EE2331 – OE I: Fuzzy Logic & Neural Network

Unit No.	Contents	Max. Hrs.
1	Crisp sets: An overview, Fuzzy sets: Basic types, basic concepts, basic properties of α-cuts, representation of fuzzy sets, and extension principle of fuzzy sets	8
2	Operations on fuzzy sets, Fuzzy numbers, Arithmetic operations on intervals, arithmetic operations on fuzzy numbers, fuzzy equations	7
3	Fuzzy controllers: an overview with applications, applications of fuzzy logic	7
4	Fundamental concepts of ANN: Basic building blocks of artificial neural networks, network architectures, activation functions, McCulloch-Pitt's neuron model, Learning rules: Hebbian learning rule, Perceptron learning rule, Delta learning (Widrow- Hoff and LMS)rule, Competitive learning rule, Boltzmann learning	8
5	Brief introduction to single layer and multilayer perceptions, ADALINE and MADALINE, feed-forward networks, back propagation networks and applications.	8
6	Radial basis function network, Self organizing feature map and applications	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Fuzzy sets and Fuzzy logic	2008	George J. Klir and Bo Yuan	Prentice Hall
2	Neural Networks: A comprehensive Foundation'	2nd Edition, 2005	Simon Haykin	Pearson publications

Reference Books

SN	Title	Edition	Authors	Publisher
1	Fuzzy sets: Uncertainty & information	1988	Klir and Folger	PHI
2	Introduction of Artificial Neural Networks	1999	Jacek Zurada	Pws Pub Co
3	Fuzzy Logic with engineering applications,	3rd Edition	Timothy Ross,	Wiley Publication
4	Principles of Soft Computing	2nd Edition	S. N. Sivanandanam and S. N. Deepa,	Wiley Publication

EE-2332 : OE-1: Basics of Analog and digital communication

Scope of subject:- The communication that occurs in our day-to-day life is in the form of signals. These signals, such as sound signals, generally, are analog in nature. When the communication needs to be established over a distance, then the analog signals are sent through wire, using different techniques for effective transmission. The conventional methods of communication used analog signals for long distance communications, which suffer from many losses such as distortion, interference, and other losses including security breach. In order to overcome these problems, the signals are digitized using different techniques. The digitized signals allow the communication to be more clear and accurate without losses.

Course outcome:-

On successful completion of the course students will be able to:

- Understand basic elements of a communication system.
- Conduct analysis of baseband signals in time domain and in frequency domain.
- Demonstrate understanding of various analog and digital modulation and demodulation techniques.

V Semester

EE2332 – OE I: Basics of Analog and Digital Communication Systems

Objective	Course Outcome
1. To Study different analog and digital modulation techniques. 2. To understand transmitter & receivers in communication systems	**On completion of this course, Students will be able to** 1. Understand different modulation and demodulation schemes for analog communication with the concept of noise 2. Understand different pulse analog and digital modulation techniques. 3. Understand different digital modulation schemes 4. Understand the different coding techniques for communication systems.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Understand different modulation and demodulation schemes for analog communication with the concept of noise	2	1												
CO 2	Understand different pulse analog and digital modulation techniques.	2	1												
CO 3	Understand different digital modulation schemes	2	1												
CO 4	Understand the different coding techniques for communication systems	2	1												

V Semester

EE2332 – OE I: Basics of Analog and Digital Communication Systems

Unit No.	Contents	Max. Hrs.
1	Basic block diagram of Analog communication system, Modulation techniques: Need for modulation, Basic concepts of AM, FM, PM, Transmitters.	8
2	Receivers: Basic receiver (TRF), Super heterodyne receiver, AM detectors, FM Detectors, Noise Types of Noise, Definition of Noise figure, signal to noise ratio, calculation of noise figure.	7
3	Pulse Modulation: Generation and demodulation of PAM, PWM, PPM, Time division Multiplexing, Frequency division multiplexing, Basic digital Modulation System- PCM.	7
4	Channel capacity, DPCM, Delta Modulation, ADM, ADPCM, Adaptive sub-band coding, applications.	8
5	Digital Modulation techniques: ASK, FSK, PSK, BPSK, QPSK, MSK, DPSK, BFSK, M-ary PSK, FSK, and QAM.	8
6	Source coding and channel coding, Information theory, Huffman coding, LZ coding, Basic concept of convolution code.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Electronic Communication System	Fourth Edition,	Gorge Kennedy	Tata McGraw-Hill
2	Digital Communications	1999	SymonHykin	Wiley, 1988

Reference Books

SN	Title	Edition	Authors	Publisher
1	Electronic Communication Systems	Second Edition, 1993	Frank R. Dungan	Delmar Publishers
2	Communication Electronics	Third Edition, 2007	Louis Frenzel	McGraw-Hill
3	Digital and analog communication systems	Fifth Edition,2003	K. Sam Shanmugam	John Wiley & Sons

EE2333 : OE I : Biomedical Instrumentation

Biomedical Instrumentation involves studying new devices and procedures that solve medical and health-related problems by combining their recent advances of knowledge in engineering, biology, and medicine to improve human health through cross-disciplinary activities that integrate the engineering sciences with the biomedical sciences and clinical practice. The instruments may range from large imaging systems such as conventional x-ray, computerized tomography and magnetic resonance imaging, to small implantable devices, such as pacemakers, cochlear implants, drug infusion pumps and some of the Prominent biomedical applications include the development of various diagnostic and therapeutic medical devices ranging from common imaging equipment such as MRIs and EEGs, regenerative tissue growth, pharmaceutical drugs and therapeutic biologicals.

The scope of biomedical instrumentation is for all branches as mechanical knowledge is needed for constructing complex machine , electrical and electronics engineering plays a vital role in measurement of parameters and automation of the instruments . Computer engineering helps in the analysis and diagnostic part whereas Information technology plays an important role in telemedicine. Since, the Covid Pandemic the biomedical instrumentation as got tremendous boost and this elective will provide exact blend of all branches thus building a strong foundation for students who want to pursue post graduation in biomedical engineering .

V Semester
EE2333 – OE I: Biomedical Instrumentation

Objective	Course Outcome
1. This course is intended for introducing the students to evolution and development of biomedical instrumentation. 2. The purpose of this course is to develop a strong foundation of use of transducers in biomedical measurements. 3. Understand concepts of working principle of various biomedical instruments and analysis their output graphs like ECG,EEG,EMG, X-rays, plethys mograph and spirogyra 4. Understand the fundamentals of Telemedicine like Teleradiology, Telecardiology, Telepsychiatry and Medical Informatics	**On completion of this course, Students will be able to** 1. Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation 2. Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram 3. Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care. 4. Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe the basic concepts of biomedical instrumentation and principle of transducer used in biomedical instrumentation	3	2	1		1									
CO 2	Explain cardiovascular, blood pressure measurement and analyze ECG, plethysmograph and spirogram	3	2	1		1									
CO 3	Identify various techniques used in generation and measurement of x-rays, EMG and use of pacemakers, defibrillators in health care.	3	2	1		1									
CO 4	Recognize concept of Telemedicine, its applications and use of internet resource for hospital management system.	3	2	1		3									

V Semester
EE2333 – OE I: Biomedical Instrumentation

Unit No.	Contents	Max. Hrs.
1	Introduction to Biomedical instrumentation, development of biomedical instrumentation, biometrics, Physiological system of body, problems encountered in measuring a living system.	8
2	Basic transducer principle, active transducer, passive transducer, electrode theory, biopotential electrodes, biochemical transducers	7
3	The heart and cardiovascular system, characteristics of blood flow, blood pressure measurement, heart sound measurement. Principles of ultrasonic diagnosis, temperature measurement, electrocardiograph, plethysmography, pulmonary function measurement spirometry, pulmonary function analyzers, respiratory gas analyzers	7
4	Generation of ionizing radiation, instrumentation for diagnostic X-ray, special technique, instrumentation for medical use of radioisotopes, radiation therapy, EMG	8
5	Patient care and monitoring, the elements of intensive care monitoring , instrumentation for monitoring patient, pacemakers, defibrillators, Electrical safety of medical equipment. Physiological effects of electrical current, shock hazards from electrical equipments.	8
6	Computers in biomedical instrumentation, digital computer, Telemedicine concept, Telemedicine applications, video conferencing, digital communication in telemedicine Teleradiology, Tele Cardiology, Telepsychiatry	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Biomedical Instrumentation & Measurement	19 Jan 2010	By Leaslie Cromwell, Fred Weibell, Erich A Pfeiffer	Prentice Hall
2	Biomedical Instrumentation	1 Jan 2010	Mandeep Singh	Prentice Hall

Reference books:

1	Handbook of Biomedical Instrumentation	1987	R.S.Khandpur	TMH
2	Bioelectronics Measurement	1983	Dean A Dmane, David Michaels	Prentice Hall
3	Medicine and Clinical Engineering	1 August 2008	Jacobson and Webster	PHI

ET2311 : OE-I Microcontroller and Embedded Systems (MAES)

Microcontroller and Embedded Systems is the subject thought by faculty of electronics and telecommunication to the students of other branches. Now a days most of the project on which engineer works are interdisciplinary .So for engineers of any branch it is necessary to have basic knowledge of few important subjects of other branches. If students want to learn basics of embedded systems they must opt MAES as open elective.

Embedded systems are used in almost every electronic device around. These systems are used in unison to come together and create a larger functioning system. Microcontroller is used as processor in every embedded system .In this subject we taught 8051 microcontroller.. In 1981, Intel introduced an 8-bit microcontroller called the **8051**. It was referred as **system on a chip** because it had 128 bytes of RAM, 4K byte of on-chip ROM, two timers, one serial port, and 4 ports (8-bit wide), all on a single chip. When it became widely popular, Intel allowed other manufacturers to make and market different flavors of 8051 with its code compatible with 8051. It means that if you write your program for one flavor of 8051, it will run on other flavors too, regardless of the manufacturer.

If students study this subject they will be in position to build their own embedded system which will be useful to perform task in their field (Mechanical, Civil, Electrical and Information technology).

V Semester
ET 2311- OE I: MICROCONTROLLER & EMBEDDED SYSTEMS

Objective	Course Outcome
The student should be able to 1) To understand the architecture and pin functions of 8 bit microcontroller. 2) To study the assembly language instruction set. 3) To understand programming microcontroller in C language. 4) To understand interfacing of on and off chip peripherals with 8051 microcontrollers	**On completion of this course, the student will be able to** 1) Explore 8051 microcontroller architecture. 2) Effectively utilize instruction set for assembly language programming. 3) Explore embedded C language for programming. 4) Apply basic skills of 8051 microcontroller interfacing to solve real life problems.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Explain 8051 microcontroller architecture.	3							3	2	2		2	2	
CO2	Develop assembly language program.	3	3						3	2	2		2	2	
CO3	Develop embedded C language program.	3	3						3	2	2		2	2	
CO4	Interface 8051 microcontroller to solve real life problems	3	3	2					3	2	2		2	2	

Unit No.	Contents	Max. Hrs.
1	Overview of 8051 Microcontroller family, Introduction to MCS 51 family, Architecture, Memory organization, Internal RAM, Flag Register, Register Banks, SFRs , Functional pin description and various resources of MCS 51. Hardware Overview	6
2	Addressing modes, Instruction set and Assembly language programming Programs using look up table, Bit manipulation, 8051 I/O programming, Delay Programs.	6
3	I/O Interfacing such as LED, switches, 7segment display, keyboard matrix programming, 8051 programming in C: Data types and time delay, I/O programming, Logic operations, Data conversion programs, Lookup table access	6
4	Timer programming in assembly and C: Various modes of operation, SFR related to timer operation. Serial Port programming in assembly and C: Basics of serial communication, 8051 connection to RS 232. Serial data transfer programs.	6

V Semester

ET 2311- OE I: MICROCONTROLLER & EMBEDDED SYSTEMS

5	Interfacing of LCD, ADC, DAC, stepper motor and DC motor with 8051 microcontroller	6
6	Block diagram of Arduino, features of Arduino Architecture, Arduino pin description: digital pins, analog pins, Power pins and other pins, Interfacing of LED, 7-Segment display, LCD, Sensors, DC motor, switch and Serial communication. **New topic to be announced time to time** .	6

Text Books

SN	Title	Edition	Authors	Publisher
1	The 8051 Microcontroller and Embedded systems using assembly & C	2nd edition	by Muhammad Ali Mazidi	Pearson Education Asia LPE
2	Programming and Customizing the 8051 Microcontroller		By MykePredko	McGraw-Hill
3	The 8051 Microcontroller	3rd edition	By Kenneth Ayala	CENGAGE Learning
4	Arduino Development Cookbook		Cornel Amariei	PACKT Publishing

Reference Books

SN	Title	Edition	Authors	Publisher
1	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets	Douglas V Hall	Tata McGraw Hill	Intel or Atmel MCS 51 Family Microcontrollers Data Sheets
2	Microprocessor & Interfacing	A. K. Ray, K. M. Bhurchandi.	Tata McGraw Hill	Microprocessor & Interfacing

ET2312 : OE-I PRINCIPLES OF COMMUNICATION ENGINEERING

Preliminary Information

This course covers fundamental concepts of communication systems, which are essential for the understanding of advanced courses in digital/ wireless communication systems. This course cover several important analog digital modulation techniques such as Amplitude Modulation, Frequency Modulation, Phase Modulation, amplitude shift keying, frequency shift keying , phase shift keying etc. Sampling process and Quatization, including Nyquist criterion and reconstruction of the original signal from the sampled signal. This course also gives an overview of the of digital communication systems. A digital communication system is one that transmits a source (voice, video, data, etc.) from one point to another, by first converting it into a stream of bits, and then into symbols that can be transmitted over channels (cable, wireless, storage, etc.). The use of the digital bit-stream as the interface between the source and the channel is universal regardless of what kind of source and channel are involved. Digital communication principle, with "bit" as the most important concept of the information age, and applications in computer science, Internet, wireless, etc. In This course we also introduce the basic concepts and techniques of Multiple access system, Satellite communication, optical communication and ,PLCC and SCADA system.

Advantages in placement

This course is suitable for all UG/PG students and practicing engineers who are looking to enhance their knowledge of the fundamental principles underlying various communication systems as well as students preparing for their college/ university/ competitive exams.

INDUSTRY SUPPORT : Most companies in wireless communications area should find this useful. Examples are Qualcomm, Broadcom, Intel etc.

V Semester

ET 2312– OE I: PRINCIPLES OF COMMUNICATION ENGINEERING

Objective	Course Outcome
The student should be able to 1) Understand various modulation and demodulation techniques of analog and digital modulation. 2) Describe and determine the performance of different error control coding schemes for the reliable transmission of digital representation of signals and information over the channel. 3) Understand various multiple access techniques in wire and wireless communication 4) To learn the basic of satellite communication and elements of optical fiber transmission	**On completion of this course, the student will be able to** 1) Describe analog and digital communication systems and various modulation schemes. 2) Analyze error correcting codes, including block codes. 3) Explain multiple access techniques in wire and wireless communication. 4) Use the different application of satellite communication and optical communications

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Describe analog and digital communication systems and various modulation schemes.	3							3	2	2		2	2	
CO2	Analyze error correcting codes, including block codes.	3	3						3	2	2		2	2	
CO3	Explain multiple access techniques in wire and wireless communication.	3							3	2	2		2	2	
CO4	Explain the different application of satellite communication and optical communications	3							3	2	2		2	2	

V Semester
ET 2312– OE I: PRINCIPLES OF COMMUNICATION ENGINEERING

Unit No.	Contents	Max. Hrs.
1	**ANALOG COMMUNICATION** Introduction to Communication Systems; Noise, Types of noise, sources of noise; Need for modulation, AM-Time domain representation, Frequency spectrum, power relations, DSB/SC, SSB Angle modulation.	6
2	**DIGITAL COMMUNICATION** Introduction Digital Communication System; Pulse modulations – concepts of sampling and sampling theorems, PAM, PWM, PPM; Waveform coding Techniques: Pulse code Modulation (PCM), Delta Modulation, Adaptive Delta modulation.	6
3	**Digital Modulation** Data formats; Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) Phase Shift Keying (PSK) – BPSK – QPSK– Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM ; Bandwidth Efficiency; Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).	6
4	**SOURCE CODES, LINE CODES & ERROR CONTROL** Entropy, Properties of entropy; source coding: Huffman coding; error control codes and applications: convolutions & block codes.	6
5	**MULTIPLE ACCESS TECHNIQUES** FDMA, TDMA, CDMA, SDMA application in wire and wireless communication : Advantages (merits)	6
6	**SATELLITE, OPTICAL FIBER – POWERLINE, SCADA** types of satellites , frequency used link establishment, MA techniques used in satellite communication, earth station; aperture actuators used in satellite – Intelsat and Insat; fibers – types: sources, detectors used, digital filters, optical link: power line carrier communications SCADA, New topic to be announced time to time	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Principles of Communication Systems	2007	Taub &Schiling	Tata McGraw Hill
2	Principles of Digital Communication	1986	J.Das	New Age International

Reference Books

SN	Title	Edition	Authors	Publisher
1	Electronic Communication Systems	4th Edition, 1993	Kennedy and Davis	Tata McGraw hill
2	Digital Communication Fundamentals and Applications	2001	Sklar	Pearson Education
3	Digital Communication	2004.	Bary le, Memuschmidt	Kluwer Publication

ET2313 : OE-I Fundamentals of Image Processing

General information about course: (100-150 words)

- Image processing techniques are used for adjusting color, contrast and dynamic range to reveal the hidden detail in data. It is a part of imaging science-a multidisciplinary field concerned with the generation, collection, duplication, analysis, modification, and visualization of images. As an evolving field it includes research and researchers from computer science, Electronics & Communication, Electrical engineering, Civil engineering and Mechanical Engineering.
- Image processing has a lot of challenges that are unique. To tackle them all, a solid foundation of computer science is definitely needed. Plenty of image processing solutions come through computer science related fields such as graph theory, machine learning, neural networks etc.
- In **electrical engineering** and **computer science**, image processing is any form of signal processing for which the input is an image, such as a photograph or video frame. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it.
- Image processing is an important Engineering tool which can be used in **mechanical domain** as well. In mechatronics, vision based AI uses image processing in wide variety of problems.
- Image processing has been extensively and successfully used in many sub-areas of **civil engineering**, such as engineering document scanning, pavement distress assessment, site evaluation via satellite imagery, studies of crack propagation and microstructure in cement-based materials, and evaluation of soil fabric, etc.
- Digital image processing may be modeled in the form of multidimensional systems. The demand for a wide range of **applications in environment, agriculture, military, industry and medical science** has increased.
- Students who wish to pursue **higher studies** in the image processing filled will be immensely benefitted by this open elective.
- Due to the great demand and scope of **interdisciplinary skill**, this open elective course would be beneficial for carrying out live projects to solve different problems, the **employability/ entrepreneurship** capability of students will be substantially increased due to this course.

V Semester

ET 2313– OE I: FUNDAMENTALS OF IMAGE PROCESSING

Objective	Course Outcome
The student should be able to 1) Learn the fundamentals of digital image processing algorithms. 2) Learn the algorithms of spatial and frequency domain filtering. 3) Study the performance of digital images in frequency domain. 4) Learn segmentation and compression of digital images through various algorithms	**On completion of this course, the student will be able to** 1) Apply basic image processing algorithms for image enhancement. 2) Apply filtering techniques in spatial and frequency domain. 3) Interpret the digital images in frequency domain by using various transform techniques. 4) Implement the algorithms for image segmentation and compression

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Apply basic image processing algorithms for image enhancement.	3	3						3	2	2		2	2	
CO2	Apply filtering techniques in spatial and frequency domain.	3	3						3	2	2		2	2	
CO3	Describe and analyze various image transform techniques.	3	3						3	2	2		2	2	
CO4	Apply segmentation and compression algorithms on images	3	3						3	2	2		2	2	

V Semester

ET 2313– OE I: FUNDAMENTALS OF IMAGE PROCESSING

Unit No.	Contents	Max. Hrs.
1	**Introduction** Origin of Digital Image processing, Fundamental Steps in image processing, Component of Image processing system, Sampling and quantization, Interpolation Techniques, Geometric transformation, Concept of gray levels, Relationship between pixels, Applications of Image Processing.	6
2	**Intensity Transformations** Background, Basic intensity transformation techniques: Image negative, log transformation, power law transformation, piecewise linear transformation, Histogram processing: Histogram Equalization, Histogram Matching, Local histogram processing.	6
3	**Spatial and Frequency Domain Filtering** Mechanics of Spatial filtering, Smoothing spatial filters: Linear and Order statistic filters, Sharpening filters: Foundation, Laplacian and Gradient, Filtering in frequency domain	6
4	**Image Segmentation** Detection of discontinuities, Edge linking and boundary detection, Thresholding, Region based segmentation.	6
5	**Representation and Description** Representation, Boundary Descriptors, Regional Descriptor	6
6	**Object Recognition** Patterns and Pattern Classes, Recognition based on decision Theoretic Methods, Structural Methods, **New topic to be announced time to time**	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Digital Image Processing	2nd edition	R.C. Gonzalez & R.E. Woods	Addison Wesley/Pearson education publication 2002.
2	Digital Image Processing	4th edition	William K. Pratt	A John Wiley & Sons, Inc., Publication

Reference Books

SN	Title	Edition	Authors	Publisher
1	Fundamentals of Digital Image Processing		Anil K. Jain	PHI
2	Digital Image Processing		S. Jayaraman, S. sakkirajan, T Veerakumar	McGraw-Hill

Deptt. of Computer Technology
Information regarding open elective course

Course Name: **Essentials of IT (OE-I)**

Course Code: **CT2326 (V Sem), CT2372 (VI Sem)**

Introduction:

The course "Essentials of IT" incorporates concepts from few core Computer Science subjects aligned to practical applications in software industry. The topics are abreast to the current trends and direct application in software programming and projects. The coverage of topics is at a good depth so that students get an overview of the technologies involved and also knowledge of practical applications wherever possible. It does not focus on single computer science subject in too much of depth, rather right level of coverage for students from other branches who can relate to the topic and gain just right amount of required knowledge of variety of computer science topics. The concepts learned in this course will enable students to dive deep into the topics learnt and encourage them for life-long learning in computer science.

Scope:

The broad topics covered are algorithm design, object oriented concepts, Java programming fundamentals, database design concepts, basics of SQL, web page design using HTML, Javascript programming fundamentals and software engineering basics.

Industry alignment:

Majority of the course content is provided by Infosys.

Advantages in placement:

Evaluation of programming concepts, database system basics, problem solving skills and knowledge of software engineering processes are few of top topics targeted by software industries during recruitments. Since these topics are well covered in this course, students can definitely look forward to benefitting from this course in software industry placements.

Course Teacher:

Mrs. Gauri Chaudhary

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

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

Deptt. of Computer Technology
Information regarding open elective course

Course Name: **OE: Introduction to Salesforce**

Course Code: **CT2329 (V Sem), CT2375 (VI Sem)**

Introduction:

The course “Introduction to Salesforce” includes the cloud computing concepts as basics and complete salesforce administration. Salesforce is a cloud-based software company that provides its customers with a platform to develop their own applications without following the tough steps that they used to follow in the legacy system. The software or application once created can be uploaded onto the cloud allowing the end-users to view them.

Scope:

Salesforce is a reliable CRM platform having around 800 functionalities. It is present as an ecosystem that comprises customer management, monitoring, workflow management, analytics, collaboration, social media, and IoT integration. Hence, Salesforce software has become an affordable and top CRM solution.

Industry alignment:

Persistent Systems Pvt. Ltd. Nagpur.

Advantages in placement:

The biggest benefit that Salesforce provides for the recruitment industry is being an all-inclusive productive tool. It offers enough solutions for every aspect of hiring. In fact, most of those can be linked with each other. It helps in integrating a newly hired employee with the whole organization quite smoothly.

Course Teacher:

Mr. Ganesh K. Yenurkar

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

Chairperson	Dean (Acad. Matters)	June 2020 Date of Release	1.02 Version	Applicable for AY 2020-21 Onwards

V Semester
CT2329 – OE I: Introduction to Salesforce

Reference Books		
SN	**Title**	**Link**
1	CRM Tool Links (Online)	http://help.salesforce.com

IT2321 : OE-I Industry 4.0

Industry 4.0 refers to a new phase in the Industrial Revolution that focuses heavily on interconnectivity, automation, machine learning, and real-time data. Industry 4.0, also sometimes referred to as IIoT or smart manufacturing, marries physical production and operations with smart digital technology, machine learning, and big data to create a more holistic and better connected ecosystem for companies that focus on manufacturing and supply chain management. While every company and organization operating today is different, they all face a common challenge—the need for connectedness and access to real-time insights across processes, partners, products, and people. That's where Industry 4.0 comes into play. This course will help students inorder to provide them with an in-depth overview on the topic of Industry 4.0 and IIoT, including information on: The evolution of Industry from 1.0 to 4.0,basic IIoT concepts and Glossary of Terms, smart manufacturing use cases, whom is Industry 4.0 for?, benefits of adopting an Industry 4.0 Model and challenges to consider and overcome

V Semester
IT 2321 - OE-1: Industry 4.0

Objective	Course Outcome
Students will: 1) Able to learn an introduction to Industry 4.0 (or the Industrial Internet) 2) Will able to understand its applications in the business world. 3) Will able to understand Business Model and Reference Architecture in Industry 4) Will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.	After completion of this course: 1) Students will be Understand the basics of IoT and basics of Industry 4.0. 2) Students will be Understand Business Model and Reference Architecture 3) Students will be able to understand the different Business issues in Industry 4.0 and how to solve them. 4) Students will be able to understand the need of Security and Fog Computing and applications of IIoT.

Unit No.	Contents	Max. Hrs.
1	Introduction to IoT: History of IOT, Concepts, Products and Examples. IOT Paradigm, The Layering concepts of IOT, IOT Communication Model, IOT Architecture, IoT Sensing and Actuation, IoT Connectivity, IoT Networking. Introduction to Industry 4.0: History, Concept, The Journey so far: Developments in USA, Europe, China and other countries, The Fourth Revolution, Compelling Forces and Challenges for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory, Globalization and Emerging Issues.	7
2	Basics of Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Life-cycle Management, Augmented Reality and Virtual Reality, Introduction to Artificial Intelligence, Big Data and Advanced Analysis, Cyber-Security in Industry 4.0, Industrial Processes, Industrial Sensing & Actuation, Industrial Internet Systems.	7
3	Business Model and Reference Architecture: IIoT-Business Models, IIoT Reference Architecture, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking.	6
4	Business issues in Industry 4.0:IIoT case studies, Opportunities and Challenges, Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world	6
5	Security and Fog Computing: Cloud Computing in IIoT, Fog Computing in IIoT, Security in IIoT. Application Domains: Factories and Assembly Line, Food Industry, Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications),	7
6	Industrial IOT- Application domain: Milk Processing and Packaging Industries, Manufacturing Industries, Virtual Reality Lab, Steel Technology Lab. Facility Management, Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries. Facility Management.	7

V Semester
IT 2321 - OE-1: Industry 4.0

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Industry 4.0: The Industrial Internet of Things		Alasdair Gilchrist	Apress
2	Industrial Internet of Things: Cyber manufacturing Systems		Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat	Springer

IT2322 : OE-1 CORE JAVA

With the growth of Information and Communication Technology, there is a need to develop large and complex software. Further, those software should be platform independent, Internet enabled, easy to modify, secure, and robust. To meet this requirement object-oriented paradigm has been developed and based on this paradigm the Java programming language emerges as the best programming environment. Now, Java programming language is being used for mobile programming, Internet programming, and many other applications compatible to distributed systems. This course aims to cover the essential topics of Java programming so that the participants can improve their skills to cope with the current demand of IT industries and solve many problems in their own filed of studies.

PREREQUISITES : This course requires that the students are familiar with programming language such as C/C++

INDUSTRY SUPPORT : All IT companies.

Books and references

1.Java: The Complete Reference Hebert Schildt, Mc Graw Hill

V Semester

IT 2322 - OE-1: Core JAVA

Objective	Course Outcome
Student will : 1. Learn the Concepts of Java programming language 2. Learn Java's syntax, idioms, patterns, and styles to write simple JAVA program. 3. To develop object centric thinking and to use object oriented features of JAVA to write complex programs. 4. Learn the essentials of the Java class library, and learn how to learn about other parts of the library when you need them in application development	After completion of the course students will be able to: 1. Demonstrate the understanding of Object oriented concepts. 2. Apply the programming language JAVA efficiently in object oriented software development 3. Able to analyze problem statement and identify appropriate objects and methods 4. Design and implement a small programs using classes

Unit No.	Contents	Max. Hrs.
1	Introduction to Programming Methodologies, Introduction to Object oriented programming, Objects and Classes, Characteristics of OOP, Encapsulation and data Abstraction, Inheritance, Polymorphism, Dynamic Binding, Structured Versus Object oriented programming, Merits and demerits of object oriented methodology, introduction to Java as OOP language	7
2	Building blocks of java, Data types, Variable declarations, operators and Assignments, control structures, Identifying objects and classes, Declaring Classes and objects, Creating Classes and objects, methods, argument passing, Recursion, this keyword, constructors ,Visibility control	7
3	Java as OOP language, Other Class Modifiers: static, final, Abstract, Method overloading, Super keyword, Overriding (polymorphism), nested inner classes, packages (encapsulation), Interfaces (multiple Inheritances)	6
4	Arrays and Strings: Arrays, One Dimensional Arrays, Two Dimensional Arrays, variable size arrays, Strings and String Buffer classes, Wrapper Classes	6
5	Exception handling mechanism: Fundamentals exception types, uncaught exception, try-catch Block, displaying description of an exception, multiple catch clauses, nested try-catch statements, throw, throws, finally, built in exceptions, creating own exception subclasses	7
6	I/O Streams: Introduction to stream classes, use of stream classes, I/O stream, bytes stream, character stream, pre-defined stream, reading console input, reading character, reading string, writing console output, the print write class, reading & writing files ,transient and volatile modifiers	7

V Semester
IT 2322 - OE-1: Core JAVA

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Thinking in Java		Bruce Eckel	Prentice Hall

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Programming with Java		E Balagurusamy	TATA Mc Graw-Hill
2	Java2CompleteReference		Herbert Schildt	Mc Graw-Hill

GE-2313 - Numerical methods for partial differential equation

Numerical methods for partial differential equations is the branch of numerical analysis that studies the numerical solution of partial differential equations (PDEs). Unit-I contains finite difference method to solve 2^{nd} order and 4^{th} order ordinary differential equation with three types of boundary condition. Error analysis, stability analysis and convergence analysis of finite difference methods are discussed. In many fields of science and engineering, to determine the harmonic motion, damped and forced variation, current from electric circuit, 2^{nd} order and 4^{th} ordinary differential equation is required to solve. The analytical solution of most of the ordinary differential equations with complicated boundary condition that occur in engineering problems is not easy. Therefore, numerical technique finite difference method (FDM) is very popular and important for solving the boundary value problems. In Unit-II, III and IV , Finite difference methods are used to sove elliptic, pabalolic and hyperbolic type of partial differential equations. Partial differential equations (PDEs) arise in every field of science and engineering like hydrodynamics, elasticity, quantum mechanics and electromagnetic theory. A physical problem in applied mathematics or science and engineering can be formulated in terms of PDE, so the solution of these PDEs is of great interest in understanding various physical phenomena. Many PDEs cannot be solved by analytical methods, we go in for sufficiently approximate solution by simple numerical methods, and the method of finite differences is commonly used. Unit- II contains classification of partial differential equations, Elliptic Equations like Laplace equation, Poisson equation, iterative schemes, Dirichlet's problem, Neumann problem, mixed boundary value problem, ADI methods. Unit-III contains Schmidt's two level, multilevel explicit methods, Crank-Nicolson's two level, multilevel implicit methods, Dirichlet's problem, Neumann problem, mixed boundary value problem to solve the heat conduction equation. Explicit methods, implicit methods for one space dimension and two space dimensions are used to solve the hyperbolic equation. In mathematics, a hyperbolic partial differential equation has a well-posed initial value problem. The wave equation is an important second-order linear partial differential equation for the description of waves—as they occur in classical physics—such as mechanical waves (e.g. water waves, sound waves and seismic waves) or light waves. It arises in fields like acoustics, electromagnetics, and fluid dynamics. Finite Element methods are included in Unit-V and VI. The finite element method (FEM) is a numerical technique for finding approximate solutions to boundary value problems for differential equations. Unit-V contains heat conduction equation of heat transfer, Governing differential equation for heat conduction, Formulation of finite element method for heat conduction. Unit -VI contains Galerkin's methods for 1D, 2D, 3D heat conduction, Transient heat conduction problems solving by Finite element method.

V&VI-Semester B.E. (Open Elective OE 1)

NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

GE-2313/2363	**Numerical Solution of partial differential equations**			**L=3**	**T=0**	**P=0**	**Credits=3**
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration		
	30	30	40	100	3 Hrs		

Objective	**Outcome**
The goal of this paper is to introduce the formulation and solution of different type partial differential equations using different numerical schemes and their application in different engineering field.	Use appropriate finite difference method to solve various initial value problems
	Classify and identify different type of partial differential equations
	Solve boundary value problems using finite difference methods.
	Design the mathematical model based on boundary condition and apply finite element method to predict the solution

Unit I:

Finite difference methods: Finite difference approximations for derivatives, boundary value problems with explicit boundary conditions, implicit boundary conditions, error analysis, stabilityanalysis, convergence analysis.

(6 hours)

Unit II:

Partial Differential Equations: Classification of partial differential equations, finite difference approximations for partial derivatives and finite difference schemes. Elliptic Equations: Laplace equation,Poisson equation, iterative schemes, Dirichlet's problem, Neumann problem, mixedboundary value problem, ADI methods.

(7 hours)

Unit III:

Parabolic equations: Schmidt's two level, multilevel explicit methods, Crank-Nicolson's two level, multilevel implicit methods, Dirichlet's problem, Neumann problem, mixed boundary value problem**.**

(6 hours)

Unit IV :

Hyperbolic Equations: Explicit methods, implicit methods, one space dimension, two space dimensions, ADI methods.

(6 hours)

Unit V:

Finite Element Method-I: Conduction Heat Transfer: Basic equations of heat transfer, Governing differential equation for heat conduction, Formulation of finite element method for heat conduction.

(7 hours)

Unit VI:

Finite Element Method-II: Galerkin's methods, 1D, 2D, 3D heat conduction, Transient heat conduction problems.

(7 hours)

Text Books:

SN	Title	Edition	Authors	Publisher
1	Numerical Solution of Partial Differential Equations	Third edition (1985)	G.D.Smith	Oxford University
2	Numerical Methods	Fourth Edition (2018)	T Veerarajan, T ramachandran	McGraw Hill Education

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Finite Element Analysis: Theory and Programming	Second edition (1985)	C S Krishnamoorthy	Tata McGraw Hill
2	Introductory Methods of Numerical Analysis	Fifth Edition (2012)	S. S. Sastry	PHI, Eastern Economy Edition

GE 2314 - COMBINATORICS

Combinatorics is the branch mathematics that studies the combinatorial theory. Unit-I contains the two types of rule sum rule and product rule. Solve the examples by using the pegion hole principle, permutation and combination also to solve the examples of generating function and recurrence relation. Unit-II contains the combinatorial identity and graph theory. Unit-III contains the number theory and congruence theory. To find the least common multiplier and gretest common divisor by using Euclidian algorithm. To solve the Diophantine equation by using congruence theory. Also to solve the simultanius linear congruence by using the congruence theory. Using the fermats theorem to find the remainder and divisibility. Unit-IV and Unit-V contains the finite continued fraction and infinite continued fraction. To find the convergents of finite simple continued fraction and infinite continued fraction. Also to find the best possible approximations by using the infinite continued fraction.

V&VI-Semester B.E. (Open Elective OE 1)

COMBINATORICS

GE 2314	COMBINATORICS			L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration		
	30	30	40	100	3 Hrs		

Objective	Outcome
To introduce generating functions	Develop the generating function by using basic concepts, rules, and definitions of Algebra and Apply it to solve various combinatorial identities
To provide knowledge of number theory and continued fractions	Discuss the graphs of given data.
	Use fundamental concepts of the number theory, rational, irrational numbers, continued fraction, formal logic, Propositional logic and first order logic.
	Apply finite, infinite Continued fraction to solve Algebraic and transcendental equations

UNIT 1: Basic counting techniques & Recurrence relations [CO-I] [PO – 1,2]
Basic counting techniques, pigeon-hole principle, recurrence relations, generating functions. Examples using ordinary power series and exponential generating functions, general properties of such functions.Dirichlet Series as generating functions. A general family of problems described in terms of "cards, decks and handa" with solution methods using generating functions.

(6 hours)

UNIT II: Generating function [CO-II] [PO – 1,2]
Proofs of the sieve formula and of various combinatorial identities. Certifying combinatorial identities. Some analytical methods and asymptotic results. Polya's counting theorem. Basics of graph theory. Introduction to probabilistic method in combinatorics.
(6 hours)

UNIT III: Number Theory [CO-III] [1,2]
Examples of continued fractions. The study of the continued fractions. Alpha has infinite continued fraction if alpha is irrational.
Formal logic: Propositional logic: proof system, semantics, completeness, compactness. Length of proofs, polynomial size proofs, efficiency of proof systems.

(6 hours)

UNIT IV: Theory of rational irrational numbers [CO-IV] [PO – 1,2]
Alpha has periodic continued fraction if alpha is quadratic irrational. Application to approximation of irrationals by rationals. Hurwitz's Theorem.
First order logic: models, proof system, compactness, Examples of formal proofs in say, number theory or group theory. Some advanced topics.

(6 hours)

UNIT V:Pell's equation / Continued fraction expansion [CO-V] [PO-1,3]
Application to solutions of Pell's equation. Proof that means cos{(p x pi)/q},for natural numbers p and q are irrational(apart from obvious exceptions). Example : CS application of logic, introduction to modal and temporal logics, Or formal number theory including incompleteness theorem.

(6 hours)

UNIT VI: Transcendental numbers [CO-VI] [PO-1,2]
Statement of Liouville's Theorem on algebraic numbers. Construction of transcendental numbers.
Elements of proof theory including cut elimination, Or zero-one law for first order logic.

(6 hours)

Text Books:

SN	Title	Edition	Authors	Publisher
1	An Introduction to the Theory of Numbers	5th edition	Niven, Zuckerman and Montgomery	Wiley Publication
2	Elementary number theory	6^{th} addition	Devid M. Burton	Tata Mc Graw Hill Publishers

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Combinatorial theory	1979 edition	Martin Aigner	springer
2	Representation theory		Amritanshu Prasad	springer
3	Discrete Mathematics And Number Theory	First Edition	Vijay Manthena & Pravin P. Bhad	Central Techno Publication

GE2315 OE1 Electronic Materials and Applications

Objective/ Course Outline:

- This course is intended for students who need to understand the basic principles of different kinds of materials, their properties and applications.

- This course provides the students a thorough understanding of the fundamentals of materials ranging from conductors, superconductors, dielectrics & active dielectrics, magnetic & optical materials with an aid of nanomaterials, their unique properties, their operations and their applications.

- It will equip the students with the knowledge of how a material's structure is, the causes of its basic behaviour, and how it can be put to various applications.

- The techniques involved in working of different devices using these materials and finding their usage from bucket to rocket technology thereby touching the new dimensions of material science.

GE2315 OE1 Electronic Materials and Applications

Syllabus:

Unit:I Conduction in metals, Factors affecting electrical resistivity of metals, Properties of Conducting materials and applications, Phenomenon of Superconductivity, Characteristic and applications, New developments.

Unit:II Dielectric parameters, Mechanisms of polarization, Lorentz field, Claussius- Mosetti equation, Dielectric in ac field, Frequency and temperature dependence of polarization, Dielectric loss Dielectric breakdown and mechanism, Dielectric materials and applications.

Unit:III Ferroelectricity , Origin of ferroelectricity; Important characteristics of ferroelectrics: Normal and relaxor ferroelectrics; Applications of ferroelectricity, Piezoelectricity: Phenomenon ,Origin, Piezoelectricity in Quartz; Piezoelectric materials and applications. Pyroelectricity, Phenomenon, Origin, Pyroelectric materials and applications

Unit:IV Magnetic parameters, Origin of magnetization/ Magnetic moment, Bohr's magneton, Classification of magnetic materials: diamagnetic, paramagnetic, ferromagnetic, anti ferromagnetic , and ferri magnetic.(ferrites), Hard and soft magnetic materials , Properties and applications.

Unit:V Refractive index and relative dielectric constant, Optical absorption , Luminescence: LCD,LED materials and applications, Photo detectors, Solar cell.

Unit:VI Introduction to Nanoscience, Synthesis of nanomaterials: Top down and Bottom – up process, Different types of nano structures (1-D , 2-D and 3-D), Properties of nano materials and comparison with bulk material, Nanostructured materials (Structure, Properties and uses) : Graphene, Fullerene,CNTs

Textbooks:

1. Solid State Physics : S.O.Pillai, New Age International Publishers
2. Applied Physics: P. K. Palanisamy, Scitech Publication (India Pvt Ltd, Chennai), 600017.
3. Principles of electronic materials and devices : S.O.Kasap

Reference Books:

1. Engineering Physics : Pandey and Chaturvedi ,Ceanage Publication
2. Engineering Physics: Malik and Singh ,McGraw Hill Publication
3. Applied Physics : T Bhima Sankaran and Prasad, BS publications
4. Electrical Engineering materials , N. Alagappan and N.T .Kumar Tata McGraw-Hill Publishing Co.Ltd , New Delhi-110002.
5. Electrical Engineering materials , C. S. Indulkar and S. Thiruvengadam, S. Chand and C. Ltd , Nagpur 6.Electrical Engineering materials , Seth
7. Electrical Engineering materials , A. J. Dekker, Prentice Hall of India Pvt. Ltd, New Delhi 8.Introduction to Magnetic materials : B. D. Cullity : Addison Wesley
9. Fandamentals of Material Science : John Wiley and sons, Callister
10. The science of Engineering Materials : D.R.Askeland and P.P Phule.

V&VI-Semester B.E. (Open Elective)

Introduction to German Language

GE-2317/2369	Introduction to German Language			L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration		
	30	30	40	100	3 Hrs		

Objectives	Course Outcomes : Students will be able to
Learning Basic Vocabulary	Alphabets, Numbers, Days of the Week, Months of the Year, Seasons, Greetings, Professions
Building on Basic Grammar Skills	Gender of the words, Articles, Subject pronouns, Verbs, Sentence building using Verbs and nouns
Learn to build very simple Sentences	Very basic sentences like self-introduction – Name, Age, Profession etc. Ordering food at restaurants.
Describing people, house, places	Learning Adjectives, Demonstrative adjectives to describe people, house and other places.
Write about hobbies, likes and dislikes, daily routine	Learning to write about leisure activities, what are the likes and dislikes and describing daily routine activities.
Speaking, Listening and Practical Exercises	Playing Videos to practice listening skills. Conversation practice and Role play to enhance speaking skills.

Unit-I : Introduction and basic grammar - 6 hours

- Learning about Alphabets, Numbers
- Days of the week, Months of the year, Seasons
- Common expressions, Professions, Colors
- Subject Pronouns, SER verb
- Articles, Adjectives, Demonstrative Adjectives

Unit-II : Learning to build simple sentences- 6 hours

- ESTAR verb to describe placements
- Prepositions of place
- SER ESTAR differences and application
- Using Hay for description
- Build simple sentences about yourself, your friends, classroom objects, household objects

Unit-III : Question words, Plurals, Present Tense and Present Continuous Tense of AR verbs - 7 hours

- Question words of What, who, where, which, why, when, how
- Build conversation skills by answering questions
- Making plurals of sentences
- Learning conjugations of AR verbs in Present Tense
- Learning Present continuous tense of AR Verbs
- Learning to Present oneself

Unit- IV : ER Verbs, Stem Changing Verbs and Tener - 7 hours

- Learning conjugations of ER verbs in Present Tense
- Learning Present continuous tense of ER Verbs
- Learning Food vocabulary
- Learning Basic Conversation at restaurant
- Stem changing Verbs conjugations
- Tener Verb to talk about age, describe family

Unit-V : SaberConocer, Time, IR Verbs, Leisure activities- 7 hours

- Saber Conocer to talk about abilities and personal acquaintance
- Learn to say Time in Spanish and Time related expressions
- Learning conjugations of IR verbs in Present Tense
- Learning Present continuous tense of IR Verbs
- Speak about activities what you do in leisure using all groups of verbs.

Unit-VI : Obligations, Prepositions, Possessive Adjectives, Gustar, Possessive Pronouns and Daily routine with reflexive verbs - 7 hours

- Talk about what has to be or should be done
- Learn prepositions for connecting sentences
- possessive adjectives to learn about my, your, his her, our.
- Learn likes and dislikes with Gustar
- Possessive pronouns to learn about mine, yours, ours.
- Reflexive verbs to Speak about daily routine.

Text Books & Reference Books:
Clan 7, Listos
Aula1, Chicoschicas

V&VI-Semester B.E. (Open Elective)

Introduction to Spanish Language

GE-2319/2369	**Introduction to Spanish Language**			**L=3**	**T=0**	**P=0**	**Credits=3**
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration		
	30	30	40	100	3 Hrs		

Objectives	**Course Outcomes : Students will be able to**
Learning Basic Vocabulary	Alphabets, Numbers, Days of the Week, Months of the Year, Seasons, Greetings, Professions
Building on Basic Grammar Skills	Gender of the words, Articles, Subject pronouns, Verbs, Sentence building using Verbs and nouns
Learn to build very simple Sentences	Very basic sentences like self-introduction – Name, Age, Profession etc. Ordering food at restaurants.
Describing people, house, places	Learning Adjectives, Demonstrative adjectives to describe people, house and other places.
Write about hobbies, likes and dislikes, daily routine	Learning to write about leisure activities, what are the likes and dislikes and describing daily routine activities.
Speaking, Listening and Practical Exercises	Playing Videos to practice listening skills. Conversation practice and Role play to enhance speaking skills.

Unit-I : Introduction and basic grammar - 6 hours

- Learning about Alphabets, Numbers
- Days of the week, Months of the year, Seasons
- Common expressions, Professions, Colors
- Subject Pronouns, SER verb
- Articles, Adjectives, Demonstrative Adjectives

Unit-II : Learning to build simple sentences- 6 hours

- ESTAR verb to describe placements
- Prepositions of place
- SER ESTAR differences and application
- Using Hay for description
- Build simple sentences about yourself, your friends, classroom objects, household objects

Unit-III : Question words, Plurals, Present Tense and Present Continuous Tense of AR verbs - 7 hours

- Question words of What, who, where, which, why, when, how
- Build conversation skills by answering questions
- Making plurals of sentences
- Learning conjugations of AR verbs in Present Tense
- Learning Present continuous tense of AR Verbs
- Learning to Present oneself

Unit- IV : ER Verbs, Stem Changing Verbs and Tener - 7 hours

- Learning conjugations of ER verbs in Present Tense
- Learning Present continuous tense of ER Verbs
- Learning Food vocabulary
- Learning Basic Conversation at restaurant
- Stem changing Verbs conjugations
- Tener Verb to talk about age, describe family

Unit-V : SaberConocer, Time, IR Verbs, Leisure activities- 7 hours

- Saber Conocer to talk about abilities and personal acquaintance
- Learn to say Time in Spanish and Time related expressions
- Learning conjugations of IR verbs in Present Tense
- Learning Present continuous tense of IR Verbs
- Speak about activities what you do in leisure using all groups of verbs.

Unit-VI : Obligations, Prepositions, Possessive Adjectives, Gustar, Possessive Pronouns and Daily routine with reflexive verbs - 7 hours

- Talk about what has to be or should be done
- Learn prepositions for connecting sentences
- possessive adjectives to learn about my, your, his her, our.
- Learn likes and dislikes with Gustar
- Possessive pronouns to learn about mine, yours, ours.
- Reflexive verbs to Speak about daily routine.

Text Books & Reference Books:
Clan 7, Listos
Aula1, Chicoschicas

Unit V:

How to make simple enquiries in speaking and writing- I want to catch a train to Bamberg, could you please tell me fastest train to reach Bamberg from Berlin?, Excuse me, I was looking to find a place to eat Pizza. Are you aware of the good restaurants nearby ?,I am looking to find a recent book about…… Could you please tell me in which rack can I find it?, What do you like to eat during lunches?, Do you like playing sports? I play a lot of sports, particularly my fav sports are swimming and walking. **(6 hours)**

Unit VI:

Learn to Write very simple letters

Letter to Your House Owner for fixing water tap, Letter to your neighbor since you won't be coming home late in the evening and your brother will be coming to collect keys from him Small Listening Exercises, Small Practical Exercises - Restaurant, Shopping Market, Bank, University Library.**(6 hours)**

Text Books:

SN	Title	Edition	Authors	Publisher
1	Studio D A1 Deutsch Buch	2014	Funk and Kuhn	Cornelsen Verlag (Goyal Publishers India)
2	Netwerk Deutschals Fremdspache	2015	Stefanie Dengler	Goyal Publishers
3	Tangramaktuell	2004	Hueber	Max HueberVerlag

Department of Civil Engineering

V Semester

CV2341 – OE-II : Elements of Earthquake Engineering

Earthquake engineering is a multi-phased process that ranges from the description of earthquake sources to characterization of site effects and structural response, and to description of measures of seismic protection. Its overall goal is to make such structures more resistant to earthquakes. The course on elements of earthquake engineering provides the fundamental concept, principles, and application of earthquake engineering for the seismic analysis and design of structures. The codal provisions for earthquake-resistant design of structures are briefly introduced so that students can learn the seismic behaviour of a structure, its seismic variations, and the impact of the structural design. These studies provide valuable information to the students to assess the probability and severity of future earthquakes. This is an upcoming field in India and designed for UG students to help them in developing their knowledge. Understanding all facts of earthquake hazards will be able to quantify different earthquake hazards and their effects using different methods, which facilitate in planning new structures and retrofit old buildings and infrastructures. Having engineers with a bachelor's degree with a good understanding of seismic effects will reduce the seismic risk in earthquake porn area.

V Semester
CV2341 - OE-II : ELEMENTS OF EARTHQUAKE

COURSE OBJECTIVES	COURSE OUTCOMES
1. To study geology of earth and interior. 2. To study causes of earthquakes and its characteristics. 3. To study behavior of different types of structures under earthquake loading. 4. To study about disaster management, mitigation and different retrofitting techniques.	1. An ability to understand the necessity and importance of earthquake engineering 2. An ability to understand the provision of IS codes used for earthquake resistant design of structure 3. An ability to understand provision for earthquake resistant design of structures as per Indian standard. 4. An ability to study damages caused due to past earthquake in & outside India and remedial measures
Mapped Program Outcomes : 1,3,4,6,7,11	

UNIT–1 : Introduction to earthquakes : Geology of earth, configuration of tectonic plates in a globe, behavior of plates, their motion and effects, causes of earthquake and their characteristics, Earthquake parameters, magnitudes, intensity.	**[07 Hrs.]**
UNIT–2 : Seismic waves, recording of earthquakes, analysis and interpretation of earthquake data, determination of magnitude, location of epicenter, focal depth.	**[06 Hrs.]**
UNIT–3 : Seismicity of the world, history of earthquakes in India and abroad, case studies of effects of earthquakes, causes and sources of earthquake damage.	**[06 Hrs.]**
UNIT–4 : Non-engineered earthquake resistant structures, load bearing structures, masonry structures, seismic zoning of India (IS 1893:2002 Part I), seismic coefficients for different zones, definitions, irregularities in buildings, consequences of irregularities.	**[07 Hrs.]**
UNIT–5 : Strengthening, rehabilitation and retrofitting of earthquake damaged structures.	**[06 Hrs.]**
UNIT–6 : Earthquake disaster management, mitigation and social aspects of earthquakes, lessons from past earthquake: - study of damages caused due to past earthquake and remedial measures.	**[07 Hrs.]**

Text Books :

1. Agrawal & Shrikhande, 'Design of Earthquake Resistant Structures', 3rdEdition, 2006, Prentice – Hall of India Pvt. Ltd.
2. Jai Krishna, Chandrasekaran & Brijesh Chandra, ' Elements of Earthquake Engineering', 2nd Edition, Standard Publishers Distributors, New Delhi
3. Roberto Villaverde, 'Fundamental Concepts of Earthquake Engineering', 2009, CRC Press
4. Asadour H. Hadjian, 'Basic Elements of Earthquake Engineering', 2015, Wiley

Reference Books:

1. C.V.R. Murty, Earthquake Tips, 2005, NICEE, IITK
2. www.nicee.org, 'NICEE Guidelines for Earthquake Resistant Non-Engineered Construction', 2004, National information center of Earthquake engineering Indian Institute of Technology Kanpur Kanpur 208016, India
3. Robin K. McGuire, Seismic Hazard and Risk Analysis, 2004, Earthquake Engineering Research Institute; First edition.

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Department of Civil Engineering

V Semester

CV-2342 OE II- INTRO TO FINITE ELEMENT METHOD

The **finite element method** (**FEM**) is a widely used method for numerically solving differential equations arising in engineering and mathematical modelling. Typical problem areas of interest include the traditional fields of structural analysis, heat transfer, fluid flow, mass transport, and electromagnetic potential. The FEM is a general numerical method for solving partial differential equations in two or three space variables (i.e., some boundary value problems). Engineers use FEM software to reduce the number of physical prototypes and experiments and optimize components in their design phase to develop better products, faster while saving on expenses. This software is used in various industries. The results-oriented features of **FEM** make it widely appealing to engineers. It improves the modelling process and allows designers to save time and money. This type of subject will help students in getting placement in the industries which deals with FEM software.

V Semester
CV2342 - OE-II : INTRODUCTION TO FINITE ELEMENT METHO

COURSE OBJECTIVES	COURSE OUTCOMES
1. To provide the student with knowledge and analysis skills in applying basic laws and steps used in solving the problem by finite element method. 2. To provide the student the knowledge of various interpolation functions and elements to solve simple problems by finite element method. 3. To provide the student with the knowledge of parametric formulation. 4. To provide students the knowledge of mathematical modeling techniques.	1. An ability to understand the steps required for FEM solution to variety of physical systems. 2. An ability to create models for simple structures. 3. An ability to solve engineering problems. 4. An ability to extend the knowledge of FEM for the solution of complex problems.
Mapped Program Outcomes : 1,2,3,12	

UNIT–1 : Introduction : Development, Historical background, Applications, Advantages and Disadvantages of FEM, General steps of FEM, direct equilibrium approach, Variational approach , weighted residual approach, local and global FEM, application to simple problems.	**[07 Hrs.]**
UNIT–2 : Shape functions : Introduction, requirement of Ideal displacement functions, Derivation of shape functions using Cartesian Coordinates, Lagrange and Serendipity elements.	**[06 Hrs.]**
UNIT–3 : Application of FEM to 1D Problems : Derivation of element property matrix and influence vector, application, Application to bar, truss, steady state heat conduction, steady state flow through porous medium problems.	**[06 Hrs.]**
UNIT–4 : Application of FEM to 2D problems : Equilibrium equations, Triangular and Rectangular element formulation using Cartesian Coordinates, Application to two-dimensional stress analysis.	**[07 Hrs.]**
UNIT–5 : Natural coordinates, Isoparametric elements, Application to 1D and 2D Problems.	**[07 Hrs.]**
UNIT–6 : Numerical integration, Modeling, storage and solution techniques.	**[06 Hrs.]**

Text Books :

1. Chandrapatla T.R., Belegundu A. D. Introduction to Finite Elements in Engineering, Prentice Hall India, 1991
2. Godbole P.N, Introduction to Finite Element Method, I. K. International Publishing House Pvt. Ltd., New Delhi, 2013
3. Desai Y.M., Eldho T.I. and Shah A. H., Finite Element Method s and Application to Engineering, Pearson, 2011.

Reference Books :

1. Krishnamoorthy C S, "Finite Element Analysis – Theory and Programming", Tata McGraw Hill Publishing Co., New Delhi, 1994.
2. Cook R D, Malkus D S, Plesha M E and Witt R J, "Concepts and Applications of Finite Element Analysis", John Weily & sons inc, New York, Fourth Edition, 2003.
3. Rajasekaran S, "Finite Element Analysis in Engineering Design". S Chand & Co., 2003.

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Department of Civil Engineering

V Semester

OE-II CV 2343 Air Pollution and Solid Waste Management

Introduction to Air Pollution and Solid Waste Management welcome to the Open Learning Campus introductory course. To introduce the basic concepts of air pollution issues including pollution control, reducing environmental damage etc. and solid waste generation and management system. Air pollution may cause diseases, allergies and even death to humans; it may also cause harm to other living organisms and may damage the natural environment. A typical system of solid waste management includes segregation, reuse, and recycling at the household level, waste collection and transport, also the existing technology are revised to make it eco-friendly. Large number of industries are developed releasing various pollutants in environment. These industries have to follows air pollution standard norms before releasing pollutants and solid waste generated from industry with its treatment and disposal. It provides air quality standards and objectives for key air pollutants, which are designed to protect human health and the environment. This can sustain a healthy lifestyle by prompting the environmental education, moreover it can help youth to think in a sustainable way and develop the technologies for the same.

V Semester
CV2343 - OE-II : AIR POLLUTION AND SOLID WASTE MANAGEMENT

COURSE OBJECTIVES	COURSE OUTCOME
1. To provide general understanding of air pollution, air pollutants, their sources & effects. 2. To provide knowledge about meteorological parameters, air sampling & measurement of pollutants. 3. To provide knowledge of air pollution controlling technologies, air pollution due to automobiles & general Idea of noise pollution. 4. To study importance of solid waste management by processing, treatment, disposal & reuse of solid waste.	Students will be able to 1. Analyze the type, sources & effect of air pollutants. 2. Determine and estimate the parameters affecting air pollution and various methods of measurement. 3. Use various air pollution control equipments & pollution caused due to automobile exhaust and basics of noise pollution. 4. Interpret the concepts of solid waste management, treatment and disposal methods.
Mapped Program Outcomes : 1,5,6,7,11,12	

UNIT–1 : Introduction to air pollution: Air pollution episodes, Atmosphere and its zones, classification and sources of air pollutants, effects of air pollutants on man, plants animal & materials.	**[06 Hrs.]**
UNIT–2 : Meteorological Aspects: Atmospheric stability, plume behaviour**,** Ambient air sampling and stack sampling, collection of particulates and gaseous pollutants, methods of estimation.	**[07 Hrs.]**
UNIT–3 : Air pollution control methods and equipment: Principle of control methods for particulates and gaseous pollutants, gravity settlers, electrostatic precipitators, bag filters cyclones, wet scrubbers, automobile exhaust: Pollution due to diesel and petrol engines, exhaust treatment and abatement, noise Pollution: Sources, ill effects, control measures.	**[06 Hrs.]**
UNIT–4 : Introduction to solid waste management, sources, quantification and characterization, classification and components, sampling and analysis Method of collection.	**[07 Hrs.]**
UNIT–5 : Equipment used for collection and transportation, transfer stations, solid waste processing and management.	**[06 Hrs.]**
UNIT–6 : Treatment and disposal methods: composting, sanitary landfills, Incineration – concept, components and applications, leachate management.	**[07 Hrs.]**

V Semester

CV2343 - OE-II : AIR POLLUTION AND SOLID WASTE MANAGEMENT

Text Books :

1. M.N. Rao & H.V.N. Rao, 1988, Air Pollution, Tata McGraw Hill Publishing Co. Ltd.
2. C.S. RAO, 2007, Environmental Pollution Control Engineering, New Age International, Wiley Estern Ltd. New Delhi.
3. Stern A. C., 1973, Air pollution, Academic Press.
4. A.D. Bhide & Sunderesan B.B., 1983, Solid Waste Management in Developing countries, INSDOC, New Delhi.
5. Tohobanoglous, 1993, Intgrated Solid Waste Management Engineering Principle and Management Issues, McGraw-Hill publication Ltd.
6. K. V. S. G. Murlikrishna, 1995, Air Pollution, Kaushal & Company.

Reference Books :

1. P. Aarne Vesilind, William Worrell & Debra Reinhart, 2002, Solid Waste Engineering, Cengage Learning India pvt. Ltd.
2. Dr. Y Anjaneyulu, 2002, Air Pollution and Control Technologies, Allied Publisher pvt. Ltd.
3. Waste Management: A Reference Handbook. Contributors: Jacqueline Vaughn - Author. Publisher: ABC-Clio.

V Semester

OE-II : ME2342- RELIABILITY ENGINEERING

Objective	Course Outcome
1) To develop in the engineering students the ability to analyze any engineering problem in a simple and logical manner and to apply a few well understood basic principles to find its solution. 2) Learn how to get higher operating plant and equipment reliability that lifts efficiency and output of operating assets, stops equipment failures and creates higher plant and equipment reliability, with this subject.	1) Student will be able to use reliability modeling as a tool for evaluating system performance. 2) Student will be able to analyze the failure of a machine, determine the failure rate of systems or components. 3) Student will able to understand importance of the maintenance of engineering systems and factors affecting maintainability. 4) Student will be able to prepare the production & maintenance schedule of particular engineering system.

Unit No.	Contents	Max. Hrs.
1	**Fundamental concepts:-** Reliability definitions, failure, Failure density, Failure Rate, Hazard Rate, Mean Time To Failure, MTBF, maintainability, availability , safety and reliability, Quality, cost and system effectiveness, Life characteristic phases, modes of failure, Quality and reliability assurance rules, product liability, Importance of Reliability,	7
2	**Probability theory:-** Set theory, laws of probability, total probability theorem, probability distributions, parameters and applications.	7
3	**System reliability and modeling:** Series and parallel components, mixed configuration, complex systems. Redundancy, element redundancy, unit redundancy, standby redundancy. Types of stand by redundancy, parallel components. Markov models for reliability estimation.	8
4	Maintainability and Availability: Objectives of maintenance, types of maintenance, Maintainability, factors affecting maintainability, system down time. Availability - Inherent, Achieved and Operational availability, reliability and maintainability trade-off. Markov models for availability estimation.	8
5	System reliability Analysis: Reliability allocation or apportionment. Reliability apportionment techniques . Reliability block diagrams and models. Reliability predictions. Life testing and accelerated testing.	8
6	Strength based reliability: Safety factor, safety margin, Stress strength interaction, Failure Mode, Effects and Criticality Analysis-, , FMECA examples, Ishikawa diagram .fault tree construction, basic symbols development of functional reliability block diagram, Fault tree analysis, fault tree evaluation techniques, Design of Mechanical components and systems:-Material strengths and loads.	7

V Semester

OE-II : ME2342- RELIABILITY ENGINEERING

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Concepts of Reliability Engg	1985	L.S. Srinath	Affiliated East-Wast Press (P) Ltd
2	Reliability Engineering	1983	A.K. Govil	Tata McGraw-Hill Publishing Co. Ltd
3	Reliability Engineering	1984	E. Balagurusmy	Tata McGraw-Hill Publishing Co. Ltd
4	Engineering Reliability	1980	B.S. Dhillion, C. Singh	John Wiley & Sons
5	Probabilistic, Reliability	1968	M.L. Shooman	McGraw-Hill Book Co.,
6	Practical Reliability Engg	1985	Patric D.T.O'connor	Heyden and sons ltd.
7	Reliability in Engineering Design	1977	K.C. Kapur, L.R. Lamberson	John-Wiley and sons.
8	Reliability Engineering, Theory and Practice	3rd Edition, 1999	A.Birolini	Springer,

V Semester

OE-II : ME2343- POWER GENERATION ENGINEERING

Objective	Course Outcome
The main objective of the syllabus to understand basic knowledge about vehicle systems which are used in the regular automobiles. The modernization in automobile is also included to understand recent trend in the field.	1) Student will be able to describe basics of power generations systems. 2) Student will be able to analyze various conventional & non-conventional power plants. 3) Student will be able to analyze and examine combined operations of different power plants. 4) Student will be able to evaluate and describe Hydroelectric power plant nuclear power plant

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Student will be able to describe basics of power generations systems.	3	2												3
CO2	Student will be able to analyze various conventional & non-conventional power plants.	3	2												3
CO3	Student will be able to analyze and examine combined operations of different power plants.	3	2												3
CO4	Student will be able to evaluate and describe Hydroelectric power plant nuclear power plant	3			2					2					3

Unit No.	Contents	Max. Hrs.
1	**THERMAL POWER PLANT- I** Introduction to thermal power plants and power plant layouts. Site selection. Fuel characteristics, handling, storage, preparation & firing methods. Ash & dust collection and handling. • Boiler: classification, general arrangement, details of different components and system like draught system, steam turbine systems, condenser, cooling towers **[CO-1]**	7
2	**THERMAL POWER PLANT- II** Gas Turbine Power Plant: -Introduction, power plant layouts, Open cycle, close cycle power plants. Various components and systems. Methods to improve efficiency. Reheat and Regeneration cycle and their combinations Diesel Electric Power Plant: - Introduction, Outline, type of engines, different components, performance, plant layout. Comparison with other power plant. (visit to nearby power plant shall be arrange for the students) **[CO-2]**	8

3	**HYDROELECTRIC POWER PLANT.** Hydrology: - Rainfall, Runoff, Hydro graph, flow duration curve, mass curve. Hydroelectric power plant: - Site selection, classification of hydroelectric power plant, general arrangement, details of different components, turbine selection.Governing. • Comparison with other power plant. **[CO-2]**	7
4	**POWER PLANT ECONOMICS** Load Analysis - Fluctuating Load on power plants, Load curves, various terms & definition, peak load, effect of fluctuating load. • Economic Analysis: - Cost of electric energy **[CO-3]**	8
5	**NUCLEAR POWER PLANT** Introduction to Nuclear Engineering, Global scenario, prominent installations worldwide, present & proposed nuclear plant in India. Nuclear Reactors: - Types of reactors, PWR, BWR, CANDU, Gas cooled, liquid metal cooled, Breeder reactor. Operational requirements and difficulties, site selection for location of a nuclear power station Nuclear Waste Disposal. • Comparison with other power plant. **[CO-4]**	8
6	**COMBINED OPERATION OF DIFFERENT POWER PLANTS** Combined operation: - Need division, combination of different plant & their coordination, advantages. **NON CONVENTIONAL POWER GENERATION SYSTEMS** Introduction to Non Conventional power Generation Systems • Geo-Thermal Power Plant, Tidal Power Plant, Wind Power Plant, Solar Power Plant. **[CO-4]**	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Power Plant Engineering	2002	Domkundwar.	Dhanpat Rai & Co.
2	Power Plant Engineering	2007	Vopal & Slortzki	
3	Power Plant Engineering	2010	P K Nag	

V Semester

OE-II : ME2344- PROJECT EVALUATION & MANAGEMENT

Objective	Course Outcome
The course focuses on developing complete understanding of formulating a problem/project and finding possible solutions against the given constraints. The overall learning shall resolve project identification evaluating its technical and economic feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details.	**The students will be able** 1) To apply the concepts of monitoring and evaluation, appraise 2) To analyse the best monitoring methods, appreciate evaluation in the context of developmental project work 3) To perform problem analysis, determine relevant indicators and data necessary for evaluation, 4) Implement a monitoring and evaluation process, establish baselines and targets..

Unit No.	Contents	Max. Hrs.
1	**Project Identification** considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project demand forecasting, secondary data, accuracy, confidence level, uncertainty	7
2	**Technical feasibility**: Process selection, Level of automation, plant capacity, acquiring technology, Appropriate technology plant location, Equipment selection & procurement, Govt. policies. Value analysis and project evaluation:	7
3	**Economic feasibility:** Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Breakeven point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes.	9
4	**Project Planning and Control:** Work break down structure and network development. Basic Scheduling, Critical Path and four kinds of floats. Scheduling under probabilistic durations, Time Cost tradeoffs, CPM, PERT, Optimum project duration, resource allocation, updating	7
5	**Project report:** Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital	7
6	Initial review, performance analysis, ratio analysis, sickness, project revival, Project Monitoring with PERT/Cost, Organizational aspects, Computer packages and Project Completion environ-mental & social aspects.	8

Text Books

SN	Title	Edition	Authors	Publisher
1	Projects	7th Edition 2007	Prasanna chandra	Tata mc graw Hill publishing company Ltd.
2	CPM & PERT		L. S. Srinath	East West publisher
3	Projects	1963	P.K. Joy	Macmillon
4	Engineering Economy	5th edition	H. G Thuesen, W J Fabricky, G,J, Thuersen	Prentice-Hall
5	Finance series 'Project management' , Vol-I1 and Vol-III	2009	ICFAI	ICFAI,Press Hyderabad
6	Finance Management	6th Edition 2010	M.Y.Khan	Tata McGraw hill
7	Financial Management	4th Edition	Chandra, Prasanna	Tata McGraw-Hill Education, 1997
8	Engineering Economics	8th Edition	G. J. Thuesen, Wolter J. Fabrycky	Prentice Hall, 1993

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V Semester

OE-II : ME2343- POWER GENERATION ENGINEERING

Objective	Course Outcome
The course focuses on developing complete understanding of formulating a problem/project and finding possible solutions against the given constraints. The overall learning shall resolve project identification evaluating its technical and economic feasibility and developing skills for its planning, and establishing controls. Relevant techniques, writing skills and monitoring methods shall be dealt with in details.	**The students will be able** 5) To apply the concepts of monitoring and evaluation, appraise 6) To analyse the best monitoring methods, appreciate evaluation in the context of developmental project work 7) To perform problem analysis, determine relevant indicators and data necessary for evaluation, 8) Implement a monitoring and evaluation process, establish baselines and targets..

Unit No.	Contents	Max. Hrs.
1	**Project Identification** considering objectives and SWOT analysis, Screening of Project Ideas, Technical, Market, Financial, Socioeconomic and Ecological Appraisal of a project demand forecasting, secondary data, accuracy, confidence level, uncertainty	7
2	**Technical feasibility**: Process selection, Level of automation, plant capacity, acquiring technology, Appropriate technology plant location, Equipment selection & procurement, Govt. policies. Value analysis and project evaluation:	7
3	**Economic feasibility:** Cost of Project, working capital analysis, fixed cost, means of finance, estimation of sales & production price analysis, Breakeven point, Projected cash flow statements, projected balance sheet, projected profit & loss statement, projected cash flow, rate of return, Discounted payback period, cost benefit analysis, return after taxes.	9
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5	**Project report:** Preparation of project report, risk analysis, sensitivity analysis, methods of raising capital	7
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2	CPM & PERT		L. S. Srinath	East West publisher
3	Projects	1963	P.K. Joy	Macmillon
4	Engineering Economy	5th edition	H. G Thuesen, W J Fabricky, G,J, Thuersen	Prentice-Hall
5	Finance series 'Project management' , Vol-I1 and Vol-III	2009	ICFAI	ICFAI,Press Hyderabad
6	Finance Management	6th Edition 2010	M.Y.Khan	Tata McGraw hill
7	Financial Management	4th Edition	Chandra, Prasanna	Tata McGraw-Hill Education, 1997
8	Engineering Economics	8th Edition	G. J. Thuesen, Wolter J. Fabrycky	Prentice Hall, 1993

V Semester

EL 2321 - OE II: Electrical Energy Audit and Safety

Objectives	Course Outcomes
The student should be able to Understand various operating characteristics of electrical equipments,its monitoring, tools used in comprehensive energy audit and its procedure to save the electricity with and without investment, calculation of energy saving and its global impact	**On completion of this course, the student will be able to** 1) Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003. 2) Demonstrate, apply and evaluate different forms of electrical and thermal energy. 3) Demonstrate, apply and estimate the Energy Management, Energy Audit, Energy Monitoring and Targeting. 4) Explain, develop and determine the various Global Environmental Concerns and Electrical safety procedures.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Classify, the energy sources, methods of energy conservation and its pattern, electricity act 2003	1							1				1		
CO2	Demonstrate, apply and evaluate different forms of electrical and thermal energy.		1										1	1	
CO3	Demonstrate, apply and estimate the Energy Management, Energy Audit, Energy Monitoring and Targeting.		2			1	1	2					1		1
CO4	Explain, develop and determine the various Global Environmental Concerns and Electrical safety procedures.	1									1		1		1

V Semester

EL 2321 - OE II: Electrical Energy Audit and Safety

Unit No.	Contents	Max. Hrs.
1	Energy Scenario Commercial and Non-commercial energy, primary energy sources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance. Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features, Salient Features of Electricity Act 2003.	6
2	Basics of Energy and its various forms Electricity basics- DC & AC currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.	5
3	Energy Management & Audit Definition, need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.	5
4	Energy Monitoring and Targeting Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques - energy consumption, production, cumulative sum of differences (CUSUM).	5
5	Global environmental concerns United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).	6
6	Electrical Safety Primary hazards associated with electricity. Control measures and safety-related work practices to minimize the risk associated with electrical hazards. Response procedures in the event of electrical shock or fire.	6

Text Books:

S. N.	Author	Title	Publisher
01	Archie,W Culp	Principles of Energy Conversion	McGraw Hill
02	Wayne C Turner	Energy Management Handbook Bureau	John Willey and Sons
03		Bureau of Energy Efficiency Study Material for Energy Managersand Auditors Examination	Bureau of Energy Efficiency www.beeindia.in

Reference Books:

S. N.	Author	Title	Publisher
01.	Amit Kumar Tyagi	Handbook on Energy Audit and Management	TERI

V Semester

EL 2322 - OE II: Utilization of Electrical Energy

Objectives	Course Outcomes
The student should be able to To understand the basic principle of electrical heating, welding, illumination, refrigeration and air conditioning, fans, pumps, compressors and digi sets.	**On completion of this course, the student will be able to** 1) Demonstrate and utilize electrical energy for various purposes including heating and traction system. Students will also be able to classify illumination, its types and purpose. 2) Demonstrate and apply electric energy to different types of welding 3) Explain how refrigeration system and air condition system works. 4) Analyse, determine and estimate proper economic generation.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Demonstrate and utilize electrical energy for various purposes including heating and traction system. Students will also be able to classify illumination, its types and purpose	3	2	2					2	1	1				1
CO2	Demonstrate and apply electric energy to different types of welding			1		1			1						
CO3	Explain how refrigeration system and air condition system works	1		1	1				1						
CO4	Analyse,determine and estimate proper economic generation	3	2	2	1		1		2	2	3	1		3	1

V Semester

EL 2322 - OE II: Utilization of Electrical Energy

Unit No.	Contents	Max. Hrs.
1	**Electric Heating:** i) Electric Heating : Types and methods of electrical heating, advantages of electrically produced heat Types & application of electric heating equipment"s, transfer of heat. ii) Resistance Ovens: General constructions, design of heating elements, efficiency & losses, radiant heating. iii) Induction heating: Core type & core less induction furnace, indirect induction oven, medium and high frequency eddy - current heating. iv) Dielectric heating: Principle and application. v) Arc furnace: Direct & indirect arc furnace, power supply, characteristics & control.	6
2	**Electric Welding:** i) Importance, Advantages & Disadvantages of welding, classification of welding processes. ii) Resistance welding, Butt welding, Spot welding, Projection welding, Seam welding. iii) Electric arc welding: carbon arc welding, metal arc welding, submerged arc welding, Welding positions, Types of welding electrodes iv) Ultrasonic welding, electron beam welding, laser beam welding.	5
3	**Illumination:** Nature of light, terms used in illumination, solid angle, laws of illumination, polar curves, Colour Rendering Index (CRI), types of lamps, luminaries, Design of illumination systems, indoor lighting systems, factory lighting, outdoor lighting design, flood lighting, street lighting, energy saving in lighting systems.	5
4	**Refrigeration & Air conditioning:** Terminology, refrigeration cycle, refrigeration systems (Vapour compression, vapour absorption), domestic refrigerator, water cooler, desert cooler. Air conditioning: Factors involved in air conditioning, comfort air conditioning, industrial air conditioning, effective temperature, summer / winter air conditioning systems, types of air conditioning systems, room air conditioning, and central air conditioning.	5
5	**Electric Traction** Traction system, requirement of an ideal traction system, different systems for traction, system of railway electrification, comparison between AC and DC systems, power supply for electric traction system, overhead equipments (collector gear for overhead equipments, conductor-rail equipment)Speed- Time curve for train movement, crest speed, average speed and schedule speed, simplified speed-time curve	6
6	Economics of Power Generation, Electric Power Supply and Utilization Terms and Definitions, base load and peak load, selection of power plant equipment (boilers, prime-movers, size and number of generating units), economics in plant selection, economics of hydroelectric power plant, economics of combined hydro and steam power plant, performance and operating characteristics of power plants, power plant useful life, tariff for electrical energy, objective and requirements of tariff, general tariff forms, comparison between private generating plant and public supply.	6

V Semester

EL 2322 - OE II: Utilization of Electrical Energy

Text books:

S. N	TITLE	EDITION	AUTHOR	PUBLISHER
1	Utilization of Electric Power & Electric Traction		J.B. Gupta	Kataria & Sons
2	Art and Science of Utilization of Electrical Energy		H Pratap	Dhanpat Rai & Sons, Delhi
3	Utilization of Electrical Power		R. K. Rajput	Laxmi Publications Pvt. Ltd.

Reference books:

	TITLE	EDITION	AUTHOR	PUBLISHER
1	Guide book for National Certification Examination for Energy Managers and Energy Auditors			Bureau of Energy Efficiency
2	Utilization of Electrical Power		Dr N. Suryanarayana V.	Wiley Eastern Ltd, Age International New
3	Utilization of Electrical Energy		E.Openshaw Taylor	Orient Longman

V Semester

EL 2323- OE II: Power System Engineering

Objective	Course Outcome
The student should be able to :- (1) To comprehend the different issues related to overhead lines and underground cables. (2) To train the students with a solid foundation in power system concepts required to solve engineering problems. (3) To provide the knowledge about the system transients, sag and various issues related to cables and transmission lines. (4) To introduce the students to the general structure of the network for transferring power from generating stations to the consumers. (5) To expose the students to the different electrical & mechanical aspects of the power network along with its environmental and safety constraints	On completion of this course, the student will be able to (1) Articulate types of load and power system concepts required to engineering problems. (2) Develop the ability to implement the appropriate safety equipments for design of electrical power system with enhancing the efficiency of the transmission and distribution system with environment friendly technology. (3) Formulate A.C and D.C distribution networks for necessary variable calculation. (4) Ability to design and analyze switchgear protection system with respect to various electrical parameters which is required in substation.

CO	Statement	Mapped PO											PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	Articulate types of load and power system concepts required to engineering problems.	2				1		1			1			1	
CO2	Develop the ability to implement the appropriate safety equipments for design of electrical power system with enhancing the efficiency of the transmission and distribution system with environment friendly technology.	1	2	1				1				1	1	2	
CO3	Formulate A.C and D.C distribution networks for necessary variable calculation.	2	1					1						2	
CO4	Ability to design and analyze switchgear protection system with respect to various electrical parameters which is required in substation.	1	1	2				1			1			1	

V Semester

EL 2323- OE II: Power System Engineering

Unit No.	Contents	Max. Hrs.
1	**Introduction to Power System** Restructuring of power sector, Constituents of present day power system, sources of electrical energy, types and characteristics of generating stations: Thermal, hydro, nuclear , solar ,wind and other renewable, salient features of electricity act 2003.	6
2	**Load on Power Stations** Load, Important terms and factors, and Units generated per annum , Load duration curve , Types of loads, Load demand and diversity factors, Load curves and selection of generating units, Base load and peak load on Power station, Method of meeting the load ,Interconnected grid system.	5
3	**Transmission System I** Electric supply system, A.C power supply scheme, D.C transmission scheme, Comparison of AC and DC transmission system, advantages of A.C. transmission system, Comparison of various transmission system (Two wire dc system, Single phase two wire A.C system, Single phase three wire system , three phase three wire system, Three phase four wire system) Elements of transmission line, Economic choice of transmission voltage, requirements of satisfactory electric supply, Concept of HVDC transmission.	5
4	**Transmission System II** Line support insulators, types of insulators (pin type, suspension type, strain type, shackle type), Commonly used conductor material, concept of corona, factor affecting corona, advantages and disadvantages of corona, methods of reducing corona effect, Sag and its effects, Constants of transmission line (R, L and C) , Resistance of transmission line, skin effect , Classification of overhead transmission line and voltage regulation .	5
5	**Distribution System** Classification of distribution system, Types of distribution AC and DC, Overhead verses underground system, Requirements of distribution system, Design consideration of distribution system, AC distribution types, Voltage drop calculations in different distribution system , importance of voltage control, location of voltage control equipment and its methods, Tap changing transformer , Concept of tariff, desirable characteristics of tariff, types of tariff.	6
6	**Introduction to Switchgear** Essential features of switchgear, switchgear equipment's, switches, fuses, circuit breakers, relays, HRC fuses, Bus Bar arrangement (single bus system, One and half feeder ,Main and transfer bus system) , MCB, MCCB, ELCB Introduction to Instrument transformer Current Transformer (CT) and Potential transformer (PT).	6

V Semester

EL 2323- OE II: Power System Engineering

Text books:				
	Title	Edition	Author	Publication
1.	Power System Analysis	1st edition 2007	T.K. Nagsarkar, M.S. Sukhija	Oxford
2.	Principles of Power System	2nd edition 2005	V.K.Mehta, Rohit Mehta	S.Chand
3.	Electrical Power System	5th edition 2007	Ashfaque Hussain	CBS

V sem EE2341 – OE II: Data Acquisition & Signal Conditioning

VI sem EE2391 – OE IV: Data Acquisition & Signal Conditioning

Data Acquisition & Signal Conditioning gives an overview about the data acquisition methods, to acquaint students with ADCs and DACs and various data acquisition techniques, Types of sensors, the serial data communication standards, use of Ethernet, Medium Access control and USB.

Data acquisition systems or DAQ devices are essential in testing of products from automobiles to medical devices basically any electromechanical device that people use. Data acquisition and signal condition system main application is in manufacturing industry.

Data acquisition systems need to connect to a wide variety of sensors and signals in order to do their job. Signal conditioners take the analog signal from the sensor , manipulate it and send it to the ADC (analog to digital converter) subsystem to be digitized for further processing by computer software.

V Semester

EE2341 – OE II: Data Acquisition & Signal Conditioning

Objective	Course Outcome
The course gives an overview about the data acquisition methods, to acquaint students with ADCs and DACs and various data acquisition techniques	After study through lectures and assignments, Students will be able to: 1. Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning 2. Identify the various types of data acquisition hardware and the serial data communication standards. 3. Distinguish different standards for connection of different programmable instruments like GPIB and SCPI 4. Define use of Ethernet, Medium Access control and USB

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Describe the basic model of data acquisition system and the various methods and attributes of signal conditioning	3	2	2											
CO 2	Identify the various types of data acquisition hardware and the serial data communication standards	2	1	1											
CO 3	Distinguish different standards for connection of different programmable instruments like GPIB and SCPI	3	2	1											
CO 4	Define use of Ethernet, Medium Access control and USB	3	2	1											

V Semester

EE2341 – OE II: Data Acquisition & Signal Conditioning

Unit No.	Contents	Max. Hrs.
1	Definition of data acquisition and control, Fundamentals of data acquisition, Signal conditioning, Data acquisition and control system configuration, Computer plug-in I/O, Distributed I/O, Stand-alone or distributed loggers/controllers, Analog and digital signals: Classification of signals, Sensors and transducers, Transducer characteristics, Resistance temperature detectors (RTDs), Thermistors, Thermocouples, Strain gauges, Wheatstone bridges.	8
2	Signal conditioning: Types and classes, Field wiring and signal measurement, Noise and interference, Minimizing noise, Shielded and twisted-pair cable.	7
3	Plug-in data acquisition boards, A/D Boards, Single ended Vs differential signals, Resolution, dynamic range and accuracy of A/D boards, Sampling rate and the Nyquist theorem, Sampling techniques, D/A boards, Digital I/O boards.	7
4	Serial data communications, Transmission modes – simplex and duplex, RS-232-C interface standard, RS-485 interface standard, Comparison of the RS-232 and RS-485 standards, Serial interface converters, Protocols, Error detection.	8
5	IEEE 488 Standard, Introduction, Electrical and mechanical characteristics, Physical connection configurations, Device types, Bus structure, GPIB handshaking, Device communication, Requirements of IEEE 488.2 controllers, Standard commands for programmable instruments (SCPI).	8
6	Ethernet and field buses for data acquisition, Physical layer, Medium access control, Difference between 802.3 and Ethernet, The universal serial bus (USB), USB overall structure, Topology.	7

Text books:

SN	Title	Edition	Authors	Publisher
1	Data Acquisition for Instrumentation and Control Systems	10 June 2003	John Park and Steve Mackay	Elsevier

Reference books:

SN	Title	Edition	Authors	Publisher
1	Electronic Analog Digital Conversion	1st Edition	H. Schmid	Tata McGraw Hill
2	Data Converters	1st Edition , 1993	B. S. Sonde	Tata McGraw Hill

		June 2020	1.02	Applicable for AY2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

EE2342 : OE II : Microprocessor Programming

Microprocessor Programming

Microprocessor is central processing unit of any data processing and controlling system which is used to process binary bits of data and also used to control the devices connected to Microprocessor. To understand Microprocessor Programming subject, prerequisite are basics of Digital Circuits , C Programming . Microprocessor is basic Subject to understand Advanced Microprocessor and Controller subject like 8086,8051, ARM Processor etc. After acquiring knowledge about this subject students can explore their knowledge in the field of Embedded system design , Industrial automation . Students can also implement their final year projects based on Microprocessor and also can start up their companies based on Microprocessor.

Course Teacher

Dr. Yogesh A .Suryawanshi

V Semester
EE2342 – OE II: Microprocessor Programming

Objective	Course Outcome
▪ To understand the architecture, programming and addressing modes of Intel 8085 ▪ To study the instruction set and programming of 8085 ▪ To understand various interfacing of devices for various applications.	Students 1. Will be able to understand the architecture of 8085. 2. Will demonstrate the ability to identify, Formulate and design Program for an assigned task. 3. Will be able to interface Peripheral devices. 4. Will apply the knowledge of microprocessor in their respective field.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	Will be able to understand the architecture of 8085.	3	3	3	3										
CO 2	Will demonstrate the ability to identify, Formulate and design program for an assigned task.	2	3	3	2										
CO 3	Will be able to interface Peripheral devices	1	2	3	1										
CO 4	Will apply the knowledge of microprocessor in their respective field.	1	2	3	1										

V Semester
EE2342 – OE II: Microprocessor Programming

Unit No.	Contents	Max. Hrs.
1	Concept of bit, byte & word, Micro Computer organization with I/O devices and memory. Microprocessor, address, data & control bus, RAM / ROM memory.	8
2	Architecture of 8085 Intel microprocessor, Flag Register ,Addressing mode, pins diagram of 8085, Demultiplexing of Address & Data Bus, Generation of various control signals for I/O & Memory Organization	7
3	Basic Instruction set, Subroutine instructions like CALL, PUSH, POP, XTHL instructions and their uses,Programs based on instructions.	7
4	Delay Program,Memory Interfacing - ROM, RAM With 8085, Absolute and Linear decoding techniques.	8
5	MICROPROCESSOR APPLICATIONS - Programmable peripheral IC (8255)- Pin functions, Different Modes & Block Diagram, ADC interfacing , DAC interfacing .	8
6	USART 8251, PIT 8253, Interrupt Structure, Interrupt Controller 8259	7

Text books:

SN	Title	Edition	Authors	Publisher
1	Microprocessor Architecture ,Programming& Interfacing 8085	1 Dec 2000	Ramesh Gaonkar	Penram Publication

Reference books:

SN	Title	Edition	Authors	Publisher
1	8085 Microprocessor	2014	Ajit Pal	Tata Mc-Graw Hill ,
2	Microprocessors & interfacing	2005	D. V. Hall	Tata McGraw-hill

ET2321 : OE-II Soft Computing

Soft computing is a combination of Artificial neural network, fuzzy logic, and genetic algorithm which offers the superiority of humanlike problem solving capabilities. It is an emerging approach to computing which parallel the remarkable ability of the human mind to reason and learn in an environment of uncertainty and imprecision. Now, soft computing is the only solution when we don't have any mathematical modeling of problem solving (i.e., algorithm), need a solution to a complex problem in real time, easy to adapt with changed scenario and can be implemented with parallel computing. It has enormous applications in many application areas such as medical diagnosis, computer vision, hand written character recondition, pattern recognition, machine intelligence, weather forecasting, optimization, etc.

V Semester

ET 2321– OE II: SOFT COMPUTING

Objective	Course Outcome
The student should be able to 1) Familiarize with soft computing concepts. 2) Learn the concepts of Genetic algorithm 3) Learn the concepts of Fuzzy Logic and Neural networks	**On completion of this course, the student will be able to** 1) Identify and describe genetic operators and genetic algorithms in problem solving 2) Apply NN algorithm in pattern classification 3) Apply fuzzy logic and arithmetic to handle uncertainty and solve engineering problems 4) Understand fuzzy rule base and fuzzy controller

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Describe and apply genetic operators and genetic algorithms for problem solving	3	3						3	2	2		3	2	
CO2	Apply Neural Network algorithms in pattern classification	3	3						3	2	2		3	2	
CO3	Apply fuzzy logic and arithmetic to handle uncertainty and solve engineering problems	3	3						3	2	2		3	2	
CO4	Describe and analyze fuzzy implications and fuzzy controller	3	3						3	2	2		3	2	

V Semester

ET 2321– OE II: SOFT COMPUTING

Unit No.	Contents	Max. Hrs.
1	**Genetic Algorithm** Basic terminologies used in Genetic Algorithm, Simple GA, General Genetic Algorithm, Encoding, Selection, Crossover, Mutation, Stopping Condition for GA, Constraint in GA	6
2	**Neural Networks** Biological Neurons and Their Artificial Models, Models of Artificial Neural Networks, Learning Methods, Activation Functions, McCulloch-Pitts Neuron Model, Neural Network Learning Rules, Application of NN	6
3	**Supervised Learning** Single Layer Perceptron, Back propagation algorithm, Associative Memory.	6
4	**Unsupervised Learning** Hamming and Max net, Competitive Learning, self-organizing feature maps, ART Networks, RBF	6
5	**Fuzzy Sets and Operations** Concepts of Fuzzy sets, extension principle Operation on fuzzy sets, Fuzzy numbers, arithmetic operations, Lattice, fuzzy equations	6
6	**Fuzzy logic and Systems** Fuzzy relations Fuzzy Logic, Approximate Reasoning, Fuzzy controllers, Defuzzification Methods, Fuzzy Inference Techniques, Applications, **New topic to be announced time to time**	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Fuzzy sets and Fuzzy logic	1995	By George Klir, Bo Yuan	PHI
2	Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications	2003	By S. Rajsekharan, VijayalaxmiPai	PHI
3	Elements of Artificial Neural Network	1997	By K. Mehrotra	MIT Cognet

Reference Books

SN	Title	Edition	Authors	Publisher
1	Neural Networks, a comprehensive foundation	1999	By Simon Haykins	PHI
2	Artificial Neural Networks	2004	By B. Yegnanarayana	PHI
3	Fuzzy Logic & Applications	2003	By T. Ross	McGraw Hill
4	Soft Computing,	2011	Sivanandanam and Deepa	Wiley

		June 2020	1.02	Applicable for AY 2020-21 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	

ET2322 : OE-II Industrial Instrumentation

General information about course: (100-150 words)

- In industrial instrumentation a wide number of variables **temperature, flow, level, pressure, and distance** can be sensed simultaneously.
- All of these can be interdependent variables in a single processing require a complex microprocessor system for total control.
- The **PLC** system is the major key in the technology and industrial sector today.
- Both **PLC** and **SCADA** can be used for controlling purpose apart from these there are many other things which also plays a vital role in automation.
- Accurate instrumentation ensures that all of the processes in workplace are being monitored constantly and consistently.
- Instrumentation has wide scope in **medical engineering**, **electrical engineering, civil engineering, mechanical engineering** etc.
- Instrumentation is modeled in the form of multidimensional systems.
- The demand for a wide range of **applications in environment, agriculture** and **industry** has increased.
- Students who wish to pursue **higher studies** in the instrumentation engineering field will be immensely benefitted by this open elective.
- Due to the great demand and scope of **interdisciplinary skill**, this open elective course would be beneficial for carrying out **live projects** to solve different problems, the **employability/ entrepreneurship** capability of students will be substantially increased due to this course.

V Semester

ET 2322– OE II: INDUSTRIAL INSTRUMENTATION

Objective	Course Outcome
The student should be able to 1) Study the characteristics of Instruments. 2) Understand the Concepts of Pressure measurements and its calibration process 3) Understand the working principle of various active &passive temperature transducers. 4) Learn the working principle of various flow transducers. 5) Learn the working principle of various transducers like level, thickness speed, ph value etc. 6) Study PLC, SCADA	**On completion of this course, the student will be able to** 1) Design instrumentation system using various transducers. 2) Measure and analyze various parameters using transducers. 3) Explain and develop PLC & SCADA programming.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO2
CO1	Describe instrumentation system using various transducers.	3							3	2	2		2	2	
CO2	Measure and analyze various parameters using transducers.	3	3						3	2	2		2	2	
CO3	Explain and develop PLC & SCADA programming.	3	3						3	2	2		2	2	

Unit No.	Contents	Max. Hrs.
1	**INTRODUCTION** Block diagram of instrumentation system, static and dynamic characteristics of instruments, functions of instruments, Definition of Transducers- Role of transducers in instrumentation- Advantages of electrical transducers – Classification of transducers- Analog and Digital, Active and passive, Primary and Secondary transducers- Inverse transducer-Sensitivity and specification for transducers - Characteristics and Choice of transducer-Factors influencing choice of transducer. Need of transducers, Classification, selection criteria. Calibration Process.	6
2	**PRESSURE MEASUREMENT** Units of pressure - Manometers – Different types – Elastic type pressure gauges – Bourdon type bellows – Diaphragms– Electrical methods – Elastic elements with LVDT and strain gauges – Capacitive type pressure gauge – Piezoresistive pressure sensor –Testing and calibration of pressure gauges – Dead weight tester.	6
3	**TEMPARATURE MEASUREMENT 1** Different types of filled in system thermometer , Bimetallic thermometers – Electrical methods of temperature measurement – Signal conditioning of industrial RTDs and their characteristics – Three lead and four lead RTDs.	6

V Semester

ET 2322– OE II: INDUSTRIAL INSTRUMENTATION

4	**TEMPARATURE MEASUREMENT2: THERMOCOUPLES AND PYROMETERS** Thermocouples – Laws of thermocouple – Signal conditioning of thermocouples output –cold junction compensation –Response of thermocouple, Radiation methods of temperature measurement – Radiation fundamentals – Total radiation & selective radiation pyrometers – Optical pyrometer – Two color radiation pyrometers.	6
5	**FLOWMETERS** Variable head type flow meters: – Orifice plate – Venturi tube – Pitot tube. Area flow meter: – Rotameter, Principle and constructional details of electromagnetic flow meter – Ultrasonic flowmeters flow measurements for gases	6
6	**MISCELLANEOUS MEASUREMENT** Electrical level gauge: – Resistive , Ultrasonic type, Radar type ,Speed measurement -D.C and A.C Tacho generators ,rotary encoder, Proximity sensors- Inductive and capacitive, Introduction to PLC, SCADA, ladder diagram & programming. **New topic to be announced time to time**	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Industrial Instrumentation and Control	2003	S.K. Singh	Tata McGraw Hill, 2003.
2	Transducers and Instrumentation		D V S Murthy	prentice Hall of India Pvt. Ltd., New Delhi
3	Electrical and Electronic Measurements AND Instrumentation		A. K. Sawhney	Dhanpat Rai &Co

Reference Books

SN	Title	Edition	Authors	Publisher
1	Principles of Industrial Instrumentation ata		D. Patranabis T	McGraw Hill Publishing Company Ltd, 1996.
2	Programming for Industrial Automation		Kevin Collins	
3	Instrumentation Measurement & Analysis	2004.	B.C. Nakra & K.K.Chaudary	Tata McGraw Hill Publishing Ltd
4	Measurement Systems – Application and Design	2003	E.O. Doebelin	Tata McGraw Hill publishing company
5	Industrial Instrumentation		D.P. Eckman	Wiley Eastern Ltd.

ET2323 : OE-II Medical Electronics

Medical electronics refers to the study of electronic tools and technologies used for health diagnosis and care. It is the design of biology-applied embedded systems. Medical Electronics is one of the most diverse fields and has a lot to offer to an aspirant. The curriculum includes medical electronics subject as open electives. Aspirants are taught not just through theoretical learning but also practically through projects, research, group discussion,

A medical electronics subject helps in research, along with medical scientists, to develop and evaluate systems and products such as artificial organs, prostheses, instrumentation, medical information systems, health management, and care delivery systems. Medical Electronics also design devices used in various medical procedures, imaging systems such as magnetic resonance imaging (MRI), and devices for automating insulin injections or controlling body functions. Medical Electronics is a specialized discipline that advances knowledge in Engineering and Medicine, through cross-disciplinary activities that integrate the engineering sciences with the Biomedical Sciences and Clinical Practice.

The medical electronics subject is suitable for those who want to develop devices and procedures that solve medical and health-related problems by combining their knowledge of biology and medicine with engineering principles and practices. The subject is beneficial to become biomedical technicians and maintain, repair, and calibrate the electronic medical instruments used in healthcare. The course is also beneficial for further studies also such as M.E. and then for research work. In taking medical applications to the real world, sensors play a predominant role. Medical electronics use sensing components such as airflow, temperature, humidity, pressure transducers, thermistors, etc., to incorporate medical solutions.

Tools and Techniques used in Medical Electronics subject are:

- Blood Gas Analyzer
- Medical Glucose Monitor
- Electronic Brain Wave Machine
- Medical Heart Monitors
- Infrared and Digital Thermometers
- Defibrillator for Medical Electronics
- Sphygmomanometer
- MRI for Medical Electronics
- Fetal Monitor
- Stethoscope

Growing Industry: This is an industry that is growing at an exponential rate so due to the increase in awareness about health so we see a surge in demand for qualified professionals of medical Electronics.

Opportunity to do Good: This is also an industry where aspirants get a chance to do good for society by developing and improving medical devices which will save lives.

V Semester

ET 2323– OE II: MEDICAL ELECTRONICS

Objective	Course Outcome
The student should be able to 1) Know the physiology of heart , brain and skin, Understand the basic principles of physical parameters 2) Comprehend the working principle of recording instruments flow, Pulse oximeters, Heart rate 3) Know the physical concepts of radiography related to X rays 4) Learn working principles of advanced medical imaging system	**On completion of this course, the student will be able to** 1) Describe various parameters of human anatomy and physiology. 2) Explain the functioning of different measuring and recording instruments 3) Describe radiography equipments 4) Explain Biomedical computer application

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Describe various parameters of human anatomy and physiology.	3							3	2	2		2	2	
CO2	Explain the functioning of different measuring and recording instruments	3							3	2	2		2	2	
CO3	Describe radiography equipments	3							3	2	2		2	2	
CO4	Explain Biomedical computer application	3							3	2	2		2	2	

Unit No.	Contents	Max. Hrs.
1	Cell as bio electric generator: Heart and Circulatory system, ECG, Brain and nervous system, EEG, Skeletal , Muscle and Skin Systems, EMG	6
2	**Physical Measurement:** Blood pressure and Flow, Heart rate and Heart sounds, Respiration and temperature	6
3	**Recording Instrumentation:** Electrodes, basic instrumentation, Electrocardiograph, Electroencephalograph, ,Electromyograph, Phonocardiograph	6
4	**Measuring Instrumentation:** Transducers, Blood Pressure, Blood flow and Pulse oximeters, Heart rate respiration rate and temperature meters, Audiometer and hearing Aid	6
5	**X-rays:** X-ray Physics, Fluoroscopy and radiography, X-ray tubes and X-ray Equipments, Biomedical computer application	6

V Semester

ET 2323– OE II: MEDICAL ELECTRONICS

6	**Advanced Imaging System:** Ultrasonic scanner, CT scan, MRI, Endoscope and Measurement of blood flow and cardiac Output **New topic to be announced time to time**	6

Text Books

SN	Title	Edition	Authors	Publisher
1	Medical Electronics	2003	Patil A. G	ISTE Excel book
2	Biomedical Instrumentation and Measurements	Second edition 2004	Leslie Cromweel, Fred J. Weibell, Erich A.	PHI

Reference Books

SN	Title	Edition	Authors	Publisher
1	Handbook of Biomedical Instrumentation	New Delhi, 2003.	Khandpur, R.S	TATA McGraw Hill
2	Introduction to Biomedical equipment Technology	New York,2004	Joseph J.Carr and John M.Brown	John Wiley and Sons

ET2325 : PLC & SCADA (Industry Aligned)

PLC & SCADA is two different concepts works together for various Industrial Automation Processes**.** When you are trying to figure out what is a PLC, you should know that it is a piece of hardware. **PLC** stands for ***Programmable Logic Controller***. A programmable logic controller is installed to monitor sensors. In this manner, a PLC stands for data collection, receiving critical information about the flow and input within the system. A PLC is a versatile piece of equipment, which holds up under harsh conditions with advanced options for programming and real-time usage. Specifically, PLCs control some of the most complex processes within industrial plants. They are often deployed to monitor running machines and motors. In order to provide more functionality, a PLC is easy to program.

SCADA stands for ***Supervisory Control and Data Acquisition***. SCADA is monitoring software used in these industries. As software, it helps control the hardware and makes a record of the data collected from all remote locations. SCADA software is connected to computers, graphical user interfaces, sensors and networked data communications in order to provide a broad picture of the process. Within this context, management teams in these industries rely on SCADA to monitor progress and make operating corrections throughout the plant.

The Future of PLC and SCADA engineers has very good opportunities in every Automation Sector. The corporate needs only automation support to reduce their employees for many reasons. The PLC and SCADA engineers get and grab the experience from Beginner Company and then go for MNCS.

V Semester

ET2325 – OE II: PLCs and SCADA

Objective	Course Outcome
The student should be able to 1) Understand the fundamentals of Automation and their applications, systems used in industry such as PLC, Memory devices, Input /Output system and Relays. 2) Understand the working of Timing Circuits, Programming techniques with Input/Output Instructions and Addressing, overview of PLC timers and their application in industrial control. 3) Understand the PLC Counters, Data Comparators Instructions and application of sequencers based on these systems 4) Understand the networking using PLC systems and peripherals advanced PLC programming languages which are widely used in industrial automation.	**On completion of this course, the student will be able to** 1) Describe automation, its importance, expectations from automation and applications in industry. 2) Describe and analyze Timing Circuits and Program PLC using ladder diagram for various applications. 3) Analyze and apply various instructions of PLC, PLC counters. 4) Explain the basic concepts of networking using PLC systems and peripherals.

CO	Statement	Mapped PO												PSO	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO	PSO
CO1	Describe automation, its importance, expectations from automation and applications in industry.	3	3						3	2	2		3	2	
CO2	Describe and analyze Timing Circuits and Program PLC using ladder diagram for various applications	3	3	2					3	2	2		3	2	
CO3	Analyze and apply various instructions of PLC, PLC counters	3	3	2					3	2	2		3	2	
CO4	Explain the basic concepts of networking using PLC systems and peripherals	3	3						3	2	2		3	2	

V Semester
ET2325 – OE II: PLCs and SCADA

Unit No.	Contents	Max. Hrs.
1	Overview of PLCs and their application in industry, central processing unit,memory devices and memory storage,multiprocessing and PLC scan functions, Input/Output system for PLCs,discrete, analog, and data I/O.	5
2	Introduction to relay logic and relay logic diagrams,basic operating principles of relays, sizing and rating of electromagnetic contactors, Seal-in circuits and their application in control systems, Introduction to scaling and resolution of analog devices and signals, programming terminals, it's types ,applications,hand-held programming terminals and computer-based software packages,operation of host computer-based systems, application of peripheral devices in a PLC network various safety precautions, preventative maintenance, and troubleshooting techniques associated with a typical PLC system,grounding techniques, sources of electrical interference, and I/O installation techniques.	5
3	Introduction to timing circuits, I/O devices and their application in PLC systems introduction to ladder logic programming techniques, I/O instructions, safety circuitry, programming restrictions, and I/O addressing, overview of PLC timers and their application in industrial control circuits,Timing functions TON, TOF, and RTO, cascading and reciprocating timing circuits	6
4	PLC counters and their application in control systems, Counting functions such as CTU and CTD, cascading counters, **MCR, JUMP, and FORCE Instructions.** Overview of various zone control techniques and branching instructions, principles of Master Control Relays, subroutines and their application and benefit in complex control problems, Force Instructions.	6
5	Data comparison instructions such as EQU, LES, and GRT,advanced programming techniques including analog input and output control, combining math functions. Introduction to the principles of data transfer, move instruction, introduction to shift registers. Purpose and application of PLC sequencers, masking techniques and the various types of sequencers, SQO and SQC instructions, sequencers charts,maintenance and recording of sequencer chart information. Various aspects of process control and its application to PLC systems, open-loop and closed-loop systems, techniques of Scaling **Sequencers(Only for Allen Bradley SLC-500)**	7
6	Introduction to networking using PLC systems and peripherals, principles of Profibus using windows platform, introduction to Ethernet and network switching, topology, overview of transmission media including fiber optic, coaxial, and twisted pair cable. Treatment of digital logic and its application in PLC programming and control, converting digital logic to ladder logic Introduction to advanced PLC programming languages which are widely used in industrial automation, to graphical languages such as Sequential Function Chart (SFC) and Function Block Diagram (FBD), text-based languages such as Structured Text (ST) and Instruction List (IL), overview of the programming language and controller organizer	7

V Semester
ET OE II: PLCs and SCADA

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Programmable Logic controllers		Gary Duning	Delmar Thomson Learning
2	SCADA: Supervisory Control and Data Acquisition	Fourth Edition	Stuart A Boyer	ISA 1999

Reference Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Programmable logic controller		Frank D Petruzella	McGraw-Hill Education

Deptt. of Computer Technology
Information regarding open elective course

Course Name: **Multimedia & Animation (OE-II)**

Course Code: **CT2334 (V Sem)**

Introduction:

Multimedia offers many career paths that can lead to occupations in such fields as graphic design, web design, animation, audio and video production, and project management. To become competent in any multimedia field, however, you need to learn the fundamental multimedia concepts first. Multimedia and animation course builds a foundation for success in the discipline of multimedia by introducing you to the multi-media building blocks of text, images, sound, animation, and video while going one step further to develop an understanding of the process of making multimedia.

Course Teacher:

Prof. T. R. Ravi

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

Deptt. of Computer Technology
Information regarding open elective course

Course Name: Current Trends and Technologies (OE-I)

Course Code: CT2335 (V Sem)

Introduction:

This course is designed to introduce students with latest trends in technology & industry. This course introduces students with Fundamentals of Communications, Fundamental of INTERNET, e-Technologies, e-Learning, Green Computing and Social Networking. This is a course which will give students knowledge about how things work in day-to-day technologies they are using.

Whether industry aligned or collaborative - No

Course Teacher:

Prof. N.M.Mangrulkar

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

IT2331 : OE II: Introduction to Machine Learning

1. **Preliminary information of subject:** Understand the need for Machine Learning and its basic concepts. Understanding various supervised and Unsupervised Learning algorithms, their importance, differences among those, deciding a suitable model for given type of data, improving the performance of the models, hyperparameter tuning. Understanding the linear relationship between the attributes. Understand the meaning of classification algorithms. Understand the performance of the model, etc.

2. **Scope of subject:** Machine Learning today has all the attention it needs. Machine Learning can automate many tasks, especially the ones that only humans can perform with their innate intelligence. Replicating this intelligence to machines can be achieved only with the help of machine learning.

3. **Whether industry aligned or collaborative:** It can be if we get the experts from the industry in the domain of ML

4. **Advantages in placement**

- Better Career Opportunities and Growth: A report by TMR notes that MLaaS (Machine learning as a Service) is predicted to grow from to $19.9 billion by the end of 2025, from a mere $1.07 billion in 2016.
- Better Salaries: According to Glassdoor.co.in, the average machine learning engineer salary is 8 lakhs per annum – and that's just at the starting of one's career! An experienced machine learning engineer takes home anywhere between 15 to 23 lakhs per annum.
- Lack of Machine Learning Skills is Plaguing Corporations: Digital transformation is a huge industry, and the truth of the matter is that there are simply not enough machine learning professional to cater to new industry demands.

Prepared By: Dr. Ujwalla Gawande, Associate Professor, Department of IT, YCCE, Nagpur

V Semester

IT 2331 - OE-2: Introduction to Machine Learning

Objective	Course Outcome
1. To introduce basic concepts of machine learning and explain the relative strengths and weaknesses of different machine learning Methods. 2. To understand the different aspects of supervised learning 3. To understand the concepts of unsupervised learning 4. To learn to apply supervised and unsupervised learning algorithms to solve the problem	After undergoing the course, student will be able to: 1. Understand various models of supervised and unsupervised learning 2. analyze a problem and identify appropriate learning paradigm to solve it. 3. apply supervised learning for the given set of labeled samples and design the model to meet the desired output 4. apply unsupervised learning for the given set of samples, and design the model to meet the desired output

Unit No.	Contents	Max. Hrs.
1	Introduction to machine learning. What Is Machine Learning, Examples of Machine Learning Applications, Learning Associations, Classification, Regression, Supervised and Unsupervised Learning, Reinforcement Learning, Generalization, Overfitting, and Underfitting	6
2	Supervised Learning-1: k-Nearest Neighbors, linear Models, Naive Bayes Classifiers, Decision Trees	6
3	Supervised Learning-2: Kernelized Support Vector Machines, Uncertainty Estimates from Classifiers, The Decision Function, predicting Probabilities, Uncertainty in Multiclass Classification	6
4	Unsupervised Learning: *k*-Means Clustering , Expectation-Maximization Algorithm, Supervised Learning after Clustering , Hierarchical Clustering, Choosing the Number of Clusters	6
5	Design and Analysis of Machine Learning Experiments: Factors, Response, and Strategy of Experimentation, Randomization, Replication, and Blocking, Guidelines for Machine Learning Experiments , Cross-Validation and Resampling Methods, K-Fold Cross-Validation, Comparing Two Classification Algorithms.	5
6	Advances in Machine Learning: Introduction to learning using Neural networks, shallow and deep networks.	6

V Semester
IT 2331 - OE-2: Introduction to Machine Learning

Text Books				
SN	**Title**	**Edition**	**Authors**	**Publisher**
1	Introduction to Machine Learning, Second Edition		Ethem Alpaydın	The MIT Press
2	Introduction to Machine Learning with Python, A Guide for Data Scientists		Andreas C. Müller and Sarah Guido	ORIELLY

Reference Books				
SN	Title	Edition	Authors	Publisher
1	Machine Learning	Tom M. Mitchel	McGraw Hill	
2				

IT2332 : OE-II INFORMATION SECURITY

A simple way of introduction to Information security is by the information security definition which says that it is a set of processes and practices involved in securing information and data from unauthorized access, dissemination, destruction, and modification during transmission and storage. Information security can be said to be a branch of cyber security, even though, sometimes the two terms are used interchangeably.

Information security course will help to learn how to protect computer operating systems, networks, and data from cyber-attacks. ... Each module will have a certain focus, but the overall goal is to help you develop the computing skills needed to prevent attacks and protect people's data and privacy.

Studying cyber security gives you the opportunity to use your analytical skills to solve complex problems and analyse data patterns. In your professional life, if a security issue occurs then you'll need to be able to think quickly to research the problem and troubleshoot to find the cause.

V Semester
IT 2332 - OE-2: Information Security

Objective	Course Outcome
Student will able: 1. To focus on the foundations Computer Security and Threats to security 2. To understand basic concepts of Threats and Intruders. 3. To demonstrate and understand the concepts and application of Communication, Server, System , Network, Internet and cyber security and understanding standards. 4. To know the working of Server security, various System and Application Security, IT Act.	After completion of the course: 1. To provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security. 2. Students will be able to understand how to protect information and provide authentication using Communication, Server, System, Network, Internet and cyber security 3. Students will able to effectively use of encryption standards and its implementation. 4. Students will be able to understand various technologies and Internet Application with the understanding of IT Act and its protection.

Unit No.	Contents	Max. Hrs.
1	**Introduction**- Computer Security, History of Computer security, Computer Security Concepts (CIA), The OSI security architecture, security attacks, security mechanism, a model for network security, Threats to security, Computer System Security and Access Controls (System access and data access), Key Terms.	7
2	**Malicious software:** Types of Malicious software, Viruses, Virus countermeasures, Worms , Trojan horse, bombs, Trap doors, spoofs, Email virus, Macro viruses, Remedies, Intruders, vulnerabilities & threats, distributed Denial of service attack and Firewalls.	8
3	**Communication security**- Encryption, classical encryption techniques, Block cipher and data encryptions standards, advance encryption standard.Kerberos,X.509	8
4	**Server and System security**- Security for network server, web servers, mobile technologies (java and java script etc) Intrusion detection techniques, intruders, intrusion Detection, Password management, authentication.	8
5	**Network and Internet Security-** Transport-Level Security-Secure Socket Layer and Transport Layer Security, SSL Architecture. Electronic Mail security-Pretty Good Privacy, S/MIME.	7

V Semester
IT 2332 - OE-2: Information Security

6	**Cyber Security:** Cybercrime and Computer Crime[Types of Computer Crime, Law Enforcement Challenges, Working With Law Enforcement], Intellectual Property[Types of Intellectual Property, Intellectual Property Relevant to Network and Computer Security], Ethical Issues [Ethics and the IS Professions, Ethical Issues Related to Computers and Information Systems],Security tools, The Information Technology ACT, 2008.	7

Text Books

SN	Title	Edition	Authors	Publisher
1	Cryptography and Network Security		William Stallings	Pearson Education
2	Computer Security: Art and Science		Matt Bishop	Addison Wesley

Reference Books

SN	Title	Edition	Authors	Publisher
1	Introduction to computer Security		Mathew Bishop	Pearson
2	Network Security: Private Communication in a Public World (Prentice Hall Series in Computer Networking and Distributed)		Charlie Kaufman, Radia Perlman, Mike Speciner	Pearson Education
3	Computer Security		Dieter Gollmann	John Wiley & Sons

GE2316/2366 - Probability Distribution and Statistical Inference

A probability distribution is a statistical function that describes all the possible values and likelihoods that a random variable can take within a given range. This range will be bounded between the minimum and maximum possible values, but precisely where the possible value is likely to be plotted on the probability distribution depends on a number of factors. Unit-I includes the distribution's mean (average), standard deviation, skewness, and kurtosis.

Perhaps the most common probability distribution is the normal distribution, or "bell curve," although several distributions exist that are commonly used. Typically, the data generating process of some phenomenon will dictate its probability distribution. This process is called the probability density function.

Probability distributions can also be used to create cumulative distribution functions (CDFs), which adds up the probability of occurrences cumulatively and will always start at zero and end at 100%. In Unit –II, Sampling distributions are important for inferential statistics. In practice, one will collect sample data and, from these data, estimate parameters of the population distribution. Thus, knowledge of the sampling distribution can be very useful in making inferences about the overall population. Unit-3 contains Estimation theory which is a branch of statistics that deals with estimating the values of parameters based on measured empirical data that has a random component. The parameters describe an underlying physical setting in such a way that their value affects the distribution of the measured data. An estimator attempts to approximate the unknown parameters using the measurements. Unit-4) Hypothesis Testing: Hypothesis testing is the process used to evaluate the strength of evidence from the sample and provides a framework for making determinations related to the population, ie, it provides a method for understanding how reliably one can extrapolate observed findings in a sample under study to the larger population. Unit-5) ANOVA checks the impact of one or more factors by comparing the means of different samples. We can use ANOVA to prove/disprove if all the medication treatments were equally effective or not. Another measure to compare the samples is called a t-test. When we have only two samples, t-test and ANOVA give the same results. Unit-6) Non Parametric Test: Non-parametric methods are widely used for studying populations that take on a ranked order. The use of non-parametric methods may be necessary when data have a ranking but no clear numerical interpretation, such as when assessing preferences. In terms of levels of measurement, non-parametric methods result in ordinal data.

Probability Distribution and Statistical Inference

GE2316/2366	**Probability Distribution and Statistical Inference**			**L=3**	**T=0**	**P=0**	**Credits=3**
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration		
	30	30	40	100	3 Hrs		

Objective	**Outcomes**
• To introduce various probability distribution • To understand the concept Sampling distribution and estimations • To introduce the concept of Hypothesis Testing • To make aware of ANOVA and Non Parametric Test	• Define various special probability distribution and apply it to make predictions • Associate and interpret population and sampling distribution with some statistical parameters. • Test hypothesis of mean, proportion and variances. • Apply statistical Analysis to variety of experimental and observational studies

Unit I: ProbabilityDistribution:
Binomial, Poisson, Geometric, Uniform, Exponential, Normal, Gamma and Beta distribution. Chi -squares, Students t and F -distribution. Central limit theorem

(8hours)

Unit II: Sampling Theory:
Population and sample.Statistical inference. Sampling with and without replacement.Random samples, random numbers, population parameters, sample statistics . Sampling Distribution of means (σ known and σ unknown). Sampling distribution ofproportions.Sampling distributions of sum & difference of mean and proportions. Sampling distribution Variance**.**

(7hours)

Unit III: Estimation
Unbiased and efficient estimates. Point estimates and interval estimates . Confidence interval for means, Confidence interval for proportions, Confidence interval for differences and sums of mean and proportions, Confidence interval for variances

(6hours)

UNIT IV: Testing of Hypothesis.
Definition of mathematical expectation, functions of one and two random variables, the variance And standard deviations, moment generating function other measures of central tendency and Dispersion, Skewness and Kurtosis.

(7 hours)

UNIT V: Analysis of Variance:
Fuzzy sets and systems, crisp sets, overview of fuzzy logic and classical logic,fuzzy compliment, Fuzzy union, fuzzy intersection and combinations of these fuzzy sets operations crisp and fuzzy Relations.

(7 hours)

Unit VI: Nonparametric Test:
Introduction to nonparametric statistics. The sign test for paired data, rank sum test The Mann- Whitney U Test and Kruskal - Wallis test

(6hours)

Text Books:

SN	Title	Edition	Authors	Publisher
1	The theory and problems of probability and Statistics	5th edition	M. R. Spiegel	Schaum series
2	Basic Statistics for Business and economics	7th edition	E. K.Bowen, M. K.Star	McGraw Hill
3	Statistics for management	7^{th} edition	R.I .Levin and D. S Rubin	P.H.I
4	Higher Engineering Mathematics	8th edition	B. V. Ramana	Tata McGraw Hill

Reference Books:

SN	Title	Edition	Authors	Publisher
1	Probability and Statistics for Engineering	6th edition	Miller	Freund and Johnson
2	Fundamental of Mathematical statistics	New edition	Gupta and Kapoor.	S. Chand Group
3	Advanced Engineering Mathematics	4th edition 2006	H.K.Dass	S. Chand Group
4	A text book of Engineering Mathematics	Reprint 2008	N.P. Bali and Manish Goyal	LaxmiPrakashan

V&VI-Semester B.E. (Open Elective OE II)

Introduction to French Language

GE-2320/2370	Introduction to French Language			L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration		
	30	30	40	100	3 Hrs		

Objectives	Course Outcome: At the end of the course students will be able to:
The objective of this course is to impart preliminary knowledge about the French language and civilization and is therefore of an elementary level. At the end of the one year course, the student is expected to acquire the following skills: 1) Elementary communication skills, based on aural and written comprehension of common words and simple sentences in French. 2) Simple oral and written expression.	a) Understand simple words and expressions spoken slowly and distinctly in French and used in day-to-day situations related to the student's immediate environment. b) Read and understand common words and sentences in French. c) Say a few words in French in conversations related to simple day-to-day situations.

Unit-I : Grammar I – 6 hours
- French alphabets
- Pronunciation Guide
- Indefinite and definite articles
- Present tense: -er verbs (regular)

Unit-II : Grammar II – 6 hours
- etre, avoir (irregular verbs)
- Nouns (singular & plural)
- Adjectives
- Pronouns (subject)

Unit-III : Vocabulary – 6 hours
- Numbers (1-100)
- Days of the week
- Months of the year
- Nationalities
- Colours
- Adjectives words for common use used
- Nouns words for common use used

Unit-IV : Communication skills I – 7 hours

- Greetings
- Presentation, introduction

Unit-V : Communication skills II – 7 hours

- Interrogation relating to everyday situations
- Replying to simple questions.

Unit-VI : Civilization – 7 hours

- Day to day Iife, eg.
- Classroom
- Friends
- Family
- School
- Vacations
- Introduction to France: Geography.

Text Books:

1) Ranjit, Mahita& Singh, Monica . `Apprenons le frangais', Part 1. Saraswati House Pvt. Ltd., New Delhi. Second Revised Edition, 2007.

2) Ranjit, Mahitha&Batra, Simran. 'Cahier d'exercices', (Apprenons le francais) 1. Saraswati Book House Pvt. Ltd., New Delhi, 2007.

GE2321 OE-II: Green Chemistry and Sustainability

This course will help to understand Green Chemistry Principles and will help the students to study reflections of Green Chemistry on Sustainable Development Initiatives. The course also focuses on Techniques of Energy Conservation and various recycling processes in environmental safe manner.

Green Chemistry deals with devising chemical processes that give rise to new products and having an ability to meet sustainability goals, such as becoming more energy-efficient, reducing industrial carbon footprints, and reducing the amount of waste or harmful matter found in the environment. Better awareness is developed about global environmental concerns and green remedies to address these concerns.

Sustainability Education aims to promote education as a critical tool to prepare young people for responsible citizenship in the future and to initiate and to direct mainstream culture in a sustainable direction.

V/VI Semester
GE2321/GE2421 - Green Chemistry and Sustainability

GE2321/GE2421	Green Chemistry and Sustainability			L=3	T=0	P=0	Credits=3
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration		
	30	30	40	100	3 Hrs		

Objective	Outcomes Students will be able to
• To understand Green Chemistry principles and Design of green synthesis • To impart knowledge about recycling process in environmental safe manner. • To study reflections of Green Chemistry on sustainable development initiatives. • To learn the techniques of energy conservation,	• Develop better awareness about global environmental concerns and green remedies to address these concerns. • Differentiate types of waste and its management. • Understand principles of sustainable development and its integration with Green practices.

Unit 1: Green Chemistry - An Overview: (5 Hours)

Unit 1: Introduction to Green Chemistry What is Green Chemistry? Some important environmental laws, pollution prevention Act of 1990, emergence of green chemistry, Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry

Unit 2: Principles of Green Chemistry (8 Hours)

The twelve basic principles of green chemistry. (Atom economy, less hazardous chemical syntheses, designing safer chemicals, safer solvents and auxiliaries, design for energy efficiency, renewable feedstock, catalysis, design for degradation, realtime analysis for pollution prevention, and inherently safer chemistry for accident prevention.) Importance of Green Synthesis, Methods for Green Synthesis, Applications of Green Synthesis.

Unit 3: Materials for Green Chemistry and Technology: (6 Hours)

Catalysis, environmental friendly catalysts, Biocatalysis. Biodegradable polymers. Alternative Solvents. Supercritical fluids (SCFs): examples and properties, Extraction with SCFs

Unit 4: Green Chemistry & Sustainable development: (7 Hours)

Green chemistry in batteries, production and recycling, Fuel cell and electric vehicles, Solar energy and hydrogen production, biodiesel, bio-hydrogen, Anaerobic digestion, alcohol production from biomass; Chemical conversion process: hydrolysis and hydrogenation; Best practices in Green Chemistry for sustainable development with suitable examples

Unit 5: Energy Conservation (6 Hours)

Key element of energy management systems, use of clean technologies, energy conservation measures. Water conservation, Recycling, Harvesting. Power saving measures. Paper saving measures. Raw material saving. Life cycle assessment. Green supply chain. Eco-friendly environment good practices and innovations

Unit 6: Waste management and Waste to Energy Conversion (7 Hours)

Waste Characterization – composition, ignitability, corrosively, reactivity, toxicity. Statutory provisions for biomedical waste, e-waste. Battery waste management. Hazardous waste management. Solid waste management. ETP and STP. Six-R concept

Text Books:

SN	Title	Authors	Publisher
1	Engineering Chemistry	Shikha Agarwal	Cambridge University Press
2	Green Chemistry an Introductory Text	Lancaster, M.	Royal Society of Chemistry, Cambridge
3	Applied Chemistry:	A.V. Bharati and Walekar,	Tech Max Publications, Pune.
4	Text Book of Engineering Chemistry:	S.S. Dara	S. Chand and Company Ltd. New Delhi.

Reference Books:

SN	Title	Authors	Publisher

1	Industrial Water Reuse and Waste Water Minimization	James. G. Mann and Liu.Y.A	McGraw Hill, 1999
2	Textbook of Environmental Studies	Erach Bharucha	Universities Press (India), Hyderabad
3	Water Treatment :	F. I. Bilane	Mir publisher
4	Waste Water Engineering: Treatment, Disposal, Reuse	Metcaff and Eddy	Inc.4th ed. TMGHI. New Delhi
5	Cann, M.C.; Connelly, M.E.	Real World Cases in Green Chemistry,.	American Chemical Society: Washington DC. 2000

V&VI-Semester B.E. (Open Elective OE II)

Introduction to Japanese Language

GE2322	**Introduction to Japanese Language**			**L=3**	**T=0**	**P=0**	**Credits =3**
Evaluation Scheme	MSEs	TA	ESE	Total	ESE Duration		
	30	30	40	100	3 Hrs		

Objectives	**Course Outcome: At the end of the course students will be able to:**
The objective of this course is to impart preliminary knowledge about the Japanese language and civilization and is therefore of an elementary level. At the end of the 40 hours course, the student is expected to acquire the following skills: 1) Elementary communication skills, based on oral and written comprehension of common words and simple sentences in Japanese. 2) Simple oral and written expression.	a) Understand simple words and expressions spoken slowly and distinctly in Japanese and used in day-to-day situations related to the student's immediate environment. b) Read and understand common words and sentences in Japanese. c) Say a few words in Japanese in conversations related to simple day-to-day situations.

Unit-I : Grammar I – 10 hours
- Frist Script - Hiragana
- Reading and Writing

Unit-II : Grammar II – 10 hours
- Basic Introduction
- Basic Sentences

Unit-III : Vocabulary – 6 hours
- Numbers (1-10000)
- Days of the week
- Months of the year
- Daily Greeting

Unit-IV : Communication skills I – 6 hours
- Interrogation relating to everyday situations
- Replying to simple questions

Unit-V : Communication skills II – 4 hours

- Day to day Iife, eg.
- Classroom
- Friends
- Family
- School
- Vacations

Unit-VI : Civilization – 4 hours

- History
- Geography

Text book recommended:

1) Minna no Nihongo , by JF .
2) Marugoto by JF
3) Fujichan , By Mandar Sugwekar

Syllabus of Open Elective Innovation & Entrepreneurship

GE2323	OE-II : Innovation & Entrepreneurship	L=3	T=0	P=0	Credits=3

Evaluation Scheme	MSE-I	MSE-II	MSE-III	TA	ESE	Total	ESE Duration
	15	15	15	10	60	100	3 Hrs

Objective	Course Outcome
(1)Understand the concept of Innovation & Entrepreneurship (2)Develop the ability to understand the working of various Entrepreneurial practices. (3)Concept development to bridge the existing gap between innovation and successful Entrepreneur	(I) Students will be able to Develop Innovative Thinking (II) Students will be able to Lead through Collaboration (III) Students will be able to Combine Tenacity with Confidence (IV) Students will be able to Breaking down the skills and to select appropriate assessments and instructional strategies .

Unit 1 **[7 hrs]**

What is innovation and entrepreneurship?

Introduction to module, why do we care? Innovation and entrepreneurship, Where does innovation come from? How to drive innovation

Unit 2 **[8 hrs]**

Teaching entrepreneurship

Can entrepreneurship be taught? Toolset and skillset, Entrepreneurial mindset, The importance of failure, Putting failure to work, Pivoting, The failure value cycle

Unit 3 **[8 hrs]**

Analyzing markets

Introduction to Module, What's a start-up? Common mistakes, Market segmentation, TAM SAM SOM, Beachhead market

Unit 4 **[7 hrs]**

Engage with customers

Customer interviews - part 1, Customer interviews - part 2, Minimum viable product, Experiments

Unit 5 **[8 hrs]**

Closed vs. Open Innovation

Introduction to Module, closed innovation system, Case Xerox, Open innovation, Case transistor and iPod, IP and source of innovation

Unit 6 **[7 hrs]**

The changing landscape

The need for open innovation, The triple helix framework, The business model and open innovation frameworks, Breaking down the fortress, The story of IBM, Open innovation culture, Open innovation companies.

Text books:				
S. N.	**Title of the book**	**Edition (Year of publication)**	**Author(s)**	**Publisher**
1	Innovation & Entrepreneurship	2007	Peter Drucker	Perfect Bound
2	Basic Principles of Entrepreneurship	2010	Christine Volkmann Marc Gruenhagen	Chapman and Hall