

MOHAN BABU UNIVERSITY

Sree Sainath Nagar, Tirupati – 517 102



SCHOOL OF ENGINEERING

B.Tech. Electrical and Electronics Engineering

CURRICULUM AND SYLLABUS

(For 2022-23 Admitted Students)

**FULLY FLEXIBLE CHOICE BASED CREDIT SYSTEM
(FFCBCS)**



MOHAN BABU UNIVERSITY

Vision

To be a globally respected institution with an innovative and entrepreneurial culture that offers transformative education to advance sustainability and societal good.

Mission

- ❖ Develop industry-focused professionals with a global perspective
- ❖ Offer academic programs that provide transformative learning experience founded on the spirit of curiosity, innovation, and integrity
- ❖ Create confluence of research, innovation, and ideation to bring about sustainable and socially relevant enterprises
- ❖ Uphold high standards of professional ethics leading to harmonious relationship with environment and society

SCHOOL OF ENGINEERING

Vision

To be the sought-after destination for engineering education recognised for excellence, innovation and the societal relevance and impact of its pursuits.

Mission

- ❖ Instil within our students fundamental engineering knowledge, a broad set of skills, and an inquisitive attitude to create innovative solutions to serve industry and community
- ❖ Provide an experience par excellence with our state-of-the-art research, innovation, and incubation ecosystem to realise our learners' fullest potential
- ❖ Impart continued education and research support to working professionals in engineering fields to enhance their domain expertise in the cutting-edge technologies
- ❖ Inculcate among the engineers of tomorrow with a spirit to solve societal challenges

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Vision

To become the Nation's premiere center of excellence in electrical engineering through teaching, training, research and innovation by creating competent engineering professionals with values and ethics.

Mission

- ❖ Providing state-of-art resources that foster academic excellence through teaching-learning, research, avenues for entrepreneurship, employability and other holistic developmental activities.
- ❖ Providing contemporary curriculum with academic flexibilities and learner centric higher order learning in the field of Electrical and Electronics Engineering or multi-disciplinary domains.
- ❖ Honing technical and soft skills to bridge the gap between the industry and academia through comprehensive modular training programs.
- ❖ Inspiring students for aptitude for research and innovation by exposing them to industry and societal needs to create solutions for contemporary problems.
- ❖ Inculcating values and ethics among students for a holistic engineering professional practice.

B.Tech. Electrical and Electronics Engineering

PROGRAM EDUCATIONAL OBJECTIVES

After few years of graduation, the graduates of B.Tech. EEE will:

- PEO1.** Pursue higher academic programs in the disciplines of electrical engineering, multidisciplinary areas and in management.
- PEO2.** Become entrepreneurs or be employed as productive and valued engineers in reputed industries.
- PEO3.** Engage in lifelong learning, career enhancement and adopt to changing professional and foster the societal needs.

PROGRAM OUTCOMES

On successful completion of the Program, the graduates of B.Tech. EEE Program will be able to:

- PO1. Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- PO2. Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- PO3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- PO4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- PO6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- PO7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

- PO9. Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- PO10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- PO11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO12. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

On successful completion of the Program, the graduates of B.Tech. EEE program will be able to:

- PSO1.** Analyze specific engineering problems in the domains of Electrical and Electronics Systems, Measurements, Control Systems, Machines and provide feasible solutions by applying the knowledge of Electrical and Electronics Engineering.
- PSO2.** Analyze, design and develop, power system networks, Power Electronic circuits, drives and control strategies for sustainable operation of the electrical systems, and practice professional ethics to sustain environment and society.
- PSO3.** Develop competency to use the techniques, skills, and modern engineering tools necessary for engineering practice and provide sustainable solutions to the societal problems.

B.Tech. Electrical and Electronics Engineering

Basket Wise - Credit Distribution

S. No.	Basket	Credits (Min.- Max.)
1	SCHOOL CORE	50-54
2	PROGRAM CORE	45-61
3	PROGRAM ELECTIVE	24-36
4	SPECIALIZATION ELECTIVE	12-18
5	UNIVERSITY ELECTIVE	9-12
TOTAL CREDITS		Min. 160

School Core (50-54 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22BS102401	Engineering Chemistry	3	-	2	-	4	-
22ME101401	Basic Civil and Mechanical Engineering	3	-	-	-	3	-
22CS102001	Programming for Problem Solving	3	-	2	-	4	
22AI102401	Data Structures and Algorithms	3	-	2	-	4	Programming for Problem Solving
22ME105401	Engineering Drawing	-	1	2	-	2	-
22AI105001	Design Thinking	-	1	2	-	2	-
22EE111002	Technology Extension for Societal Problems	-	-	-	4	1	-
22EE111001	Internship	-	-	-	-	2	-
22EE108001	Capstone Project	-	-	-	-	10	-
Language Basket (Min. 4 Credits to be earned)							
22LG102401	English for Professionals	2	-	2	-	3	
22LG105402	Soft Skills	-	-	2	-	1	
22LG101403	German Language	2	-	-	-	2	
22LG101404	French Language	2	-	-	-	2	
Mathematics Basket (Min. 9 Credits to be earned)							
22MM101402	Multivariable Calculus and Differential Equations	3	-	-	-	3	-
22MM101404	Transformation Techniques and Linear Algebra	3	-	-	-	3	-
22MM101406	Special Functions and Complex Analysis	3	-	-	-	3	Multivariable Calculus and Differential Equations
22MM101405	Numerical Methods, Probability and Statistics	3	-	-	-	3	-
Physics Basket (Min. 4 Credits to be earned)							
22MM102452	Engineering Physics	3	-	2	-	4	
22MM102451	Applied Physics	3	-	2	-	4	

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
Management Basket (Min. 5 Credits to be earned)							
22CM101401	Principles of Business Economics and Accountancy	3	-	-	-	3	-
22MG101401	Essentials of Leadership	2	-	-	-	2	-
22MG101402	Organizational Behaviour	2	-	-	-	2	-
22MG101403	Project Management	2	-	-	-	2	-
Mandatory Courses (Min. 8 Credits to be earned - Earned Credits will not be considered for CGPA)							
22LG107601	Professional Ethics and Human Values	2	-	-	-	2	-
22CE107601	Environmental Science*	2	-	-	-	2	-
22CE107602	Disaster Mitigation and Management	2	-	-	-	2	-
22CE107603	Rural Technology	2	-	-	-	2	-
22LG107603	Spoken English	-	1	2	-	2	English for Professionals
22LG107602	Essential Life Skills for Holistic Development	2	-	-	-	2	-
22AB107601	NCC/NSS Activities	-	-	-	-	2	-
22MG107401	Innovation, Incubation and Entrepreneurship	2	-	-	-	2	-
22EE107001	Intellectual Property Rights	2	-	-	-	2	-
22EE107002	Fundamentals of Research Methodology	2	-	-	-	2	-
22AB107602	Yoga	-	-	-	-	2	-

* Compulsory Course

Program Core (45-61 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22EE102001	Electrical Circuits	3	-	2	-	4	-
22EE101002	Electromagnetic Fields	3	-	-	-	3	Multivariable Calculus and Differential Equations
22EE102003	Signals and Networks	3	-	2	-	4	Electrical Circuits; Transformation Techniques and Linear Algebra
22EE101004	Electrical and Electronic Measurements	3	-	-	-	3	Electrical Circuits
22EE102005	Electrical Machines-I	3	-	2	-	4	Electrical Circuits
22EE102006	Electrical Machines-II	3	-	2	-	4	Electrical Machines-I
22EE102007	Control Systems	3	-	2	-	4	Signals and Networks
22EE101008	Transmission and Distribution	3	-	-	-	3	Electromagnetic Fields
22EE102009	Power System Analysis	3	-	2	-	4	Transmission and Distribution
22EE105010	Electrical CAD Lab	-	-	2	-	1	Engineering Drawing
22EE101011	Power Electronics	3	-	-	-	3	Analog Electronics
22EE102012	Solid State Drives	3	-	2	-	4	Power Electronics
22EC102001	Semiconductor Devices and Circuits	3	-	2	-	4	-
22EC102401	Analog Electronics	3	-	2	-	4	Semiconductor Devices and Circuits
22EC102402	Linear and Digital IC Applications	3	-	2	-	4	-
22EC102010	Digital Design	3	-	2	-	4	-
22EC102013	Microcontrollers and Interfacing	3	-	2	-	4	Computer Organization

Program Elective (24 - 36 Credits)

Course Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
22EE101019	Power Systems	Generation of Electrical Power	3	-	-	-	3	-
22EE101022		Power System Operation and Control	3	-	-	-	3	Transmission & Distribution
22EE102025		Switchgear and Protection	3	-	2	-	4	Power System Analysis
22EC104018	Control and Automation	Advanced Microcontrollers	3	-	2	4	5	Microcontroller and Interfacing
22EE101016		DSP Control for Electric Drives	3	-	-	-	3	Signals and Networks; Solid State Drives
22EE101029		Electric Vehicles	3	-	-	-	3	
22EE103014	Networks and Measurements	Design and Estimation of Electrical Systems	3	-	-	4	4	Transmission and Distribution
22EE104017		Energy Audit, Conservation and Management	3	-	2	4	5	-
22EC101401		Sensors and Signal Conditioning	3	-	-	-	3	-
22EC101016	Electronics	Microelectromechanical Systems	3	-	-	-	3	-
22EC103011		VLSI System Design	3	-	-	4	4	Digital Design
22EC104017		Embedded Systems	3	-	2	4	5	Microcontrollers and Interfacing
22EC101012	Interdisciplinary	Computer Organization	3	-	-	-	3	-
22AI102001		Operating Systems	3	-	2	-	4	-
22AI104002		Object Oriented Programming Through Java	3	-	2	4	5	Programming for Problem Solving
22CB102004		Internet of Things	3	-	2	-	4	Sensors and Signal Conditioning
22CS102005		Database Management Systems	3	-	2	-	4	-
22CS102006		Computer Networks	3	-	2	-	4	Object Oriented Programming Through Java
22CS102002		Python Programming	3	-	2	-	4	-
22EE101018		Evolutionary and Swarm Computing Techniques	3	-	-	-	3	-
22EE101021		Neural Network and Fuzzy Logic Control Applications	3	-	-	-	3	-
22ME101023		Optimization Techniques	3	-	-	-	3	-

Course Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
22EE101020	Power Electronics	Industrial Drives and Automation	3	-	-	-	3	Solid State Drives
22EE101023		PWM Converters and Applications	3	-	-	-	3	Power Electronics

Specialization Elective (12 - 18 Credits)

Course Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
22EE101024	Control and Automation	Robotics and Control	3	-	-	-	3	Control Systems
22EE101033		Optimal Control	3	-	-	-	3	Control Systems
22EE101028		Digital Control System	3	-	-	-	3	Control Systems
22EE101013		Advanced Control Systems	3	-	-	-	3	Control Systems
22EC101133	Electronics	Principles of Communications	3	-	-	-	3	
22EC101134		Industrial Data Communications	3	-	-	-	3	Computer Network
22EC101026		Image Processing	3	-	-	-	3	-
22EC101019		FPGA Architectures and Applications	3	-	-	-	3	VLSI System Design
22EE104027	Power Electronics	Analysis and Design of Power Electronic Converters	3	-	2	4	5	Power Electronics
22EE101034		Power Electronics for Renewable Energy Systems	3	-	-	-	3	Power Electronics
22EE101039		Switched Mode Power Conversion	3	-	-	-	3	Power Electronics
22EE101026		Advanced Electrical Drives and Control	3	-	-	-	3	Solid State Drives
22EE101032	Power systems	Flexible AC Transmission System	3	-	-	-	3	Power System Analysis
22EE104035		Power Quality	3	-	2	4	5	
22EE101036		Power System Automation	3	-	-	-	3	
22EE101037		Restructured Power Systems	3	-	-	-	3	Power System Analysis
22EC102403	Instrumentation	PLC and SCADA	3	-	2		4	Digital Design
22EC101103		Industrial Instrumentation	3	-	-	-	3	Sensors and Signal Conditioning

Course Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
22EC101105		Bio-Medical Instrumentation	3	-	-	-	3	-
22EC101112		Power Plant Instrumentation	3	-	-	-	3	Industrial Instrumentation
22EE101031	Machines	Finite Element Analysis for Electrical Machines	3	-	-	-	3	Electrical Machines-II
22EE101040		Utilization of Electrical Energy	3	-	-	-	3	
22EE101038		Special Electrical Machines	3	-	-	-	3	Electrical Machines-II
22EE103030		Electrical Machine Design	3	-	-	4	4	Electrical Machines-II

University Elective (9-12 Credits)

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22EC101701	AI in Healthcare	3	-	-	-	3	-
22CM101701	Banking and Insurance	3	-	-	-	3	-
22AI101701	Bioinformatics	3	-	-	-	3	-
22BS101701	Biology for Engineers	3	-	-	-	3	-
22LG101701	Business Communication and Career Skills	3	-	-	-	3	-
22CE101701	Civil Engineering and The Society	3	-	-	-	3	-
22SS101701	Constitution of India	3	-	-	-	3	-
22CM101702	Cost Accounting and Financial Management	3	-	-	-	3	-
22CB101701	Cyber Laws and Security	3	-	-	-	3	-
22EE101701	Electrical Safety and Safety Management	3	-	-	-	3	-
22MG101701	Entrepreneurship for Micro, Small and Medium Enterprises	3	-	-	-	3	-
22CE101702	Environmental Pollution and Control	3	-	-	-	3	-
22EC101702	Essentials of VLSI	3	-	-	-	3	-
22CB101702	Introduction to Ethical Hacking	3	-	-	-	3	-
22CB101703	Forensic Science	3	-	-	-	3	-
22SS101702	Gender and Environment	3	-	-	-	3	-
22ME101701	Global Strategy and Technology	3	-	-	-	3	-
22EE101704	Green Technologies	3	-	-	-	3	-
22ME101702	Human Resource Management	3	-	-	-	3	-
22SS101703	Indian Economy	3	-	-	-	3	-
22SS101704	Indian History	3	-	-	-	3	-
22SS101705	Indian Tradition and Culture	3	-	-	-	3	-
22EC101703	Instrumentation in Industries	3	-	-	-	3	-
22EC101704	Introduction to Nanotechnology	3	-	-	-	3	-
22AI101702	Introduction to Artificial Intelligence	3	-	-	-	3	-
22AI101703	Introduction to Data Science	3	-	-	-	3	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22AI101704	Introduction to Machine Learning	3	-	-	-	3	-
22CS101701	Introduction to Python Programming	3	-	-	-	3	-
22CB101704	Introduction to Internet of Things	3	-	-	-	3	-
22ME101703	Management Science	3	-	-	-	3	-
22ME101704	Managing Innovation and Entrepreneurship	3	-	-	-	3	-
22ME101705	Material Science	3	-	-	-	3	-
22LG101702	Personality Development	3	-	-	-	3	-
22CE101703	Planning for Sustainable Development	3	-	-	-	3	-
22EC101705	Principles of Communication Engineering	3	-	-	-	3	-
22EE101702	Reliability and Safety Engineering	3	-	-	-	3	-
22CE101704	Remote Sensing, GIS and GPS	3	-	-	-	3	-
22CE101705	Smart Cities	3	-	-	-	3	-
22EC101706	Smart Sensors for Engineering Applications	3	-	-	-	3	-
22LG101703	Stress Management and Well Being	3	-	-	-	3	-
22EE101703	Sustainable Energy Systems	3	-	-	-	3	-
22CS101702	Web Design Fundamentals	3	-	-	-	3	-
22SS101706	Women Empowerment	3	-	-	-	3	-

Note:

1. If any student has chosen a course or equivalent course from the above list in their regular curriculum then, he/she is not eligible to opt the same course/s under University Elective.
2. The student can choose courses from other disciplines offered across the schools of MBU satisfying the pre-requisite other than the above list.

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22BS102401	ENGINEERING CHEMISTRY	3	-	2	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on water technology, multi functional materials, applications of electrochemistry, instrumental methods of analysis, fuel chemistry and lubricants. This course also provides analytical skills for the quantitative estimation of materials through volumetric and instrumental methods of analysis and addresses the societal, health issues related to quality of water.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Solve problems associated with water, and address the societal, health and safety issues related to quality of water
- CO2.** Acquire basic knowledge on industrial polymers, composites, and Nano materials used in engineering applications.
- CO3.** Apply and demonstrate competency in the basic concepts of electrochemical cells and sensors.
- CO4.** Acquire basic knowledge of instrumental methods and their applications in the analysis of materials.
- CO5.** Identify the quality of fuels and lubricants for their engineering applications.
- CO6.** Develops independent working ability, through problem solving and effective communication.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	-	1	-	2	1	-	-	-	-
CO2	3	-	-	-	-	-	2	-	-	-	-	-
CO3	3	-	-	-	1	-	1	-	-	-	-	2
CO4	3	-	-	-	2	-	-	-	-	-	-	1
CO5	3	2	-	-	-	-	1	-	-	-	-	-
CO6	3	3	-	-	1	1	2	-	3	3	-	1
Course Correlation Mapping	3	3	-	-	2	1	2	1	3	3	-	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: WATER TECHNOLOGY

(09 Periods)

Introduction, types of water, Impurities in water and their consequences. Hardness of water, units of hardness, disadvantages of hardness, determination of hardness by EDTA method, numerical problems, boiler troubles, softening of water – Internal treatment, External treatment (Ion exchange process, zeolite process), desalination of brackish water by reverse osmosis, specifications of potable water as per WHO and BIS standards. Fluoride in ground water: Effects on human health, defluoridation method – Nalgonda method; merits and demerits of various defluoridation methods.

Module 2: CHEMISTRY OF MULTI FUNCTIONAL MATERIALS

(09 Periods)

Engineering plastics: Definition, synthesis, properties and applications of PC, PTFE, and PMMA.

Conducting polymers: Definition, types and applications.

Biodegradable polymers: Definition, classification, mechanism of degradation and applications.

Nano Materials: Introduction, size dependent properties (Colour, magnetic and electrical), method of synthesis – CVD, applications of Nano materials.

Module 3: ELECTROCHEMICAL CELLS, STORAGE DEVICES AND SENSORS

(09 Periods)

Electrode potential, Electrochemical cell, EMF of an electrochemical cell.

Batteries: Introduction, types of Batteries-Primary battery-dry cell, secondary battery-Lead-acid batteries, Lithium-ion batteries, Lithium- Polymer batteries, Applications of batteries.

Fuel Cells: Definition, H_2 - O_2 fuel cell, solid oxide fuel cell, applications of fuel cells.

Sensors: Introduction, Types of Sensors, electrochemical sensors, applications.

Module 4: INSTRUMENTAL METHODS AND APPLICATIONS

(08 Periods)

Introduction to spectroscopy–types of energy present in molecules, types of spectra, UV-Vis spectroscopy – principle, types of electronic transitions, Instrumentation and applications; Infrared spectroscopy – principle, types of vibrational modes, Instrumentation and applications; working principle and applications of SEM, TEM, and XRD.

Module 5: FUELS AND LUBRICANTS

(10 Periods)

Fuels: Classification of fuels, calorific value, numerical problems; Liquid fuels, cracking of oils (Thermal and Fixed-bed catalytic cracking), Synthetic petrol: Fischer-Tropsch method and Bergius process. Eco friendly fuels-Types, significances.

Lubricants: Definition, functions of lubricants, mechanism of lubrication, classification of lubricants, properties of lubricants – viscosity and viscosity index, flash and fire point, cloud and pour point, Aniline point, neutralization number and mechanical strength.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXPERIMENTS: (Minimum 10 exercises shall be conducted)

1. Determination of hardness of ground water sample.
2. Determination of alkalinity of Water sample.
3. Estimation of residual chlorine in drinking water.
4. Estimation of Dissolved Oxygen in water by Winkler's method.
5. Estimation of Fe (II) by Dichrometry.
6. Conductometric titration of strong acid Vs strong base.
7. Estimation of Ferrous ion amount by Potentiometry.

8. Synthesis of nano ZnO using sol-gel process.
9. Determination of Viscosity by Ostwald's viscometer.
10. Determination of strength of acid by using P^H metric method.
11. Determination of Strength of an acid in Pb-Acid battery.
12. Determination of percentage of Iron in Cement sample by colorimetry.

RESOURCES

TEXT BOOKS:

1. P. C. Jain & Monika Jain, *Engineering Chemistry*, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 16th edition, 2013.
2. K.N. Jayaveera, G.V. Subba Reddy and C. Ramachandriah, *Engineering Chemistry*, Mc.Graw Hill Publishers, New Delhi.
3. Engineering Chemistry lab Manual

REFERENCE BOOKS:

1. Peter Atkins, Julio de Paula and James Keelar, *Atkins' Physical Chemistry*, Oxford University Press, 10th edition, 2010.
2. Skoog and West, *Principles of Instrumental Analysis*, Thomson, 6th edition, 2007.
3. K. Mukkanti, *Practical Engineering Chemistry*, BS Publications, 2013.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=ly_FS3LZXEY
2. https://www.youtube.com/watch?v=0_ZcCqqpS2o
3. <https://www.youtube.com/watch?v=Tye3dcBOqtY>
4. <https://www.youtube.com/watch?v=tsvIvQJiTL4>

WEB RESOURCES:

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4851520/>
2. [https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_\(Analytical_Chemistry\)/Analytical_Sciences_Digital_Library/Active_Learning/Shorter_Activities/Electrochemical_Sensor_Project/01_Introduction_To_Electrochemical_Sensors](https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Analytical_Sciences_Digital_Library/Active_Learning/Shorter_Activities/Electrochemical_Sensor_Project/01_Introduction_To_Electrochemical_Sensors)
3. <https://www.arsdcollege.ac.in/wp-content/uploads/2020/04/Document-2.pdf>
4. https://www.salon.com/2015/10/14/4_outlandish_things_our_ancestors_used_as_lube_partner/

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22ME101401	BASIC CIVIL AND MECHANICAL ENGINEERING	3	-	-	-	3

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course provides an overview of civil engineering such as surveying, civil engineering materials, mechanics of materials, building components and civil engineering infrastructure. This course also provides an overview of basic mechanical engineering concepts like functioning of various prime movers, their prospects, advantages and limitations. It further enlighten about basics of power transmission systems, Additive manufacturing processes and their classifications.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the principles of surveying, materials used in civil engineering and their mechanics.
- CO2.** Apply the basic principles of civil engineering, techniques and tools for analyzing civil structures and solve related problems.
- CO3.** Understand the functional aspects of various prime movers used in industrial applications.
- CO4.** Realize the principle of mechanical power transmission through belts and gear trains.
- CO5.** Realize the fundamental concepts of Additive Manufacturing (i.e. Rapid Prototyping) and 3-D printing, its advantages and limitations.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	-	-	-	-	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	2	-
CO4	2	3	3	-	-	-	-	-	-	-	-	-
CO5	3	3	3	-	-	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	3	-	-	-	-	-	-	-	2	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: Surveying and Civil Engineering Materials **(09 Periods)**

Overview of Civil Engineering: Civil Engineering contributions to the welfare of society, specialized sub disciplines in Civil Engineering.

Surveying: Objectives, classification and principles; Measurements – distances, angles, levels, areas and volumes; contouring; Illustrative examples.

Civil Engineering Materials: Bricks, stones, concrete, steel, glass, timber, composite materials.

Mechanics of Materials: Forces, system of forces, laws of mechanics, moment of a force, equilibrium, resultant, Internal and External forces, Stress, Strain, Hooke's law and Elasticity.

Module 2: Building Components and Civil Engineering Infrastructure (9 Periods)

Building Components: Sub structure - Types of foundations, Bearing capacity and settlement, Requirement of good foundations.

Superstructure - Civil engineering construction - Brick masonry, Stone masonry, Beams, Columns, Lintels, Roofs, Floors, Stairs, Building bye-laws - bye-laws floor area, carpet area and floor space index, basics of interior design and landscaping.

Civil Engineering Infrastructure - Types of Bridges and Dams, Water supply and Sanitary systems, Rainwater harvesting, Types of Highways and Railways, Ports and Harbors.

Module 3: Internal Combustion Engines, Turbines and Pumps (9 Periods)

Internal Combustion Engines - Classification - Working principle of Petrol and Diesel Engines - Four stroke and two stroke engines - Comparison of four stroke and two stroke engines.

Turbines and Pumps - Classifications of Steam turbines - Impulse turbine, Reaction turbines; Working principle of Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps.

Module 4: Mechanical Power Transmission Systems (9 Periods)

Power Transmission Systems: Belt, rope and chain drives, Gears and Transmission screw

Power transmission by belts: Classification of belts, Length of the Belt (Open and Crossed-Belt Drives), Power Transmitted by Belt Drive, Tension due to Centrifugal Forces, Initial Tension, Maximum Power Transmitted.

Power transmission by Gear train: Gear terminology, Classification of gears, Gear train- Simple Gear Train and Compound Gear Train, Power Transmitted by Simple Gear Train.

Module 5: Additive Manufacturing Processes (09 Periods)

Rapid Prototyping: Introduction, Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages and Limitations of Rapid Prototyping,

Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Three-dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Visit the IC engine lab
2. Visit Machine Tools Lab and Foundry
3. Visit Design lab

CASE STUDIES/ ARTICLES:

Contemporary relevant case studies/Articles will be provided by the course instructor at the beginning.

(Note: It's an indicative one. The course instructor may change the activities and shall be reflected in the course handout.)

RESOURCES

TEXT BOOKS:

1. Shanmugam G and Palanichamy MS, *Basic Civil and Mechanical Engineering*, Tata McGraw Hill Publishing Co., New Delhi, 1st Edition 2018.
2. R. Vaishnavi, Prof. M. Prabhakaran & Prof. V. Vijayan, *Basic Civil and Mechanical Engineering*, S.CHAND Publications, 2nd Edition, 2013.

REFERENCE BOOKS:

1. Kalpakjian, Serope, *Manufacturing Engineering and Technology*, Pearson Education, 7th Edition, 2014
2. Mikell P. Groover, *Automation, Production Systems & CIM*, 3rd Edition, PHI.
3. Rapid prototyping; *Principles and Applications* / Chua C.K., Leong K.F. and LIM C.S / World Scientific Publications.

VIDEO LECTURES:

1. <https://archive.nptel.ac.in/courses/116/102/116102012/>
2. <https://archive.nptel.ac.in/courses/112/103/112103262/>
3. <https://archive.nptel.ac.in/courses/108/106/108106182/>

WEB RESOURCES:

1. <https://www.britannica.com/technology/prime-mover-mechanics>
2. <https://unacademy.com/content/gate/study-material/mechanical-engineering/additive-manufacturing/>
3. <https://www.tezu.ernet.in/sae/Download/transmission.pdf>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CS102001	PROGRAMMING FOR PROBLEM SOLVING	3	-	2	-	4

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on C Programming concepts, Operators and Expressions, Input and Output Functions, Control Structures, Problem Solving Aspects, Arrays and Strings, Functions, Pointers, Structures and Unions and File Handling.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Demonstrate knowledge on C programming constructs to develop programs.

CO2. Design algorithms using problem-solving techniques for given problems.

CO3. Apply functions and Arrays to enhance reusability and data manipulation.

CO4. Use pointers to manage the memory effectively.

C05. Apply Structures, Unions and File handling concepts to develop societal applications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	2	-	-	-	-	-	-	-	-	-	-
C02	3	2	2	3	-	-	-	-	-	-	-	-
C03	3	2	3	-	-	-	-	-	-	-	-	-
C04	2	2	2	2	3	-	-	-	-	-	-	-
C05	3	2	2	3	2	3	-	-	-	-	-	-
Course Correlation Mapping	3	2	3	3	3	3	-	-	-	3	3	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO C PROGRAMMING (09 Periods)

Basics of C Programming: Introduction, Structure of a C program, Concept of a variable, Data types in C, Program statement, Declaration, Storing the data in memory, Tokens, Operators and expressions, Lvalues and Rvalues, Type conversion in C.

Input and Output: Basic screen and keyboard I/O in C, Non-formatted input and output, formatted input and output functions.

Module 2: CONTROL STATEMENTS AND INTRODUCTION TO PROBLEM SOLVING (08 Periods)

Control Statements: Specifying test condition for selection and iteration, Writing test expression, Conditional execution and selection, Iteration and repetitive execution, goto statement, Special control statements, Nested loops.

Introduction to Problem Solving: Algorithms, Flowcharts, Problem solving aspect, Top-down design, Implementation of algorithms, program verification and efficiency of algorithms.

Module 3: ARRAYS & STRINGS AND FUNCTIONS (10 Periods)

Arrays and Strings: One-dimensional array – Declaration, Initialization, Accessing elements, operations; Multi-dimensional arrays – Declaration, Initialization, Working with 2D arrays; Strings – Declaration, Initialization, Printing strings, String input, Character manipulation, String manipulation; Arrays of strings – Initialization, manipulating string arrays.

Functions: Concept of function, Using functions, Call by value mechanism, working with functions, passing arrays to functions, Scope and extent, Storage classes, Recursion.

Module 4: POINTERS (08 Periods)

Introduction to Pointers: Understanding memory addresses, Address operator (&), Pointer – declaration, Initialization, Indirection operator and dereferencing, Void and Null pointers, Use of pointers, Arrays and pointers, Pointers and strings, Pointer arithmetic, Pointers to pointers, Array of pointers, Pointers to an array, Two-dimensional arrays and pointers, Pointers to functions, Dynamic memory allocation.

Module 5: USER-DEFINED DATA TYPES AND FILES (10 Periods)

User-Defined Data Types: Structures - Declaration, Accessing the members, Initialization, typedef and its use, Arrays of structures, Arrays within structure, Structures and pointers, Structures and functions; Unions, Enumeration types, Bitfields.

Files: Using files in C, Working with text and binary files, Direct File Input and Output, Files of records, Random access to files of records.

Total Periods: 45

EXPERIENTIAL LEARNING

1.
 - a) Write a C program to perform the arithmetic operations on two integer numbers.
 - b) Write a program to evaluate the following expressions by reading the necessary values from the keyboard.
 - i. $(ax + b)/(ax - b)$
 - ii. $2.5 \log x + \cos 32^\circ + |x^2 + y^2|$
 - iii. $ax^5 + bx^3 + c$
 - iv. ae^{kt}
2.
 - a) Write a C program to find the roots of a quadratic equation.
 - b) In a town, the percentage of men is 52. The percentage of total literacy is 48 and the total percentage of literate men is 35 of the total population. Write a C program to find the total number of illiterate men and women if the population of the town is 7000.
 - c) The total distance travelled by a vehicle in t seconds is given by the distance $ut + at^2/2$ where u and a are the initial velocity (m/sec.) and acceleration (m/sec²). Write C program to find the distance travelled at regular intervals of time given the values of u and a. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of u and a.

3. a) Write a C Program to compute an electricity bill based on the following slab rates.

Consumption units Rate (in Rupees/unit)

0-100	4.0
101-150	4.6
151-200	5.2
201-300	6.3
Above 300	8.0

(**Hint:** Take current and old meter readings from the user to get consumption units)

- b) An insurance company computes the premium amount based on the following;
- If a person's health is excellent and the person is between 25 and 35 years of age and lives in a city, and is a male then the premium is Rs.4 per thousand and the policy amount cannot exceed Rs.2 lakhs.
 - If a person satisfies all the above conditions and is female then the premium is Rs.3 per thousand and the policy amount cannot exceed Rs.1 lakh.
 - If a person's health is poor and the person is between 25 and 35 years of age and lives in a village and is a male then premium is Rs.6 per thousand and the policy cannot exceed Rs. 10000.
 - In all other cases the person is not insured.

Write a C program to determine whether the person should be insured or not, his/her premium rate and maximum amount for which he/she can be insured.

- c) Write a C Program to find the grade for a student using a Switch case. The user needs to enter a subject score (varies from 0 to 100) and then display the grade as described below.

Score	Grade	Score	Grade
> = 90	O	>=50 to < 60	D
>=80 to < 90	A	>=40 to < 50	E
>=70 to < 80	B	< 40	Fail
>=60 to < 70	C		

4. a) A Fibonacci sequence is defined as follows:

The first and second terms in the sequence are 0 and 1. Sub-sequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

- b) Write a C program to find the sum of individual digits of a positive integer.
- c) Write a C program to read two numbers x and n, and then compute the sum of the geometric progression: $1+x+x^2+x^3+\dots+x^n$. Show appropriate error message for $n<0$. (Example: if n is 3 and x is 5, then the sum is: 1+5+25+125)
- d) Write a C program to print the following pattern.

```

          1
        1 2
      1 2 3
    1 2 3 4
  1 2 3 4 5
1 2 3 4 5 4 3 2 1

```

5. a) Write a C program to generate all the prime numbers between 1 and n, where n is a value entered by the user. Define a separate function to generate prime numbers.
b) Write C program that uses recursive function to find the following.
i) Factorial of a given integer ii) GCD of two given integers
6. a) Write a C program to find both the largest and smallest numbers in a list of integers.
b) Write a C program that uses function to perform the following:
i) Addition of Two Matrices ii) Multiplication of Two Matrices
7. a) Write a C program to insert a sub-string in to a main string at a given position.
b) Write a C program to count the lines, words and characters in a given text.
8. a) Write a C program to print the elements of an array in reverse order using pointers.
b) Write a C program to count the number of vowels and consonants in a string using pointers.
c) Write a C program to store n elements in an array and print the elements in sorted order using pointers.
9. a) Write a C program that performs the following operations:
i. Reading a complex number ii. Writing a complex number
iii. Addition of two complex numbers iv. Multiplication of two complex numbers
(**Note:** Represent complex number using a structure.)
b) Define a structure to store employee details include Employee-Number, Employee-Name, Basic-pay, Date-of-Joining. Write a C program for the following.
i. A function to store 10 employee details.
ii. A function to implement the following rules while revising the basic pay.
If Basic-pay ≤ Rs.5000 then increase it by 15%.
If Basic-pay > Rs.5000 and ≤ Rs.25000 then it increase by 10%.
If Basic-pay > Rs.25000 then there is no change in Basic-pay.
iii. A function to print the details of employees who have completed 20 years of service from the Date-of-Joining.
- 10 a) Write a C program to reverse the first n characters of a given text file.
b) Write a C program to merge two files into a new file.

RESOURCES

TEXT BOOKS:

- 1 Pradip Dey and Manas Ghosh, *Programming in C*, 2nd Edition, Oxford University Press, New Delhi, 2013.
- 2 R. G. Dromey, *How to Solve it by Computer*, 1st Edition, Pearson Education, 2013.

REFERENCE BOOKS:

1. Byron S Gottfried and Jitender Kumar Chhabra, *Programming with C*, 4th Edition, McGraw Hill Education, 2019.
2. Yashavant Kanetkar, *Let Us C*, 15th Edition, BPB Publications, 2017.
3. E. Balagurusamy, *Programming in C*, 7th Edition, McGraw Hill Education Pvt, Ltd, New Delhi, 2017.

4. Behrouz A. Forouzan and Richard F. Gilberg, *Computer Science: A Structured Programming Approach Using C*, 3rd Edition, Cengage Learning, 2008.

SOFTWARE/TOOLS:

1. Software: Turbo C++/Dev C++

VIDEO LECTURES:

1. <https://www.digimat.in/nptel/courses/video/106105171/L03.html>
2. <https://nptel.ac.in/courses/106104128>

WEB RESOURCES:

1. Learn C Programming - <https://www.programiz.com/c-programming>
2. Learn C Programming - <https://www.tutorialspoint.com/cprogramming/index.htm>
3. C Programming Exercises, Practice, Solution - <https://www.w3resource.com/c-programming-exercises/>
4. Basic programming exercises and solutions in C - <https://codeforwin.org/2015/05/basic-programming-practice-problems.html>
5. C Programming Exercises, Practice, Solution - <https://www.w3resource.com/c-programming-exercises/>
6. Basic programming exercises and solutions in C - <https://codeforwin.org/2015/05/basic-programming-practice-problems.html>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22AI102401	DATA STRUCTURES AND ALGORITHMS	3	-	2	-	4

Pre-Requisite Programming for Problem Solving

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides theoretical and practical knowledge on sorting and searching, Linked list, stacks and queues. It also emphasizes on concepts and techniques of trees, search trees and heaps, multi way trees, graphs and hashing.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

CO1. Understand the fundamental concepts of data structures, asymptotic notations and Algorithm analysis techniques to measure the performance of an algorithm.

CO2. Analyze performance of sorting and searching algorithms by making use of time and space complexity.

CO3. Design algorithms to solve societal problems by applying contextual knowledge on linked lists.

CO4. Identify suitable data structure to Solve computational problems

CO5. Construct hash tables by using Hash functions and relevant collision resolution technique.

CO6. Work independently or in team to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	-	-	1	-	-	-	-	-	-	-
CO3	2	2	3	-	1	1	-	-	-	-	-	-
CO4	3	2	3	-	1	-	-	-	-	-	-	-
CO5	2	2	3	-	1	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-
Course Correlation Mapping	3	2	3	-	1	1	-	-	3	3	-	-

Correlation Levels: 3: High; 2: Medium; 1: Low

COURSE CONTENT

Module 1: INTRODUCTION, SORTING AND SEARCHING (11 Periods)

Introduction: Introduction to data structures, Introduction to Algorithm, Performance Analysis- Space Complexity, Time Complexity, Asymptotic Notation- Big Oh, Omega, Theta notations, Guidelines for Asymptotic Analysis, Algorithms Analysis: Problems & Solutions.

Sorting: Bubble Sort, Insertion sort, Selection Sort, Shell Sort, Radix sort and their performance analysis.

Searching: Linear Search, Binary Search and their performance analysis.

Module 2: LINKED LIST (08 Periods)

Single Linked List, Circular Linked List, Double Linked List, Circular Double Linked List, Applications of Linked List- Sparse Matrix Representation and its performance analysis, Addition of Polynomials and its performance analysis.

Module 3 STACKS AND QUEUES (08 Periods)

Stacks: Introduction, Definition, Implementation of stacks using arrays, Implementation of stacks using linked list, Applications of Stacks.

Queues: Introduction, Definition, Implementation of queues using arrays, Implementation of queues using linked list, Circular Queue, Dequeue, Priority Queue, Applications of Queues.

Module 4 TREES, SEARCH TREES AND HEAPS (09 Periods)

Trees: Basic Terminologies, binary trees, Properties of binary tree, Representation of Binary Tree, Binary tree traversals.

Search Trees: Binary Search Trees, Operations on Binary Search Trees, AVL Trees and Operations on AVL trees

Heap: Heap Trees, Implementation of Heap Trees, Applications of Heap – Heap Sort and Its performance Analysis.

Module 5 MULTI WAY TREES, GRAPHS AND HASHING (09 Periods)

Multiway Trees: M-way search trees, B-trees, Operations on B-trees, B+-trees.

Graphs: Introduction, Basic Terminologies, Representation of Graphs, Breadth First Search and its Complexity Analysis, Depth First Search and its Complexity Analysis.

Hashing: Introduction, Hash Table Structure, Hash Functions, Linear Open Addressing, Chaining and their performance analysis.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1. Implement following sorting algorithms
 - a) Bubble Sort
 - b) Insertion sort
 - c) Selection sort
2. Store roll numbers of students who attended placement training program in random order in an array.
 - a) Write a program to search whether a particular student attended training or not using linear search
 - b) Write a program to search whether a particular student attended training or not using binary search

3. **a)** Department of CSE has a readers club named 'Prerana'. Students of all years can be granted membership on request and they can get books. Similarly one may cancel the membership of club. First node is reserved for head of readers club and last node is reserved for in-charge of readers club. The student's information in each node consisting of name of the student and roll no of the student. Develop a program to perform following operations on readers club member's information using singly linked list.
 - i) Add and delete the members as well as head or even in-charge.
 - ii) Compute total number of members in readers club
 - iii) Display members in readers club
 - iv) Display list in reverse order using recursion
 - v) Sort the list using name and display it.
- b)** A Company has N employees and it maintains each employee data with the following attributes like: emp_id, emp-dept, emp_sal, emp_mobilen. Use a menu driven Program to perform following operations on employee's data using Doubly Linked List (DLL).
 - i) Create a DLL of N Employees Data by using end insertion.
 - ii) Display the status of DLL and count the number of nodes in it
 - iii) Perform Insertion and Deletion at End of DLL
 - iv) Perform Insertion and Deletion at Front of DLL
 - v) Perform Insertion and Deletion at any user specified position of DLL
 - vi) Exit
4. **a)** Implement a menu driven Program for the following operations on stack using arrays.
 - i) Push an Element on to Stack
 - ii) Pop an Element from Stack
 - iii) Demonstrate how Stack can be used to check Palindrome
 - iv) Display the elements of a Stack
 - v) Exit
- b)** Develop a menu driven program to implement queue operations using arrays
5. **a)** Write a program to implement stack using linked list
b) Write a program to implement queue using linked list
6. **a)** Develop a program to convert an infix expression to postfix expression using stack
b) Write a program to evaluate given postfix expression using stack
7. Develop a menu driven program to perform the following operations on a binary search tree
 - a)** Create a binary search tree

- b)** Insert an element into a binary search tree
 - c)** Delete an element from binary search tree
 - d)** Traverse the binary search tree in In order, Preorder and post order
8. Write a program to perform the following operations on AVL tree
- a)** Insert an element into AVL tree
 - b)** Delete an element from AVL tree
 - c)** Display the elements of AVL tree in ascending order
9. **a)** Develop a program to implement Breadth first search traversal.
b) Develop a program to implement Depth first search traversal.
10. Write a program to implement hashing with
- a)** Separate Chaining Method
 - b)** Open Addressing Method

RESOURCES

TEXT BOOKS:

1. Debasis Samanta, *Classic Data Structures*, PHI Learning private limited, 2nd Edition, 2017.
2. Narasimha Karumanchi, *Data Structures and Algorithms made easy*, Career Monk, 5th Edition, 2017.

REFERENCE BOOKS:

1. G A V Pai, *Data Structures and Algorithms: Concepts, Techniques and Applications*, McGraw Hill Education.
2. Satraj Sahani, *Data Structures, Algorithms and Applications in Java*, Universities Press, 2nd Edition, 2008.
3. Michael T. Goodrich, Roberto Tamassia, *Data Structures and Algorithms in java*, Wiley India, 2nd Edition, 2007.

SOFTWARE/TOOLS:

1. **Software:** JDK 1.8
2. **Operating System:** Windows/ Linux

VIDEO LECTURES:

1. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/lecture-videos>
2. <http://nptel.ac.in/courses/106106127/>
3. <http://www.nptel.ac.in/courses/106102064>

WEB RESOURCES:

1. <https://www.codechef.com/certification/data-structures-and-algorithms/prepare>
2. <https://hackr.io/tutorials/learn-data-structures-algorithms>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22ME105401	ENGINEERING DRAWING	-	1	2	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on engineering drawing conventions, Importance of engineering drawing, fundamental concepts of sketching, computer aided drafting and different types of projections of geometric entities (both 2D and 3D) through computer aided drafting packages.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Apply the principles of engineering drawing, Methods and CAD tools to draw the Geometries and Curves to communicate in engineering field.
- CO2.** Understand and draw projections of points (0D) located in four quadrants.
- CO3.** Visualize, plan and draw projections of lines (1D) and planes (2D) (inclined to both planes of projection).
- CO4.** Visualize and draw projections of regular solids (3D) (inclined to both planes of projection) and sections of regular solids (front view, top view and true shape).
- CO5.** Develop lateral surfaces of solids and draw Isometric views of given objects for engineering communication using principles of engineering drawing and CAD tools.
- CO6.** Work independently or in teams to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-
CO5	3	2	2	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	3	-	-
Course Correlation Mapping	3	2	1	-	-	-	-	-	3	3	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO ENGINEERING GRAPHICS AND (06 Periods) DESIGN

Principles, significance -Conventions in drawing-lettering - BIS conventions-Dimensioning principles and conventional representations.

Exercises:

1. Practice exercise on Basic Lettering and Dimensioning
2. Practice exercise on Conventional representations

Introduction to AutoCAD: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions.

Exercises:

3. Practice exercise using basic drawing commands
4. Practice exercise using editing commands

Module 2: CONICS, PROJECTION OF POINTS

(06 Periods)

Conics & Special Curves: Conic sections - eccentricity method only

Exercises:

5. Practice exercises on Ellipse, Parabola, Hyperbola
6. Practice exercises on Projection of points

Module 3 PROJECTION OF LINES AND PLANES

(8 Periods)

Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line, Projections of regular plane surfaces.

Exercises:

7. Practice exercises on projection of lines inclined to one plane
8. Practice exercises on projection of lines inclined to both planes
9. Practice exercises on Projections of regular plane surfaces

Module 4 PROJECTION OF SOLIDS AND SECTION OF SOLIDS

(6 Periods)

Projection of solids: Projection of regular solids inclined to one plane.

Sections of solids: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone, True shapes of the sections.

Exercises:

10. Practice exercises on Projections of regular solids
11. Practice exercises on Sections of solids

Module 5 DEVELOPMENT OF SURFACES, ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS

(10 Periods)

Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

Exercises:

12. Practice exercises on Development of surfaces of right regular solids

ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS

Orthographic Projections: Systems of projections, conventions and application to orthographic projections.

Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

Exercises:

14. Practice exercises on Orthographic Projections
15. Practice exercises on Isometric Projections
16. Practice exercise on Isometric Projection of the 2-storage building.

Total Periods: 36

RESOURCES

TEXT BOOKS:

1. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, *Engineering Graphics with AutoCAD*, PHI Learning Private Limited, New Delhi, Revised edition, 2010. 2. 1.. 2.
2. N. D. Bhatt and V. M. Panchal, *Engineering Drawing*, Charotar Publishing House, Gujarat, 51st edition, 2013.

REFERENCE BOOKS/LABORATORY MANUALS:

1. Sham Tickoo, *AutoCAD 2013 for Engineers and Designers*, Dreamtech Press, 2013

2. M. H. Annaiah & Rajashekar Patil, *Computer Aided Engineering Drawing*, New Age International Publishers, 4th edition, 2012.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/112105294>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22AI105001	DESIGN THINKING	-	1	2	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands-on experience on design thinking process, evaluation of requirement specification and reflections on design experience. This course also focuses on demonstration of five phases of design thinking such as empathize, define, ideate, prototyping, testing and validation with design thinking tools and frameworks.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Investigate the requirements of a problem by conducting surveys.
- CO2.** Create meaningful and actionable problem statements for creative problem solving.
- CO3.** Construct blueprints to visualize user attitudes and behavior for gaining insights of customers.
- CO4.** Design prototypes of innovative products or services for a customer base.
- CO5.** Develop relevant products or services by choosing good design and applying empathy tools for experiencing user requirements.
- CO6.** Work independently and communicate effectively in oral and written forms.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	3	-	2	-	-	-	-	-	-	-	-
CO2	1	-	1	3	-	-	-	-	-	-	-	-
CO3	-	2		3	-	-	-	-	-	-	-	1
CO4	-	2	3	2	-	-	-	-	-	-	-	-
CO5	-	3	-	1	1	-	1	2	-	-	-	-
CO6	-	-	-	-	-	-	-	-	3	3	2	-
Course Correlation Mapping	1	3	2	3	1	-	1	2	3	3	2	1

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

Introduction to Design Thinking – Design thinking Process, Definition, Importance, Phases of Design Thinking, Canva Tool.

- 1 Conduct survey and identify the problem by either individual or group and frame a problem statement using AEIOU (Activities, Environment, Interactions, Objects, Users) framework.

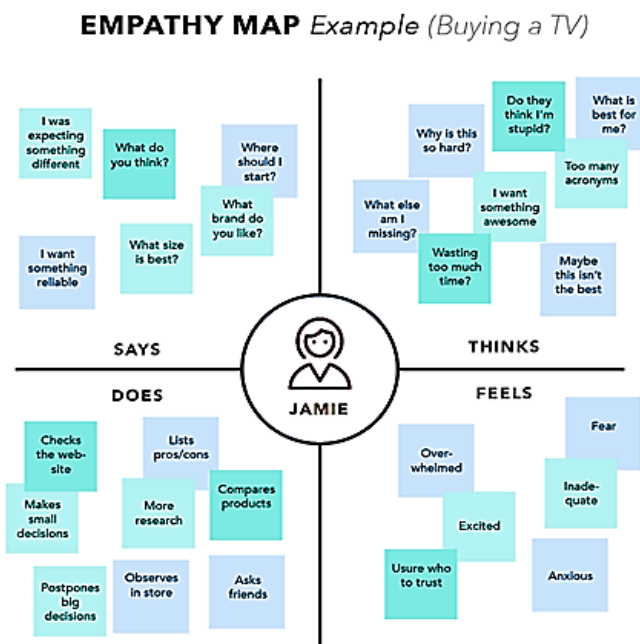
- Identify demographic or focus group for problem statement and create persona and explicitly define the characteristics of persona using Canva tool.

Empathize - Role of empathy in design thinking, Purpose of Empathy Map, Empathy Tools - Customer Journey Map, Personas, Coggle Tool.

- Build a Customer Journey Map (CJM-Before-During-After) and identify touch points for any mock scenario or persona created during last experiment and frame 2-3 questions using HMW (How Might We).

- Create an Empathy Map using Coggle design thinking tool.

Sample Empathy Map:

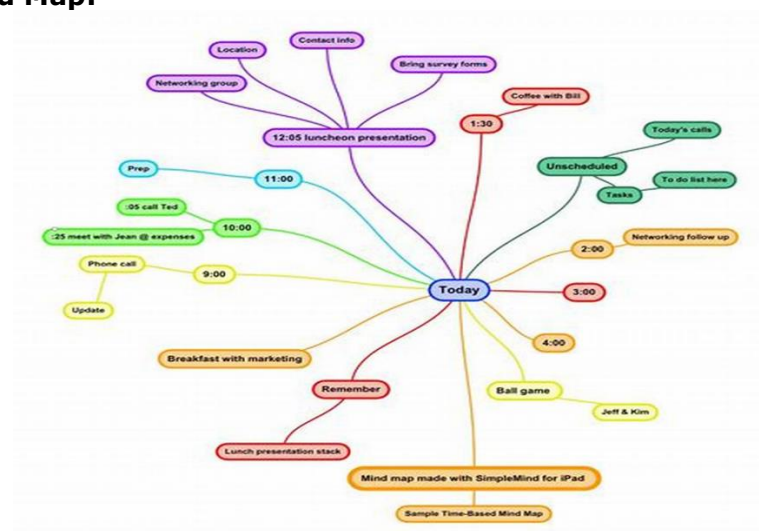


Ideation - Importance of visualizing and empathizing before ideating, Applying the method, Ideation Tools - Story board, Brainstorming, Mind Map, SCAMPER.

- Story boarding design ideas:** Consider a mock scenario and create user stories and storyboards to transform information about user needs into design concepts using any story board tool.

- Create Mind Map for your problem statement using Coggle.

Sample Mind Map:



- 7 Perform Brain Storming Session with your team and record using the SCAMPER framework and finalize the best three innovative ideas.



Prototyping and Testing – Definition, Prototype examples, Need for Prototyping, Fidelity for prototypes, Process of prototyping, Introduction to Marvel POP Software, Testing prototypes with users.

- 8 Create an application prototype for product recommendation using **Marvel POP Software**.
- 9 Create a **low-fidelity paper prototype** by sketching out the product design and adding relevant functionality.
- 10 Test the prototype created in Exercise 9 by interacting with each member of the team, walking them through the design and gathering feedback. Use feedback grid with the following quadrants: what worked, what could be improved, questions, and ideas.

What worked?	What could be improved?
Questions	Ideas

RESOURCES

REFERENCES:

1. Michael G. Luchs, Scott Swan , Abbie Griffin, *Design Thinking – New Product Essentials from PDMA*, Wiley, 2015.
2. Vijay Kumar, *101 Design Methods: A Structured Approach for Driving Innovation in Your Organization*, 2012.
3. Kathryn McElroy, *Prototyping for Designers: Developing the best Digital and Physical Products*, O'Reilly, 2017.
4. S.Salivahanan, S.Suresh Kumar, D.Praveen Sam, *Introduction to Design Thinking*, Tata McGraw Hill, 1st Edition, 2019.

SOFTWARE/TOOLS:

1. Canva (<https://www.canva.com/>)
2. Coggle (<https://coggle.it/>)
3. Marvel POP

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/109/104/109104109/>
2. <https://nptel.ac.in/courses/110106124/>

3. <https://www.youtube.com/watch?v=q654-kmF3Pc&t=0s>
4. <https://www.youtube.com/watch?v=TNAdanuvwtc>
5. <https://www.youtube.com/watch?v=U-hzefHdAMk>
6. <https://www.youtube.com/watch?v=zbLxs6te5to>

WEB RESOURCES:

- 1 <https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process>
- 2 <https://www.ibm.com/design/thinking/page/toolkit>
- 3 <https://www.interaction-design.org/literature/article/define-and-frame-your-design-challenge-by-creating-your-point-of-view-and-ask-how-might-we>
- 4 <https://www.culturepartnership.eu/en/article/ten-tools-for-design-thinking>
- 5 https://www.mindtools.com/pages/article/newCT_02.htm

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG102401	ENGLISH FOR PROFESSIONALS	2	-	2	-	3
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course deals with listening strategies, reading comprehension, grammar, vocabulary, pronunciation, Written, Verbal and Non-verbal communication, Channels of communication, Barriers to communication, Modes of technology-based communication, and Technical Communication.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the basics of Reading, Writing, Listening, and Speaking skills.
- CO2.** Analyze the rules of English grammar in speaking and writing.
- CO3.** Demonstrate knowledge of English pronunciation in speaking.
- CO4.** Apply the knowledge of reading strategies and vocabulary in communication.
- CO5.** Apply the strategies of writing in preparing a report.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	3	-	2
CO2	-	3	2	-	-	-	-	-	-	3	-	2
CO3	3	2	-	-	-	-	-	-	-	3	-	2
CO4	-	-	-	-	3	-	-	-	-	3	-	2
CO5	-	-	-	-	3	-	-	-	-	3	-	2
Course Correlation Mapping	3	2	2	-	3	-	-	-	-	3	-	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: SUPER HEROES – THE SCIENCE BEHIND SUPER HEROES **(06 Periods)**

Reading for Comprehension, Grammar, Speaking, Listening, Vocabulary, Writing, Verbal and Non-verbal communication.

Module 2: ALIENS – THE CYLINDER OPENS **(06 Periods)**

Reading for comprehension, Grammar, Vocabulary, Writing, Listening, and Channels of communication.

Module 3: INVENTORS – THE RAMAN EFFECT **(06 Periods)**

Reading comprehension, Listening, Writing, Grammar, Speaking, Pronunciation, and communication barriers.

Module 4: HEALTH AND NUTRITION – WHAT SHOULD YOU BE EATING (06 Periods)

Reading comprehension, Listening, Speaking, Grammar, Writing, Pronunciation, and Modes of technology-based communication.

Module 5: NEW-AGE ENTREPRENEURS – HOW A CHINESE BILLIONAIRE BUILT HER FORTUNE (06 Periods)

Reading comprehension, Vocabulary, Listening, Grammar, Writing, and Technical Communication

Total Periods: 30

EXPERIENTIAL LEARNING

PART-A

Any six modules among the following:

1. Conversation starters and role play
2. Reading comprehension
3. Listening comprehension
4. Vocabulary Building (business and job-related vocabulary)
5. Describing people, places, objects, and Events
6. Phonetics - Accent/ Rhythm/ Intonation
7. Tenses
8. Proposal Writing

PART-B

Any four modules among the following:

1. Communicating effectively is important to become successful in any business. Prepare a Case study of successful business personnel regarding communication competence.
2. Prepare a PowerPoint presentation on an orator and analyze the voice dynamics.
3. People face situations to convince or agree with the points they have. The college arranges a 5-day tour program to Goa. Prepare a video on persuasive talk and convince parents to get permission.
4. Write an article on the famous clichés of our time.
5. Prepare a poster on the effects of social media on youth.
6. Give a short talk on the importance of inventors and their role in present socio, political and economic changes.
7. Prepare a collage of entrepreneurs' pictures and their achievements.
8. NASA released recent photos of the universe with the help of the James Webb Space Telescope. Write down the expected impact on the existing theory on planets and the universe.
9. Obesity is the most common problem for people. List out the reasons for the problem and prepare food habits to overcome.

10. Epics of India deals with superheroes of those days. Compare the weapons used in the battles of Mahabharata with modern weapons.
11. Write a report on your recently invented product so that it should be sold as a hot cake in the market.
12. Illustrate the essential rules for good precis writing.

RESOURCES

TEXTBOOK:

N.P. Sudharshana & C.Savitha, "*English for Technical Communication*", Cambridge University Press. 2016.

REFERENCE BOOKS:

1. Kline, J. A. "*Speaking effectively: Achieving excellence in presentations. Upper Saddle River*", NJ: Pearson/Prentice Hall, 2004.
2. Kuiper, "S. *Contemporary business report writing*" (3rd ed.). Cincinnati, OH: Thomson/South, Western, 2007.
3. Locker, K. O. & Kaczmarek, "S. K. *Business communication*": Building critical skills (3rd ed.). New York: McGraw, Hill/Irwin, 2007.
4. Mascull, "B. *Business vocabulary in use: Advanced. Cambridge*": Cambridge University Press, 2004.
5. Matthews, C. B. & Matthews, and M. *Quick steps to winning business presentations: Make the most of your PowerPoint presentations*. New York: McGraw, Hill, 2007.
6. Marsh, C. *Strategic writing: Multimedia writing for public relations, advertising, sales and marketing, and business communication*. Boston: Pearson/Ally and Bacon, 2005.
7. Munter, M. & Russell, L. *Guide to presentations*. (2nd ed.). Upper Saddle River: NJ: Pearson/Prentice Hall, 2008.
8. Reardon, K. K. *The skilled negotiator: Mastering the language of engagement*. San Francisco: Jossey, Bass, 2004.
9. Stiff, J. B. *Persuasive communication* (2nd ed.). New York: Guilford Press. Engagement. San Francisco: Jossey, Bass, 2003.
10. Stiff, J. B. *Persuasive communication* (2nd ed.). New York: Guilford Press, 2003.

VIDEO LECTURES:

1. <https://learnenglish.britishcouncil.org/general/english/video/zone/the/day/elizabeth,became,queen>
2. <https://www.youtube.com/watch?v=CscHc8qSn1A>

WEB RESOURCES:

1. <https://galgotiacollege.edu/assets/pdfs/study,material/Notes,english.pdf>
2. <https://lecturenotes.in/subject/183>
3. <https://www.fluentu.com/blog/english/professional,english/>
4. <https://learnenglish.britishcouncil.org/business,english>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22LG105402	SOFT SKILLS	-	-	2	-	1
Pre-Requisite	-					
Anti-Requisite	-					
Co - Requisite	-					

COURSE DESCRIPTION: This course deals with an understanding of the fundamental soft skills and their practical social and workplace usage. It helps participants to communicate effectively and to carry themselves confidently and in harmony with their surroundings. They also learn how to identify and overcome the barriers in interpersonal relationships, and to employ oral and written communication, teamwork, leadership, problem-solving, and decision-making skills, to gain the best results.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate knowledge of career skills by analyzing the strategies of Goal Setting, Thinking Skills, interpersonal skills, and etiquette.
- CO2.** Analyze various situations by applying Assertive communication and Non-verbal forms in developing Interpersonal Skills.
- CO3.** Apply appropriate managerial strategies by analyzing the conflicts in various situations.
- CO4.** Demonstrate various communication styles by analyzing and applying Thinking Skills in diverse teams as an individual and a team member and during Interviews and Group Discussions.
- CO5.** Analyze and apply appropriate strategies of emotional intelligence and adaptability skills for personal and professional success.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	-	2	-	2	-	-	-	-	2
CO2	3	3	2	-	2	-	2	-	-	2	-	2
CO3	2	2	2	-	3	-	2	-	-	-	-	2
CO4	3	2	2	-	2	-	2	-	3	2	3	2
CO5	2	2	2	-	3	-	3	-	-	2	-	3
Course Correlation Mapping	3	2	2	-	3	-	2	-	3	2	3	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

***Any ten modules are mandatory among the following:**

Module 1: BODY LANGUAGE

Body language basics, Types of Body Language, Facial Expressions and their messages, Eye Contact Insights, Body Posture, Hand gestures, and finger movements

Module 2: ASSERTIVENESS

Communication Styles, Benefits, Asserting yourself, Tips, and Role Play

Module 3: GOALSETTING

Seven Steps of Goal Setting, Self-Motivation, Personal Goal Setting, and Setting Career Goals

Module 4: THINKING SKILLS

Positive Thinking, Creative Thinking, Lateral Thinking, Logical Thinking, and Intuitive Thinking

Module 5: TEAM BUILDING

Learning Activities, Management Essentials, and Team Building Scenarios

Module 6: CONFLICT MANAGEMENT

Ways of Resolving Conflict, Personality Types and Conflict, Conflict Resolution Process, and Team Conflict

Module 7: EMOTIONAL INTELLIGENCE

Definition, understanding emotions, Identifying emotional intelligence, and self-assessment

Module 8: ADAPTABILITY SKILLS

Understanding organizational communication, Identifying adaptability skills, and self-assessment.

Module 9: GROUP DISCUSSIONS

Types of GD, Dos, and Don'ts, Dynamics of GD, Intervention, and Summarization Techniques

Module 10: INTERVIEW SKILLS

Planning, Opening Strategies, Answering Strategies, Teleconferencing, Videoconferencing, Practice questions, and Dress code

Module 11: INTERPERSONAL SKILLS

Starting a Conversation, Responding to a Conversation, Conversation Examples, Body Language, and Role Play

Module 12: ETIQUETTE

Basic Social Etiquette, Telephone Etiquette, Dining Etiquette, Conference Etiquette, and Email Etiquette

RESOURCES**REFERENCES:**

1. Manual...
2. Dr. K. Alex, *Soft Skills*, S. Chand & Company LTD, Latest Edition, New Delhi, 2018.
3. R. C. Sharma & Krishna Mohan, *Business Correspondence and Report Writing*, Tata McGraw,Hill Publishing Company Limited, 3rd Edition, New Delhi, 2012.
4. S.P. Dhanavel, *English and Soft Skills*, Orient Black Swan Private Limited, 2010.

SOFTWARE/TOOLS:

1. K-VAN Solutions.
2. Learning to Speak English 8.1, The Learning Company, 4 CDs.
3. English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
4. Language in Use 1, 2 & 3.
5. Cambridge Advanced Learner's Dictionary, 3rd Edition.
6. Let's Talk English, Regional Institute of English South India

VIDEO LECTURES:

1. <http://nptel.ac.in/courses/106102064>
2. <http://nptel.ac.in/courses/106106127/>

WEB RESOURCES:

1. http://psydilab.univer.kharkov.ua/resources/ucheba/softskills/Chapter_1_Introduction.PDF
2. <https://learning.tcsionhub.in/courses/tcs,ion/introduction,to,soft,skills/>
3. <https://goo.gl/IaEHOY> (dealing with complaints)
4. <http://www.adm.uwaterloo.ca/infocecs/CRC/manual/resumes.html>
5. <https://goo.gl/FEMGXS>
6. <http://www.career.vt.edu/interviewing/TelephoneInterviews.html>
7. http://job,search,search.com/interviewing/behavioral_interviews
8. <https://www.thebalancecareers.com/what,are,soft,skills,2060852>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM101402	MULTIVARIABLE CALCULUS AND DIFFERENTIAL EQUATIONS	3	-	-	-	3
Pre-Requisite	--					
Anti-Requisite	--					
Co-Requisite	--					

COURSE DESCRIPTION: This course contains various topics related to the calculus of the functions of two or more variables and differential equations. In particular, this contains topics like differentiation and integration of the functions of several variables together with their applications. It includes calculus of vector functions with applications. The methods of solving ordinary and partial differential equations are also incorporated for a better exposure.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Determine the extreme values of functions of two variables.
- CO2.** Evaluate multiple integrals in Cartesian, Polar and Spherical coordinates.
- CO3.** Demonstrate gradient, directional derivative, divergence, curl and Green's, Gauss, Stoke's theorems.
- CO4.** Solve higher order linear differential equations related to various engineering fields.
- CO5.** Identify solution methods for partial differential equations that model physical processes.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	2	1	-	-	-	-	-	-	-
CO2	2	3	-	3	1	-	-	-	-	-	-	-
CO3	3	2	-	3	1	-	-	-	-	-	-	-
CO4	3	2	-	3	1	-	-	-	-	-	-	-
CO5	3	3	-	3	1	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	-	3	1	-	-	-	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: Multivariable Calculus (Differentiation) (07 Periods)

Introduction to function of several variables, Jacobian and its properties, Functional dependence, Maxima and minima of functions of two variables, Lagrange's multiplier method.

Module 2: Multivariable Calculus (Integration) (10 Periods)

Evaluation of Double integrals (Cartesian and Polar coordinates), Change of order of integration (Cartesian form only), Evaluation of triple integrals, Change of variables: Double integration from Cartesian to Polar coordinates, Triple integration from Cartesian to Spherical polar coordinates.

Module 3: Multivariable Calculus (Vector Calculus) (11 Periods)

Vector Differentiation: Scalar and Vector fields: Gradient of a scalar field, Directional derivative, Divergence of a vector field, Solenoidal vector, Curl of a vector field, Irrotational vector, Laplacian operator.

Vector Integration: Line, Surface and Volume integrals, Vector integral theorems: Statement of Green's, Stoke's and Gauss divergence theorems, Verification and evaluation of vector integrals using them.

Module 4: Ordinary Differential Equations (10 Periods)

Second and higher order linear differential equations with constant coefficients: Non-Homogeneous equations with R.H.S terms of the type e^{ax} , $\sin ax$, $\cos ax$, polynomials in x , $e^{ax} V(x)$ and $x^n V(x)$, Method of variation of parameters, Equations reducible to linear differential equations with constant coefficients: Cauchy-Euler and Cauchy-Legendre differential equations.

Module 5: Partial Differential Equations (07 Periods)

Formation of partial differential equations by the elimination of arbitrary constants and arbitrary functions, Lagrange's linear equation, Method of separation of variables.

Total Periods: 45

EXPERIENTIAL LEARNING

- 1 American Airlines requires that the total outside dimensions (length + width + height) of a checked bag not exceed 62 inches. Suppose you want to check a bag whose height is equal to its width. What is the largest volume bag of this shape that you can check on an American Airlines flight?
- 2 An insulated rod of length l has its ends A and B maintained at $0^\circ C$ and $100^\circ C$ respectively until steady state conditions prevail. If B is suddenly reduced to $0^\circ C$ and maintained at $0^\circ C$, establish an equation to find the temperature at a distance x from A at time t under the above conditions.
- 3 Apply the Gamma function; obtain the mass of an octant of the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$ with the density at any point being $\rho = kxyz$.
- 4 A person weighs 150lb walking exactly one revolution up a circular, spiral staircase of radius x ft. if the person rises 10ft then find the work done by the person. Consider different radii and find the work done by the person in each case.

(Note: It's an indicative one. The course instructor may change the activities and shall be reflected in the course handout.)

RESOURCES**TEXT BOOKS:**

1. B. S. Grewal, *Higher Engineering Mathematics*, Khanna publishers, 44th edition, 2017.
2. Erwin kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 10th edition, 2011.

REFERENCE BOOKS:

1. Dennis G. Zill and Warren S. Wright, *Advanced Engineering Mathematics*, Jones and Bartlett, 6th edition, 2011.
2. N.P. Bali and Manish Goyal, "A Text Book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/111107108>
2. <https://nptel.ac.in/courses/111106100>
3. <https://nptel.ac.in/courses/111103021>

WEB RESOURCES:

1. http://www.efunda.com/math/math_home/math.cfm
2. <http://www.sosmath.com/>
3. <http://www.mathworld.wolfram.com/>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM101404	TRANSFORM TECHNIQUES AND LINEAR ALGEBRA	3	-	-	-	3

Pre-Requisite -

Anti-Requisite Calculus and Transformation Techniques

Co-Requisite -

COURSE DESCRIPTION: This course focus on basic areas of theory and more advanced Engineering Mathematics topics which provide students with the relevant mathematical tools required in the analysis of problems in Engineering and scientific professions. This course includes Fourier series, Fourier Transforms, Laplace transforms, Inverse Laplace transform, solutions for linear systems, Eigen values and Eigen vectors, Linear transformation.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate Fourier series to study the behaviour of periodic functions and their applications and Fourier transform to connect the frequency and time domain systems.
- CO2.** Apply the techniques of Laplace transform to solve ordinary differential equations.
- CO3.** Make use of echelon forms in finding the solution of system of linear equations. Compute Eigen values and Eigen vectors of square matrices.
- CO4.** Use the fundamental concept of a basis for a subspace to give a precise definition of dimensions and rank, and to solve problems in appropriate situations.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	1	-	-	-	-	-	-	-
CO2	3	3	-	3	1	-	-	-	-	-	-	-
CO3	3	2	-	1	1	-	-	-	-	-	-	-
CO4	3	2	-	3	1	-	-	-	-	-	-	-
Course Correlation Mapping	3	3	-	2	1	-	-	-	-	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: FOURIER SERIES & FOURIER TRANSFORMS (09 Periods)

Introduction to Fourier series, Convergence of Fourier series (Dirichlet's conditions), Fourier series in $(-\pi, \pi)$, Half-range Fourier sine and cosine expansions in $(0, \pi)$, Fourier integral theorem (statement only), Fourier sine and cosine integrals; Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms.

Module 2: LAPLACE TRANSFORMS (09 Periods)

Definition of Laplace transforms, Existence conditions, Laplace transforms of standard functions, Properties of Laplace transforms (without proofs), Laplace transforms of derivatives, Laplace transforms of integrals, Multiplication by t^n , Division by t , Laplace transforms of periodic functions, Laplace transforms of unit step function and unit impulse function.

Module 3: INVERSE LAPLACE TRANSFORMS**(09 Periods)**

Inverse Laplace transforms by different methods, Convolution theorem (without proof), Inverse Laplace transforms by convolution theorem, Applications of Laplace transforms to ordinary differential equations of first and second order with constant coefficients.

Module 4: LINEAR ALGEBRA -MATRICES**(09 Periods)**

Rank of a matrix: Echelon form, Linear systems of equations: solving system of Homogeneous and Non-Homogeneous equations; Eigen values and Eigen vectors of a matrix and properties (without proofs), Diagonalization of a matrix by orthogonal transformation, Cayley-Hamilton Theorem.

Module 5: LINEAR ALGEBRA- VECTOR SPACES**(09 Periods)**

Vector spaces, Linear dependence and independence of vectors, Basis, Dimension, Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem (without proof).

Total Periods: 45**EXPERIENTIAL LEARNING**

- 1 A 100-gm mass is suspended from a spring with constant 50 N/m. It is set into motion by raising it 10 cm above its equilibrium position and giving it a velocity of 1 m/s downward. During the subsequent motion a damping force acts on the mass and the magnitude of this force is twice the velocity of the mass. If an impulse force of magnitude 2 N is applied vertically upward to the mass at $t = 3$ s, find the position of the mass for all time.
- 2 Develop a differential equation from an LRC circuit connected in series using Kirchoff Voltage law and then solve using Laplace transform. Analyze the result by using any technology.
- 3 Check that the complex numbers $\mathbb{C} = \{x + iy \mid i^2 = -1, x, y \in \mathbb{R}\}$, satisfy all of the conditions in the definition of vector space over \mathbb{C} . Make sure you state carefully what your rules for vector addition and scalar multiplication.
- 4 Let Breakfast consists of orange juice, cereal, and eggs with the following nutritional information:

	OJ	Cereal	Eggs
Protein	0%	10%	20%
Vitamin C	20%	15%	0%
Calories	100	120	100

If you must have 30% protein, 30% Vitamin C and 300 calories for your breakfast, How many servings of OJ, Cereal, and Eggs should you have?

(Note: It's an indicative one. The course instructor may change the activities and shall be reflected in the course handout.)

RESOURCES**TEXT BOOKS:**

1. B. S. Grewal, *Higher Engineering Mathematics*, Khanna publishers, 44th edition, 2017.
2. David Poole, *Linear Algebra: A Modern Introduction*, Brooks/Cole, 2nd edition, 2005.

REFERENCE BOOKS:

1. Erwin kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 10th edition, 2011.

2. Belkacem Said-Houari, *Linear Algebra*, Springer International publish, 2017.
3. Bernard Kolman and David, R. Hill, Introductory *Linear Algebra- An applied first course*, Pearson Education, 9th Edition, 2011.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/111106111>
2. <https://nptel.ac.in/courses/111106051>

WEB RESOURCES:

1. <https://www.coursera.org/learn/matrix-algebra-engineers>
2. <https://www-users.cse.umn.edu/~mille003/fouriertransform.pdf>
3. <https://nitkkr.ac.in/docs/12-%20Laplace%20Transforms%20and%20their%20Applications.pdf>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22MM102452	ENGINEERING PHYSICS	3	-	2	-	4
Pre-Requisite	--					
Anti-Requisite	--					
Co-Requisite	--					

COURSE DESCRIPTION: This course provides a complete discussion about the wave theory of light, propagation of electromagnetic waves on a dielectric medium, and behavior of various semiconducting materials in addition to that dielectric, magnetic, nanomaterials, and superconducting materials. This course also provides hands-on experience on the above concepts.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Apply the concepts of light waves to interpret the concepts of Interference, Diffraction, and Polarization.
- CO2.** Demonstrate the concepts of electromagnetic wave propagation in optical fibers.
- CO3.** Understand the basic concepts of semiconductors in the functioning of various optoelectronic devices.
- CO4.** Demonstrate the basic concepts of dielectric and magnetic properties in the behavior of the various dielectric polarizations and magnetic materials.
- CO5.** Analyze the concepts of superconductors and nanomaterials to familiarize their applications in emerging fields.
- CO6.** Work independently and in teams to solve problems with effective communications.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-		1	-	-	-	-	-
CO2	3	2	-	-	1	-	-	-	-	-	-	-
CO3	3	2	1	-	-	1	-	-	-	-	-	-
CO4	3	2	-	-	-	1	-	-	-	-	-	-
CO5	3	2	-	-	-	-	1	-	-	-	-	-
CO6	3	2	-	-	-	-	-	1	1	1		
Course Correlation Mapping	3	2	1	-	1	1	1	1	1	1	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: WAVE OPTICS (09 Periods)

Interference: Introduction- Interference in thin films (reflected light) - Newton's rings.

Diffraction: Fraunhofer diffraction - Single slit diffraction (qualitative) - Double slit diffraction (qualitative).

Polarization: Polarization by reflection and double refraction - Nicol's prism - Half wave and Quarter wave plate - Engineering applications of interference, diffraction, and polarization.

Module 2: ELECTROMAGNETIC WAVES AND FIBER OPTICS (09 Periods)

Electromagnetic Waves: Divergence, Curl of Electric and Magnetic Fields - Maxwell's Equations (qualitative).

Fiber Optics: Introduction to fiber optics - Total Internal Reflection - Critical angle of propagation - Acceptance angle, Acceptance cone - Numerical Aperture - V number (qualitative) - Classification of fibers based on Refractive index profile, modes - Applications of optical fiber - Fiber optic Sensors (temperature, displacement).

Module 3: SEMICONDUCTORS AND OPTOELECTRONIC DEVICES (10 Periods)

Semiconductors: Introduction - Intrinsic semiconductors - Density of electrons in intrinsic semiconductor - Intrinsic carrier concentration - Fermi energy - Extrinsic semiconductors - Density of charge carriers in Extrinsic semiconductors (qualitative) - Drift and Diffusion currents - Direct and Indirect band gap semiconductors - Hall effect - pn junction

Optoelectronic devices: Light Emitting Diode (LED) - Photodiode - Semiconductor diode laser.

Module 4: DIELECTRICS AND MAGNETIC MATERIALS (09 Periods)

Dielectric Materials: Introduction - Electric polarization - Types of polarizations (qualitative) - Frequency dependence of polarization - Lorentz (internal) field - Dielectric break down - Piezoelectricity - Applications of dielectrics.

Magnetic Materials: Introduction - Origin of magnetic moment - Classification of magnetic materials - Hysteresis loop - Soft and hard magnetic materials - Applications.

Module 5: SUPERCONDUCTORS AND NANOMATERIALS (08 Periods)

Superconductors: Introduction - Critical parameters of Superconductors - Meissner effect - Types of Superconductors - BCS Theory - Applications of Superconductors.

Nanomaterials: Basic principles of nanomaterials - Synthesis of nanomaterials by Ball Milling and Pulsed Laser Deposition (PLD) methods - Properties of nanomaterials - Applications of nanomaterials.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXPERIMENTS: (Minimum 10 experiments shall be conducted)

1. Find the thickness of a human hair using the interference technique.
2. Determination of the radius of curvature of the lens (or) wavelength of monochromatic source by forming Newton's ring.
3. Estimate the wavelength of a given laser source by using a diffraction grating.
4. Determination of the numerical aperture of a given optical fiber and hence estimate its acceptance angle.
5. Estimation of the number of charge carriers of a given semiconducting specimen by calculating Hall coefficients using the Hall apparatus.
6. Calculation of forward and reverse resistances of a p-n junction diode by studying I-V characteristic curves.
7. Prediction of the energy gap of a given semiconductor diode by varying the temperatures.
8. Estimation of threshold voltages of different LEDs by plotting I-V curves.
9. Study the characteristics of Photodiode by varying the intensity of light.
10. Estimation of the magnetic field along the axis of a circular coil carrying current using Stewart Gee's method.
11. Determination of wavelength of light by plane diffraction grating using spectrometer by minimum deviation method.
12. Determination of particle size using laser source with help of diffraction technique.

RESOURCES

TEXTBOOKS:

1. M.N. Avadhanulu, P.G.Kshirsagar, and T.V.S Arun Murthy, *A Textbook of Engineering Physics*, S. Chand Publications, 11th edition, 2019.
2. R.K. Gaur and S.L. Gupta, *Engineering Physics*, Dhanpat Rai Publications (P) Ltd, 2015.
3. P.K. Palaniswamy, *Engineering Physics*, Scitech Publications India Private Limited, 2nd edition, 2009.
4. Serway and Jewett, *Physics for Scientists and Engineers with Modern Physics*, 6th Edition, Thomson Brooks, 2007.

REFERENCE BOOKS:

1. K. Thyagarajan, *Engineering Physics*, McGraw-Hill Education (India) Pvt. Ltd, 2016.
2. V. Rajendran, *Engineering Physics*, Tata McGraw Hill Publications Ltd, 7th Edition, New Delhi, 2014.
3. N.K. Verma, *Physics for Engineers*, PHI Pvt. Ltd., 2014.

VIDEO LECTURES:

1. <https://archive.nptel.ac.in/courses/122/107/122107035>
2. <https://nptel.ac.in/courses/117102061>
3. <https://nptel.ac.in/courses/118104008>
4. <https://nptel.ac.in/courses/115107095>

WEB RESOURCES:

1. <http://www.freepdfbook.com/engineering-physics-mcgraw-hill/>
2. <https://quickstudyhelper.com/textbook-engineering-physics.html>
3. <https://salmanisaleh.files.wordpress.com/2019/02/physics-for-scientists-7th-ed.pdf>
4. https://www.researchgate.net/publication/344758634_Short_Notes_on_Engineering_Physics

MANDATORY COURSE

Course Code	Course Title	L	T	P	S	C
22LG107601	PROFESSIONAL ETHICS AND HUMAN VALUES	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course deals with personal conviction, and ethics and describes the accepted principles and standards of conduct regarding moral duties and virtues as applied to an organization. Codes of professional ethics guide the stakeholders of an organization about the desirable and undesirable acts related to the profession.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate the principles of ethics, professional values, and social responsibility.
- CO2.** Analyze the problems in the implementation of moral autonomy and use ethical theories in resolving moral dilemmas.
- CO3.** Develop suitable strategies to resolve problems that arise in practicing professional ethics and Industrial standards.
- CO4.** Function as a member, consultant, manager, advisor and leader in multi-disciplinary teams.
- CO5.** Provide solutions to complex problems associated with professional ethics using analysis and interpretation.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	2	2	2	2	-	-	-
CO2	2	3	2	-	2	2	2	2	2	-	-	-
CO3	2	-	3	-	2	2	2	2	2	-	-	-
CO4	2	-	-	-	-	2	2	2	2	-	3	-
CO5	2	2	3	2	-	3	2	2	2	-	-	-
Course Correlation Mapping	2	3	-	-	2	2	2	2	2	-	3	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: PROFESSIONAL ETHICS (06 Periods)

Scope and aim of ethics, Senses of ethics, Variety of moral issues, Types of inquiry, Moral dilemmas, Moral autonomy-Kohlberg's theory, Gilligan's theory, Consensus, and controversy.

Module 2: PROFESSIONAL IDEALS AND VIRTUES (06 Periods)

Theories on virtues and ideals, Professions, Professionalism, Characteristics, Expectations, Professional responsibility, Integrity, Self-respect, Sense of responsibility, Self-interest,

Customs and religion, Self-interest and ethical egoism, Customs and ethical relativism, Religion and divine command ethics, Use of ethical theories, Resolving moral dilemmas and moral leadership.

Module 3: SOCIAL EXPERIMENTATION (06 Periods)

Experimentation, Similarities to standard experiments, Learning from the past and knowledge gained, responsible experimenters, Conscientiousness, Moral autonomy and accountability, The challenger case, Codes of ethics and limitations, Industrial standards and Problems with the law of engineering.

Module 4: RESPONSIBILITIES AND RIGHTS (06 Periods)

Collegiality and loyalty, Respect for authority, Collective bargaining, Confidentiality, Conflict of interests, Occupational crime, Rights of engineers, Professional rights, Whistle-blowing, The BART case, Employee rights, and discrimination.

Module 5: HARMONY WITH PROFESSIONAL ETHICS (06 Periods)

Acceptance of human values; Ethical Human Conduct; Basis for Humanistic Education, Constitution, and Universal Order; Competence in professional ethics; Case studies: Holistic technologies, Management Models and Production Systems; Transition from the present state to Universal Human Order: socially and ecologically responsible engineers, technologists and managers - enriching institutions and organizations.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Demonstrate orally using your experiences of what is naturally acceptable in a relationship – Feeling of respect or disrespect and what is naturally acceptable is to nurture or exploit others.
2. Identify community partners and discuss with a community partner or organization. Prepare a report by identifying and analysing the issues or opportunities.
3. Field experiences may be directed to include a range of time-intensive endeavours that require varying levels of student interaction. Prepare a report on visiting a Juvenile home.
4. Students read a speech in the classroom by former United Nations Secretary-General Kofi Annan on human values.
5. Students are encouraged to bring a daily newspaper to class or to access any news related to the need for human values and note down the points.
6. Bring out the relevance of engineering ethics theory and practice with relevance to current trends.
7. Professional ideals and virtues are important to everyone. Prepare a case study on the professional ideals and virtue of any one of the famous sports personalities from India.
8. Compare the present to the past in engineering experimentations concerning the change in professionalism.
9. Make a study on occupational crime and the role of modern technology in finding solutions.
10. Prepare a case study on how to maintain harmony with different cultural people using professional ethics.

(Note: It's an indicative one. The course instructor may change the activities and shall be reflected in the course handout.)

RESOURCES

TEXTBOOKS:

1. Gaur R R, Sangal R & G P Bagaria, *Human Values and Professional Ethics*, Excel Books, New Delhi, 2010.

2. Govindarajan, M., Nata Govindarajan, M., Natarajan, S. and Senthilkumar, V. S., *Engineering Ethics*, Prentice Hall of India, 2004.
3. Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, Tata McGraw-Hill, 3rd Edition, 2007.

REFERENCE BOOKS:

1. S. Kannan and K. Srilakshmi, *Human Values and Professional Ethics*, Taxmann Allied Services Pvt Ltd., 2009.
2. Edmund G. Seebauer and Robert L. Barry, *Fundamental of Ethics for Scientists and Engineers*, Oxford University Press, 2001.
3. Charles F. Fledderman, *Engineering Ethics*, Pearson Education, 2nd Edition, 2004.
4. R. Subramanian, *Professional Ethics*, Oxford Higher Education, 2013.

VIDEO LECTURES:

1. https://www.youtube.com/watch?v=jfGIq_EiXzI
2. <https://www.youtube.com/watch?v=QFH0tH54oUc>
3. <https://www.youtube.com/watch?v=JJshY11nX14>
4. <https://www.youtube.com/watch?v=TyP09S0UEzA>
5. https://www.youtube.com/watch?v=0QMwjV_ZVtc

WEB RESOURCES:

1. <https://siiet.ac.in/wp-content/uploads/2020/09/7.1.10-professional-ethics-manual.pdf>
2. <https://soaneemrana.org/onewebmedia/Professional%20Ethics%20and%20Human%20Values%20by%20R.S%20NAAGARAZAN.pdf>
3. <https://india.oup.com/productPage/5591038/7421214/9780199475070>

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CE107601	ENVIRONMENTAL SCIENCE	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion on natural resources, ecosystems, biodiversity, environment pollution and control, social issues and environment, human population and environment.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze natural resources to solve complex environmental problems and natural resource management considering society, environment and sustainability.
- CO2.** Analyze ecosystems and biodiversity to solve complex environmental problems by following environmental ethics considering society, environment and sustainability besides communicating effectively in graphical form.
- CO3.** Analyze various types of pollution and their control measures to solve environmental problems through appropriate tools and techniques following latest developments considering society, ethics, environment and sustainability.
- CO4.** Analyze social issues and its impact on environment, environmental acts to solve complex environmental problems considering society, environment and sustainability besides communicating effectively in graphical form.
- CO5.** Analyze human population and its impact on environment to solve complex environmental problems through team work and using appropriate tools and techniques considering ethics, society, environment and sustainability.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	-	1	1	-	-	-	1	-
CO2	3	3	-	2	-	1	1	1	-	1	-	-
CO3	3	3	-	2	1	1	1	1	-	-	-	1
CO4	3	3	-	3	-	1	1	1	-	1	-	-
CO5	3	3	-	2	1	1	1	1	1	-	-	-
Course Correlation Mapping	3	3	-	3	1	1	1	1	1	1	1	1

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: NATURAL RESOURCES

(07 Periods)

Multidisciplinary nature of environment; Natural Resources: Renewable and non-renewable resources; Forest, Water, Mineral, Food and Energy resources -Causes, Effects, Remedies, Case studies; Role of an individual in conservation of natural resource and equitable use of resources for sustainable lifestyles.

Module 2: ECOSYSTEMS AND BIODIVERSITY**(07 Periods)**

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem - Producers, Consumers, Decomposers; Food chains, Food webs, Ecological pyramids - Types; Characteristic features, Structure and functions of forest ecosystem, Desert ecosystem, Aquatic ecosystem.

Biodiversity: Concept and value of biodiversity, Role of biodiversity in addressing new millennium challenges, Hot spots of biodiversity, Threats to biodiversity, Man-wild life conflicts, Endemic, Endangered and extinct species of India, Conservation of biodiversity - In-situ and ex-situ.

Module 3: ENVIRONMENTAL POLLUTION AND CONTROL**(06 Periods)**

Causes, Adverse effects and control measures of pollution - Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear pollution, Solid waste management - Urban waste, industrial waste; Latest developments in pollution control, Hazards and disaster management - Floods, Earthquakes, Tsunamis, Case studies.

Module 4: SOCIAL ISSUES AND THE ENVIRONMENT**(06 Periods)**

Sustainable development, Urban problems related to energy, Environmental ethics -Issues, Solutions; Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and case studies, Wasteland reclamation, Consumerism and waste products, Concept of green technologies, Environment justice: National Green Tribunal and its importance; Environment protection act, Air act, Water act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation, Public environmental awareness.

Module 5: HUMAN POPULATION AND THE ENVIRONMENT**(04 Periods)**

Population growth, Population characteristics and variation among nations, Population explosion, Family welfare programme, Environment and human health, Human rights, Value education, HIV/AIDS, Women and child welfare, Role of information technology in environment and human health; Case studies - Field Work/Assignment/Seminar on Environmental assets - Water bodies/Forest/Grassland/Hill/Mountain.

Total Periods: 30**EXPERIENTIAL LEARNING**

1. Visit a nearby villages and know the status of availability of local resources that can be improved through proper education.
2. Make an awareness program in the villages for the development of natural resources, ecosystems and biodiversity.
3. Prepare a document by visiting a local urban waste dumping yard near to the Tirupati city.
4. Visit a local village and find a barren land and make the land into a useful land by planting plants or providing the soil and fertilizers required to improve the soil.
5. Visit a local zoological park and identify the species variety and variability.

(Note: It's an indicative one. The course instructor may change the activities and shall be reflected in the course handout.)

RESOURCES

TEXT BOOKS:

1. Anubha Kaushik and Kaushik, C.P., *Perspectives in Environmental Studies*, New Age International (P) Ltd. Publications, 6th Edition, 2018.
2. Erach Barucha, *Environmental Studies*, Orient Blackswan, 3rd Edition, 2021.

REFERENCE BOOKS:

1. Cunningham, W. P. and Cunningham, M. A., *Principles of Environmental Science*, Tata McGraw-Hill Publishing Company, New Delhi, 8th Edition, 2016.
2. Benny Joseph, *Environmental Studies*, Tata McGraw-Hill, 2nd Edition, 2009.
3. Anji Reddy, M., *Text Book of Environmental Science and Technology*, BS Publications, Revised Edition, 2014.
4. Rajagopalan, R., *Environmental Studies*, Oxford University Press, 3rd Edition, 2015.

VIDEO LECTURES:

1. <http://nptel.ac.in/courses/109/104/109104047>
2. <https://www.youtube.com/watch?v=mIPBPG-5dUw>

WEB RESOURCES:

1. <https://nptel.ac.in/courses/122102006>
2. <https://www.flame.edu.in/academics/ug/program-structure/major-minor/courses/environmental-studies>
3. https://www.tutorialspoint.com/environmental_studies/environmental_studies_environment.htm

SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
22CE107603	RURAL TECHNOLOGY	2	-	-	-	2
Pre-Requisite	-					
Anti-Requisite	-					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion on technology for rural development, nonconventional energy, technologies for rural development, community development and its role in rural development.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Compare various technologies for rural development by solving rural problems through different schemes by considering ethics, society, environment and sustainability.
- CO2.** Analyze non-conventional energy sources using appropriate tools and techniques to solve rural energy problems considering society, environment and sustainability besides communicating effectively in graphical form.
- CO3.** Select appropriate technologies in different areas of rural development to solve rural issues following latest developments considering society, environment and sustainability.
- CO4.** Relate water conservation, health, safety and rural employment issues for community development to solve rural problems through appropriate technologies considering ethics, society, environment and sustainability.
- CO5.** Analyze the impact of IT, public and private partnership on rural development to solve complex rural problems using appropriate tools and techniques considering ethics, society, environment and sustainability.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	-	3	2	1	1	1	-	-	-	-
CO2	2	3	-	2	2	1	1	-	-	1	-	-
CO3	2	3	-	2	2	1	1	-	-	-	-	1
CO4	2	3	-	2	2	1	2	1	-	-	-	-
CO5	2	3	-	3	2	1	1	1		-	-	-
Course Correlation Mapping	2	3	-	3	2	1	2	1	-	1	-	1

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO RURAL DEVELOPMENT (06 Periods)

India - Technology and rural development, Pre and post-independence period, Rural India Life, Indian farmer, Role of science and technology in rural development, Rural technology and poverty eradication, Rural business hubs, Technology in improving rural infrastructure,

Various organizations related to innovation, Issues of technology transfer - CAPART, NABARD, CSIR, NIF.

Module 2: NON CONVENTIONAL ENERGY (06 Periods)

Definition of energy, Types of alternative sources of energy, Sources of non-conventional energy – Solar energy: Solar pump in agriculture, Solar dryer, Solar cooker, Solar heater; Biogas, Recycling and management, Wastes conservation, Assessment and production of biomass products and their utilization.

Module 3: TECHNOLOGIES FOR RURAL DEVELOPMENT (06 Periods)

Food and agro based technologies, Tissue culture, Nursery, Building and construction technologies, Cultivation and processing of economic plants, Cottage and social industries, Latest developments in rural technologies.

Module 4: COMMUNITY DEVELOPMENT (06 Periods)

Water conservation, Rain water Harvesting, Drinking water Standards and simple treatments used, Environment and Sanitation, Bio fertilizers, Medical and aromatic plants, Employment generating technologies – Apiculture, Pisciculture, Aquaculture.

Module 5: IT IN RURAL DEVELOPMENT (06 Periods)

Role of information technology (IT) in rural areas, Impact of IT in rural development, Need and necessity of technology, Corporate social responsibilities, Private sector participation (Activities in different spheres: Employment, Education, Health, Agriculture and service sectors) and Saansad Adarsh Gram Yojana (SAGY), Village adoption schemes.

Total Periods: 30

EXPERIENTIAL LEARNING

1. Visit a nearby village and know the status of small-scale industries which are implanted and to be established based on the availability of the local resources.
2. Visit a local village and make an awareness program on energy utilization using biomass products.
3. Make a awareness program in the villages for the rural development in terms of home-made products.
4. Construct rain water harvesting structures in nearby villages where water scarcity is more and prepare a document.
5. Develop a small IT application the village area which will be used for the growth of the village.

(Note: It's an indicative one. The course instructor may change the activities and shall be reflected in the course handout.)

RESOURCES

TEXT BOOKS:

1. Virdi, M. S., *Sustainable Rural Technologies*, Daya Publishing House, 2nd Edition 2018.
2. Prabhath, S. V. and P. Ch. Sita Devi, *Technology and Rural India*, Serials Publications, 1st Edition, 2012.

REFERENCE BOOKS:

1. Chakravarthy, R., and Murthy, P. R. S., *Information Technology and Rural Development*, Pacific Book International, 1st Edition, 2012.
2. Shivakanth Singh, *Rural Development Policies and Programmes*, Northern Book Centre, 1st Edition, 2002.

3. Katar Singh, and Anil Shishodia, *Rural Development: Principles, Policies, and Management*, SAGE Publications India Private Limited, 4th Edition, 2016.
4. Vinayak Reddy, A. and Yadagira Charyulu, M., *Rural Development in India: Policies & Initiatives*, New Century Publications, 1st Edition, 2008.

VIDEO LECTURES:

1. <http://nptel.ac.in/courses/109/104/109104047>
2. https://www.youtube.com/channel/UCEZxAQu3ZBuIN-pYMYO2i_A/videos
3. <https://www.youtube.com/watch?v=HnrIB-QmvlQ>

WEB RESOURCES:

1. en.wikibooks.org/wiki/Technologies_for_Rural_Development/Complete
2. <https://www.oecd-ilibrary.org/sites/ae6bf9cd-en/index.html?itemId=/content/component/ae6bf9cd-en>
3. <https://crdt.iitd.ac.in/>

MANDATORY COURSE

Course Code	Course Title	L	T	P	S	C
22LG107603	SPOKEN ENGLISH	-	1	2	-	2

Pre-Requisite --

Anti-Requisite --

Co-Requisite --

COURSE DESCRIPTION: This course deals with the development of fluency and intelligibility in spoken English. Through individual and group activities, students work on improving pronunciation, practicing conversation strategies, and delivering oral presentations.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate knowledge of functional English for effective communication.
- CO2.** Analyze different types of vocabulary for fluency in communication
- CO3.** Apply correct usage of English grammar in writing and speaking.
- CO4.** Apply speaking strategies in terms of usage of English with accuracy, appropriacy, and fluency.
- CO5.** Analyze techniques to use communication skills for effective presentation.

CO, PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	2	-	3	-	-	-
CO2	2	3	-	-	-	-	2	-	3	-	-	-
CO3	2	-	3	-	3	-	2	-	3	-	-	-
CO4	2	-	-	-	3	-	2	-	3	-	-	-
CO5	2	3	2	-	3	-	2	-	3	-	-	-
Course Correlation Mapping	2	3	-	-	3	-	2	-	3	-	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: FUNCTIONAL ENGLISH (06 Periods)

Concepts of Functional Spoken English, Self Introduction; Listening and Speaking: Do's and Don'ts; Expressions: Ability, Admiration, Agreement, Annoyance, Appreciation, Pleasure, Sarcasm, Satisfaction, Surprise, Approval, Certainty, Doubt, Gratitude, Possibility, Fear, Worry, Condolences; Asking for: Advice, Clarification, Direction, Information, Permission; Making: Predictions, recommendations

Module 2: VOCABULARY BUILDING (06 Periods)

Vocabulary for day-to-day conversations: Vegetables, Groceries, Fruits, Weather, Parts of a Human body, Dresses, Furniture; Relations: Birds, Cries of Animals, Food, Hospitality, Houses, Rooms, Tools, Airport, News Paper, Books, Gems, Corporate Vocabulary, Jobs, Occupations, Diseases; British and American spelling; Slang Words and Technical Jargons.

Module 3 FUNCTIONAL GRAMMAR - I**(06 Periods)**

English Grammar and the Indian Student, Parts of Speech, Verb forms: Tenses, Voice and Speech.

Module 4 FUNCTIONAL GRAMMAR -II**(06Periods)**

Universal Auxiliaries: Sentence Structure, WH Questions, framing of Questions with answers; Question Tags, Subject and verb agreement, Spotting Errors.

Module 5 COMMUNICATION SKILLS:**(06 Periods)**

Polite, Courteous and diplomatic expressions, Good manners and Etiquette, Conversation Techniques, Narrating Stories.

Total Periods: 30**EXPERIENTIAL LEARNING**

1. Critically analyse the value of Indian money and its impact on the common man and Prepare a PowerPoint Presentation.
2. Prepare a conversation between you and a sanitary officer regarding sanitary conditions in your locality.
3. The English Language has a rich vocabulary and it increases day by day. Present a seminar on the norms adhered to in adding new words and list out the words added in the last five years with their meaning.
4. Enact roleplays in different situations.
5. Participate in group discussions and debate on present issues
6. A conversation is an exchange of ideas, thoughts, and feelings between two or more persons. Explain it with suitable examples
7. Prepare a schedule and identify various committees to be formed for celebrating the Annual Day of a college and explain team involvement in the celebration.
8. Gather various ideas on discussing with parents the role of higher education and job opportunities.
9. Imagine you see a person wasting water. Write a dialogue objecting to such wastage of natural resources.
10. Since social media offers a wide reach easily, it becomes easier for bullies to spread gossip or issue threats. How do you think Cybercrime is a menace brought about by social media?

RESOURCES**TEXTBOOKS:**

1. L. Adinarayana and V. Prakasam, "*Spoken English*", Neelkamal Publications Pvt. Ltd., NewDelhi, 2008.
2. Ram Bhasker Raju, "*The Complete Book on Spoken English*" Goutham Buddha Publications, Hyderabad, 2002.

REFERENCE BOOKS:

1. Sabina Pillai, *Spoken English for my World*, Oxford University Press, New Delhi, 2016.
2. K. R. Lakshminarayanan, *Speak in English*, Scitech Publications, Chennai, 2009.

VIDEO LECTURES:

1. <https://www.britishcouncil.in/programmes/english-partnerships/state/skills-projects/AP-English-Skills>
2. <https://www.fluentu.com/blog/english/websites-to-learn-english/>

WEB RESOURCES:

1. https://study.sagepub.in/kakarla_fec
2. <https://www.theconfidentteacher.com/2018/04/five-useful-vocabulary-websites/>
3. <https://ling.sprachwiss.uni-konstanz.de/pages/home/lfg/resources.html>
4. <https://www.makeuseof.com/tag/improve-communication-skills-7-websites/>

MANDATORY COURSE

Course Code	Course Title	L	T	P	S	C
22LG107602	ESSENTIAL LIFE SKILLS FOR HOLISTIC DEVELOPMENT	2	-	-	-	2

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course deals with the enhancement of employability skills and maximizes the potential by introducing the principles that are for personal and professional success, and helping to apply them in their lives and careers.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Demonstrate life skills required in personal and professional life.
- CO2.** Analyse well-defined techniques to cope with emotions and stress.
- CO3.** Apply appropriate thinking and problem-solving methods to solve problems.
- CO4.** Function effectively in a team and as an individual.
- CO5.** Demonstrate the qualities of an effective leader.

CO-PO Mapping Table:

Course Outcomes	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	2	-	2	-	-	-
CO2	2	3	-	-	2	-	2	-	2	-	-	-
CO3	2	3	2	-	-	-	2	-	2	-	-	-
CO4	2	2	-	-	2	-	2	-	2	-	3	-
CO5	2	2	-	-	-	-	2	-	2	-	-	-
Course Correlation Mapping	2	3	2	-	2	-	2	-	2	-	3	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: OVERVIEW OF LIFE SKILLS (06 Periods)

Meaning and significance of life skills, Life skills identified by WHO: Self-awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem-solving, Effective Communication, interpersonal relationships, coping with stress, coping with emotion.

Ethics, Moral & Professional Values: Human Values, Civic Rights, Engineering Ethics, Engineering as Social Experimentation, Environmental Ethics, Global Issues, Code of Ethics like ASME, ASCE, IEEE.

Module 2: STRESS MANAGEMENT**(06 Periods)**

Stress Management: Stress, reasons, and effects, identifying stress, stress diaries, the four A's of stress management, techniques, **Approaches:** action-oriented, emotion-oriented, acceptance oriented, resilience, Gratitude Training, **Coping with emotions:** Identifying and managing emotions, harmful ways of dealing with emotions, PATH method, and relaxation techniques.

Module 3 TRANSFORMATIONAL SKILLS**(06 Periods)**

Creativity, Critical Thinking, Collaboration, Problem Solving, Decision Making, Need for Creativity in the 21st century, Imagination, Intuition, Experience, Sources of Creativity, Lateral Thinking, Myths of creativity, Critical thinking Vs Creative thinking, Functions of Left Brain & Right brain, Convergent & Divergent Thinking, Critical reading & Multiple Intelligence.

Module 4 GROUP AND TEAM DYNAMICS**(06 Periods)**

Introduction to Groups: formation of the group, thinking strategies, Clarifying expectations, Problem Solving, Consensus, Dynamic techniques, Group vs Team, Team Dynamics, and Virtual Teams. Managing team performance and managing conflicts, Intrapreneurship.

Module 5 LEADERSHIP**(06 Periods)**

Leadership framework, entrepreneurial and moral leadership, vision, cultural dimensions. Growing as a leader, managing diverse stakeholders, crisis management. Types of Leadership, Traits, Styles, VUCA Leadership, Levels of Leadership, Transactional vs Transformational Leaders, Leadership Grid, Effective Leaders.

Total Periods: 30**EXPERIENTIAL LEARNING**

1. Prepare an attitude test by making small groups in the class and measure the attitudes of students in your class.
2. Students are psychologically pressurized for qualifying in campus interviews. Prepare a Case study on the Campus Interview pressure and stress of students using SWOT analysis.
3. Record and prepare a video presentation on people of different cultures and make a comment on their accents.
4. The qualities of the leaders play an important role in their success. Prepare a short film about a leader and list out the best qualities.
5. In the present context, social media plays a vital role in the success of leaders and the wide spread of their principles. Prepare a presentation on the impact of social media on a success of a leader.
6. 'Knowledge of present technologies helps us to live a harmonious life.'
Make a video to justify the statement.
7. Prepare a PowerPoint presentation on life skills needed in our day-to-day life and their importance.
8. Every person wants to be successful in their personal and professional life and apply various strategies for that. List out the strategies to become successful in one's professional life.
9. A boy/girl who is a neighbour feels depressed for not being given with mobile for playing video games. Find methods and solutions to overcome the self-pity of the boy/girl.
10. Identify the persons who are irregular to class. Find out their problems and come up with solutions.

(Note: It's an indicative one. The course instructor may change the activities and shall be reflected in the course handout.)

RESOURCES

TEXTBOOK:

1. Dr.K Alex, *Soft Skills*. S Chand & Company Pvt.Ltd.2013
2. Monmohan Joshi, *Soft Skills*. Boolkboon.com, First Edition, 2017

REFERENCE BOOKS:

1. Aгна Fernandez, *Generic Skills for Employability*, Cambridge University Press, 2020.
2. Larry James, "*The First Book of Life Skills*"; First Edition; Embassy Books, 2016.
3. Shiv Khera, *You Can Win*, Macmillan Books, New York, 2003.
4. Barun K. Mitra, "*Personality Development & Soft Skills*", Oxford Publishers, Third impression, 2017.
5. ICT Academy of Kerala, "*Life Skills for Engineers*", McGraw Hill Education (India) Private Ltd., 2016.
6. David R. Caruso, "*The Emotionally Intelligent Manager How to Develop and Use the Four Key Emotional Skills of Leadership*", John Wiley & Sons, 2004.
7. Kalyana, "*Soft Skill for Managers*"; First Edition; Wiley Publishing Ltd, 2015.
8. Larry James, "*The First Book of Life Skills*"; First Edition, Embassy Books, 2016.
9. Shalini Verma, "*Development of Life Skills and Professional Practice*"; First Edition; Sultan Chand (G/L) & Company, 2014.
10. Daniel Goleman, "*Emotional Intelligence*"; Bantam, 2006.
11. Remesh S., Vishnu R.G., "*Life Skills for Engineers*", Ridhima Publications, First Edition, 2016.
12. Butterfield Jeff, "*Soft Skills for Everyone*", Cengage Learning India Pvt Ltd; 1 edition, 2011.
13. Training in Interpersonal Skills: *Tips for Managing People at Work*, Pearson Education, India; 6 edition, 2015.
14. The Ace of Soft Skills: *Attitude, Communication and Etiquette for Success*, Pearson Education; 1 edition, 2013.

VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=xM0fajUI7Bg>
2. <https://www.youtube.com/watch?v=HwLK9dBQn0g>
3. <https://www.youtube.com/watch?v=sxX5LoojdJw>
4. <https://www.youtube.com/watch?v=xJBgqW9-lzc>
5. <https://www.youtube.com/watch?v=QVwTVM1Iv1c>

WEB RESOURCES:

1. <https://www.clarke.edu/campus-life/health-wellness/counseling/articles-advice/developing-a-positive-attitude/>
2. <https://www.skillsyouneed.com/ps/personal-swot-analysis.html>
3. <https://ecampusontario.pressbooks.pub/profcommsontario/chapter/cross-cultural-communication/>

4. <https://thepeakperformancecenter.com/educational-learning/thinking/#:~:text=There%20are%20several%20core%20thinking,storing%20and%20then%20retrieving%20information.>
5. <https://www.webmd.com/anxiety-panic/guide/stage-fright-performance-anxiety>

MANDATORY COURSE

Course Code	Course Title	L	T	P	S	C
22EE107002	FUNDAMENTALS OF RESEARCH METHODOLOGY	2	-	-	-	2
Pre-Requisite	--					
Anti-Requisite	--					
Co-Requisite	--					

COURSE DESCRIPTION: The course is developed for the students' to understand the underlying concepts of research methodology and a systematic approach for carrying out research in the domain of interest. The course is emphasised on developing skills to recognise and reflect the strength and limitation of different types of research; data collection methods, methods of Processing and analysing data. The course also emphasises on interpreting the findings and research articulating skills.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understands the underlying concepts of research methodology, types of research and the systematic research process.
- CO2.** Understand the philosophy of research design, types of research design and develop skills for a good research design.
- CO3.** Understand the philosophy of formulation of research problem, methods of data collection, review of literature and formulation of working hypothesis.
- CO4.** Understand various data processing and analysing techniques and their significance in research.
- CO5.** Develop skills to interpret the findings and research articulating skills along with the ethics of research.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes											
	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO 12
CO1	3	--	--	--	--	-	--	--	--	--	--	--
CO2	3	--	1	--	--	-	--	--	--	--	--	--
CO3	3	--	--	--	2	1	-	--	--	--	--	--
CO4	3	2	--	--	3	1	--	--	--	--	--	--
CO5	3	--	--	--	--	--	--	--	3	3	--	--
Course Correlation Level	3	2	1	--	3	1	--	--	3	3	--	--

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO RESEARCH METHODOLOGY (06 Periods)

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process, Criteria of Good Research.

Module 2: RESEARCH DESIGN (06 Periods)

Research design—Basic Principles, Need of research design, Features of good design, Important concepts relating to research design, Different research designs, Basic principles of experimental designs, Developing a research plan.

Module 3: RESEARCH FORMULATION**(06 Periods)**

Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Data collection – Primary and secondary sources; Critical literature review – Identifying gap areas from literature review, Development of working hypothesis.

Module 4: PROCESSING AND ANALYSIS OF DATA**(06 Periods)**

Processing Operations, Elements/Types of Analysis, Statistics in Research, Measures of Central Tendency, Measures of Dispersion, Measures of Relationship, Simple Regression Analysis.

Module 5: INTERPRETATION AND REPORT WRITING**(06 Periods)**

Interpretation: Meaning of interpretation; Techniques of interpretation; Precautions in Interpretation.

Report Writing: Significance, Different Steps, Layout, Types of reports, Mechanics of Writing a Research Report, Precautions in Writing Reports.

Total Periods: 30**EXPERIENTIAL LEARNING**

1. Should conduct a survey based on a hypothesis, analyze the data collected and draw the inferences from the data.
2. Should review the literature on the given topic and should identify the scope/gaps in the literature and develop a research hypothesis.
3. Should study a case, formulate the hypothesis and identify an appropriate testing technique for the hypothesis.
4. Study an article and submit a report on the inferences and should interpret the findings of the article.

(Note: It's an indicative one. The course instructor may change the activities and shall be reflected in the course handout.)

RESOURCES**TEXT BOOKS:**

1. C.R. Kothari, *Research Methodology: Methods and Techniques*, New Age International Publishers, 2nd revised edition, New Delhi, 2004.
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. *An introduction to Research Methodology*, RBSA Publishers.

REFERENCE BOOKS:

1. R. Panneerselvam, *Research Methodology*, PHI learning Pvt. Ltd., 2009.
2. Singh, Yogesh Kumar. *Fundamental of research methodology and statistics*. New Age International, 2006.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/121106007>
2. https://onlinecourses.nptel.ac.in/noc22_ge08/preview
3. <https://www.youtube.com/watch?v=VK-rnA3-41c>

WEB RESOURCES:

1. <https://www.scribbr.com/category/methodology/>
2. <https://leverageedu.com/blog/research-design/>
3. <https://prothesiswriter.com/blog/how-to-formulate-research-problem>
4. <https://www.formpl.us/blog/hypothesis-testing>
5. <https://www.datapine.com/blog/data-interpretation-methods-benefits-problems/>
6. <https://leverageedu.com/blog/report-writing/>

MANDATORY COURSE

Course Code	Course Title	L	T	P	S	C
22EE107001	INTELLECTUAL PROPERTY RIGHTS	2	-	-	-	2
Pre-Requisite	--					
Anti-Requisite	--					
Co-Requisite	--					

COURSE DESCRIPTION:

The course is designed to provide comprehensive knowledge to the students regarding the general principles of intellectual property rights, Concept and Theories, Criticisms of Intellectual Property Rights, International Regime Relating to IPR. The course provides an awareness on how to protect ones unique creation, claim ownership, knowledge of what falls under the purview of someone's rights and what doesn't, and safeguard their creations and gain a competitive edge over the peers.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the need and the concepts of intellectual property right and avenues for filling intellectual property rights.
- CO2.** Understand the legislative practices and protocols for acquisition of trademark and the judicial consequences for violating laws of trademark protection.
- CO3.** Understand the legislative practices and protocols for acquisition of copyrights and the judicial consequences for violating laws of copyrights protection.
- CO4.** Understand the fundamentals of patent laws, legislative practices and protocols for acquisition of trade secrets and the judicial consequences for violating laws of trade secrets protection.
- CO5.** Understand the importance of geographical indications and various laws and protocols for protecting geographical indications.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	3	--	--	--	--	--	--	--	--	--	--	2
C02	3	--	--	--	1	--	--	3	--	--	--	2
C03	3	--	--	--	1	--	--	3	--	--	--	2
C04	3	--	--	--	1	--	--	3	--	--	--	2
C05	3	--	--	--	1	--	--	3	--	--	--	2
Course Correlati on Level	3	--	--	--	1	--	--	3	--	--	--	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (06 Periods)

Introduction and the need for intellectual property rights (IPR); types of intellectual property- Design; International organizations, agencies and treaties.

Module 2: TRADEMARKS (06 Periods)

Introduction to trademark, Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating trade mark, trade mark registration processes.

Module 3: LAW OF COPYRIGHTS**(06 Periods)**

Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

Module 4: TRADE SECRETS**(06 Periods)**

Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

Module 5: GEOGRAPHICAL INDICATIONS**(06 Periods)**

The Geographical indications law in India, The objectives and features, the registry of geographical indications powers and functions. Types of goods offered. Protection: Agriculture goods, manufactured goods and natural goods. Registration of indications and the requirements. Prohibition of misleading use of indications of geographical origins, prohibition of dilution of geographical origins.

Total Periods: 30**EXPERIENTIAL LEARNING**

1. Should conduct a survey based on the real scenario, where IPR is misused or unethically used and present an article.
2. Prepare an article on the registration processes of IPR practically (copy right/trade mark/ patents).
3. Should study a case of conflict on trademarks/patents and should produce an article mentioning the circumstances and remedial measures.
4. Prepare an article on the latest development in the international intellectual property rights.

(Note: It's an indicative one. The course instructor may change the activities and shall be reflected in the course handout.)

RESOURCES**TEXT BOOKS:**

1. Deborah, E. Bouchoux, *Intellectual property: The law of Trademarks, Copyright, Patents, and Trade Secrets*, Cengage learning, 4th Edition, 2013.
2. Prabuddha Ganguli, *Intellectual property right - Unleashing the knowledge economy*, Tata McGraw Hill Publishing Company Ltd.
3. Marsha AEchols; *Geographical Indications for Food Products*, , Wolters, 2008

REFERENCE BOOKS:

1. Neeraj P., & Khusdeep D. *Intellectual Property Rights*. India, IN: PHI learning Private Limited. 1st Edition 2019.
2. Nithyananda, K V. *Intellectual Property Rights: Protection and Management*. India, IN: Cengage Learning India Private Limited. 2019

VIDEO LECTURES:

<https://nptel.ac.in/courses/110105139>

WEB RESOURCES:

1. Subramanian, N., & Sundararaman, M. (2018). *Intellectual Property Rights – An Overview*. Retrieved from <http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf>
2. World Intellectual Property Organisation. (2004). *WIPO Intellectual property Handbook*. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf
3. Cell for IPR Promotion and Management (<http://cipam.gov.in/>)
4. World Intellectual Property Organisation (<https://www.wipo.int/about-ip/en/>)
5. Office of the Controller General of Patents, Designs & Trademarks (<http://www.ipindia.nic.in/>)

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22EE102001	ELECTRICAL CIRCUITS	3	-	2	-	4
Pre-Requisite	--					
Anti-Requisite	Fundamentals of Electrical Engineering; Network Analysis; Basic Electrical and Electronics Engineering.					
Co-Requisite	--					

COURSE DESCRIPTION: This course is designed to provide a complete overview of electric circuit analysis and hands-on experience for electrical and electronics engineering graduates. The course provides a deep insight about the various concepts such as network reduction techniques, analysis methods of DC and AC circuits, and magnetic circuits. The course has a huge scope in various competitive exams and provides foundations for subsequent electrical and electronics engineering courses.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Analyze the electrical circuits by applying the principles of network reduction techniques, mesh and nodal analysis.
- CO2.** Analyze the single phase circuits to investigate the response and to determine various electrical quantities.
- CO3.** Analyze various electrical circuits, by applying circuit theorems and determine various electrical quantities.
- CO4.** Analyze 3-phase circuits, to determine various electrical quantities and assert the relation between the circuit variables.
- CO5.** Analyze magnetic circuits, coupled circuits by applying the principles of electromagnetism and determine various parameters.
- CO6.** Work independently or in teams to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO 1	PSO2	PSO3
CO1	3	3	--	1	2	1	--	--	--	--	--	--	3	--	3
CO2	3	3	2	1	--	1	--	--	--	--	--	--	3	--	3
CO3	3	3	--	1	3	1	1	--	--	--	--	--	3	--	3
CO4	3	3	--	1	2	2	--	--	--	--	--	--	3	--	3
CO5	3	3	--	1	2	2	--	--	--	--	--	--	3	--	3
CO6	--	--	--	--	--	--	--	--	3	3	--	--	--	--	--
Course Correlation Level	3	3	2	1	2	1	1	--	3	3	--	--	3	--	3

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: FUNDAMENTALS OF ELECTRIC CIRCUITS

(12 Periods)

Classification of network elements; Voltage-Current relations for passive elements; Network reduction techniques-series, parallel, series-parallel circuits, current and voltage division rules; source transformation, wye-to-delta and delta-to-wye transformations; nodal analysis and

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super node concept, mesh analysis and super mesh concept with dependent and independent sources.

Module 2: ANALYSIS OF SINGLE PHASE AC CIRCUITS (10 Periods)

Peak factor and form factor for different wave forms; Analysis of single phase AC circuits: impedance and admittance, impedance triangle; Power triangle; Sinusoidal response of R, L and C elements with different combinations; Resonance, bandwidth and quality factor for series and parallel networks.

Module 3: CIRCUIT THEOREMS (09 Periods)

Superposition, Thevenin's, Norton's, Maximum power transfer, Millmann's, Telligen's and Reciprocity theorems for DC & AC Excitations (without proof).

Module 4: POLY-PHASE CIRCUITS (07 Periods)

Advantages of poly-phase system; Analysis of three phase balanced and unbalanced systems; Measurement of active and reactive power in balanced and unbalanced systems-single wattmeter and two wattmeter methods.

Module 5: MAGNETIC AND COUPLED CIRCUITS (07 Periods)

Coupled circuits-self and mutual inductance, coefficient of coupling, DOT convention; series and parallel connection of coupled coils, equivalent circuits of coupled coils. Magnetic Circuits – Series and Parallel; Analogy between electrical and magnetic circuits.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

Pre-Lab: *Demonstration of bread board connections, component identification, Meters for measurement of electrical quantities, Types of sources available, function generator, CROs.*

1. Verification of Mesh and Nodal Analysis.
2. Measurement of power and power factor in a single phase ac series inductive circuit and improvement of power factor using capacitor.
3. Development of Locus diagram for RL and RC circuits.
4. Design a resonant circuits to select or reject the specified range of frequencies.
5. Verification of Superposition theorem.
6. Verification of Thevinan's and Nortorn's theorem.
7. Verification of Maximum power transfer theorem for DC and AC excitations.
8. Verification of Reciprocity theorem for DC and AC excitations.
9. Measurement of active and reactive power in a three phase load using two wattmeter method and determination of load power factor.
10. Measurement of reactive power using single wattmeter in a three phase load.
11. Determination of coefficient of coupling in a coupled circuit.
12. Determination of equivalent inductance for aiding and opposing fluxes.

RESOURCES

TEXT BOOKS:

1. Charles K. Alexander, Mathew N O Sadiku, *Fundamentals of Electric Circuits*, 5th edition, McGraw Hill Education (India) Private Limited, New Delhi, 2013.
2. A. Sudhakar, Shyammoohan S Palli, *Circuits and Networks Analysis and Synthesis*, 5th edition, McGraw Hill Education (India) Private Limited, New Delhi, 2015

REFERENCE BOOKS:

1. J.A.Edminister, M.D.Nahvi, *Theory and Problems of Electric Circuits*, 4th edition, Schaum's outline series, McGraw Hill, New Delhi, 2004.
2. W H Hayt, J E Kemmerly, S M Durbin, *Engineering Circuit Analysis*, 6th edition, McGraw Hill, New Delhi, 2008.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/117106108/>
2. <https://nptel.ac.in/courses/108105159>

WEB RESOURCES:

1. <https://www.electrical4u.com/electric-circuit-or-electrical-network/>
2. <https://www.electronicshub.org/dc-circuits-basics/>
3. <https://www.engineeringenotes.com/electrical-engineering/circuits/single-phase-ac-circuit-with-diagram-electrical-engineering/27590>
4. <https://electrical-engineering-portal.com/resources/knowledge/theorems-and-laws>
5. <https://circuitglobe.com/what-is-a-polyphase-system.html>
6. <https://khitguntur.ac.in/shmat/NA%20Unit-III%20Coupled%20Circuits.pdf>

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22EC102001	SEMICONDUCTOR DEVICES & CIRCUITS	3	-	2	-	4

Pre-Requisite -

Anti-Requisite -

Co-Requisite -

COURSE DESCRIPTION: This course provides a detailed discussion and hands on experience on semiconductor devices like transistors, MOSFETs and their applications like amplifiers and oscillators.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Understand the operation of various semiconductor diodes.
- CO2.** Analyze the applications of semiconductor diodes.
- CO3.** Analyze various configurations and biasing techniques for BJT and FET.
- CO4.** Design various Oscillators for desired specifications.
- CO5.** Work independently and in teams to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	1	-	-	-	-	3	-	-
CO2	3	3	1	1	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-	3	-	-
CO4	3	3	3	1	-	-	-	-	-	-	-	-	3	-	-
CO5	-	-	-	-	-	-	-	-	3	3	-	-	3	-	-
Course Correlation Mapping	3	3	2	1	-	-	-	1	3	3	-	-	3	-	-

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: SEMICONDUCTOR DIODES **(08 Periods)**

Introduction, Semiconductor diodes, ideal versus practical diodes, resistance levels, Diode equivalent circuits, transition and diffusion capacitance, reverse recovery time, diode specification sheet, zener diode, Light Emitting diode, Tunnel diode, schottky diode, varicap diode.

Module 2: DIODE CIRCUITS **(10 Periods)**

Introduction, Series Diode configuration, Parallel and series-parallel configurations, Half-wave & Full wave rectifier, Clippers, Clampers, Zener Diode as voltage regulator, Problems.

Module 3: BIPOLAR JUNCTION TRANSISTOR **(10 Periods)**

Introduction, Transistor construction, Operation, Common-base configuration, Transistor as an amplifier, Common-Emitter configuration, Common collector configuration, Operating point, Fixed

biased configuration, Emitter-bias configuration, Voltage divider bias configuration, Collector feedback configuration, compensation Techniques, Problems.

Module 4: FIELD-EFFECT TRANSISTORS

(10 Periods)

JFET -construction, operation and characteristics, MOSFET - Device Structure and Physical Operation, Current-Voltage Characteristics, The MOSFET as an Amplifier and as a Switch, Biasing in MOS Amplifier Circuits, Small-Signal Operation and Models, The Depletion-Type MOSFET.

Module 5: OSCILLATORS

(07 Periods)

Introduction, Feedback Oscillators, Oscillation with RC Feedback Circuits, Wien Bridge Oscillator, Phase Shift Oscillator, Oscillation with LC Feedback Circuits, crystal oscillator.

Total Periods: 45

EXPERIENTIAL LEARNING

LIST OF EXERCISES:

1. Verification of switching action of a PN junction diode with V-I characteristics.
2. Rectify the AC signal and then to find out Ripple factor and percentage of Regulation in Half wave/Full wave rectifier with and without Capacitor filter.
3. Verify input and output characteristics of transistor in common base and common emitter configurations.
4. Study and draw the Drain and Transfer Characteristics of a JFET.
5. Design and analyze any biasing circuit using BJT.
6. Study the characteristics of an emitter follower circuit.
7. Design RC integrator and differentiator and determine their response to the square input.
8. Develop clipper circuit to clip positive and negative portions of the input waveform with two reference voltages.
9. Develop clamping circuits to clamp different positive and negative dc levels of the input signal.
10. Design and Verification of RC and LC Oscillators.
11. Study and experimental verification of MOSFET Transfer characteristics (with depletion and enhancement mode)

RESOURCES

TEXT BOOKS:

1. Millman & Halkias, *"Integrated Electronics"*, McGraw Hill Publications, 1992.
2. Boylestad & Nashlesky, *"Electronic Devices & Circuit Theory"*, PHI, 10th Edition.
3. Albert Malvino & David J. Bates, *"Electronic Principles"*, Tata McGraw Hill, 7th Edition 2007.

REFERENCE BOOKS:

1. Sedra, Smith, *'Microelectronic Circuits'*, Oxford University Press, 5th Edition, 2004.

2. David A.Bell, "*Electronic Devices and Circuits*", Prentice Hall of India Private Limited, New Delhi, 2007.
3. Paul Horowitz and Winfield Hill, '*The art of electronics*', Cambridge university press, 3rd Edition, 2011.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/108108112>
2. <https://www.coursera.org/specializations/semiconductor-devices>

WEB RESOURCES:

1. www.electronic_circuits.com
2. www.circuitstoday.com

PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
22EC102010	DIGITAL DESIGN	3	-	2	-	4
Pre-Requisite	-					
Anti-Requisite	Digital Logic Design					
Co-Requisite	-					

COURSE DESCRIPTION: This course provides a detailed discussion and hands on experience on Number systems, Boolean algebra, Minimization of Boolean functions, Analysis and synthesis of digital circuits; Asynchronous Sequential Logic & Programmable Memories.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1.** Design logical circuits by analyzing various Boolean functions and simplification methods to perform desired logical operations using logical gates.
- CO2.** Design combinational logical circuits for performing various arithmetic operations and data encoding and decoding in various data lines.
- CO3.** Analyze various sequential circuits for realizing counters and registers using flip-flops
- CO4.** Design Asynchronous sequential logic and programmable memories for societal needs.
- CO5.** Work independently and in teams to solve problems with effective communication.

CO-PO-PSO Mapping Table:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	2	3	1	-	1	1	-	-	-	-	-	3	-	3
CO3	3	2	3	1	-	1	1	-	-	-	-	-	3	-	3
CO4	3	2	3	1	-	1	1	-	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	-	3	3	-	-	3	-	3
Course Correlation Mapping	3	2	3	1	-	1	1	-	3	3	-	-	3	-	3

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: NUMBER SYSTEMS AND BOOLEAN ALGEBRA **(10 Periods)**

Digital systems, Binary Numbers, Number base conversions, Complements of numbers, Binary codes, Error detection and correction codes. Boolean Algebra-Basic definition, Basic theorems and properties, Boolean Functions, Canonical & Standard forms, logic operations & Logic gates.

Module 2: GATE LEVEL MINIMIZATION **(08 Periods)**

The map method, four variable, Five variable K-map, POS & SOP Simplification, Don't care conditions, NAND & NOR Implementation, Tabular Method- Simplification of Boolean function.

Module 3: COMBINATIONAL LOGIC CIRCUIT DESIGN**(09 Periods)**

Combinational circuits, Adders, Subtractors, Binary Adder-Subtractor, Decimal Adder, carry look-a-head adder, Binary Multiplier, Magnitude comparator, Decoder, Encoders, Priority Encoder, Multiplexers.

Module 4: SEQUENTIAL LOGIC CIRCUIT DESIGN**(10 Periods)**

Sequential Circuits, Latches, Flip-Flops-SR, D, JK & T, Introduction to Registers-Universal Shift Registers, State table and state diagrams, State Reduction & Assignment, Sequence Detector, Design of counters-Modulo-n, Johnson, Ring, Up/Down.

Module 5: ASYNCHRONOUS SEQUENTIAL LOGIC & PROGRAMMABLE MEMORIES**(08 Periods)**

Introduction, Analysis procedure, Design Procedure-Primitive Flow Table, Reduction of State and Flow Tables-Implication Table and Implied States, Hazards.

Programmable Memories: ROM, PLA, PAL.

Total Periods: 45**EXPERIENTIAL LEARNING****LIST OF EXERCISES:****Part-A: Simulation using any EDA tool**

(Minimum **Ten** Experiments are to be conducted)

1. Minimization of logic circuits using K-Map.
2. Design of half adder & subtractor and full adder & subtractor.
3. Design of 4 bit
 - a. binary adder and
 - b. binary adder-subtractor
4. Design of 3 bit Magnitude comparator.
5. Design of BCD Adder
6. Design of 3 to 8 decoder & 8 to 3 encoder for an engineering application.
7. Design of 16 to 1 multiplexer using two 8 to 1 multiplexer.
8. Design of BCD to seven segment decoder.
9. Design SR, JK, T and D Flip-flops using logic gates.
10. Design of Universal Shift Register circuit.
11. Design and implementation of 3-bit synchronous up/down counter.
12. Design a ring counter using flip flops.

RESOURCES**TEXT BOOKS:**

1. M. Morris Mano, *Digital Design*, Pearson education, 5th Edition, 2013.
2. Charles H. Roth, *Fundamentals of Logic Design*, Thomson Publications, 5th Edition, 2004.

REFERENCE BOOKS:

1. A. Anand Kumar, *Switching Theory and Logic Design*, PHI Learning Private Limited, 3rd Edition, India, 2017.
2. ZviKohavi and NirahK.Jha, *Switching theory and Finite Automata Theory*, Tata McGraw-Hill, 2nd Edition, 1978.

SOFTWARE/TOOLS:

Digital Schematic tool (DSCH2)

VIDEO LECTURES:

1. https://onlinecourses.nptel.ac.in/noc21_ee75/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs63/preview

WEB RESOURCES:

1. <https://www.digitalelectronicsdeeds.com/>
2. https://www.tutorialspoint.com/digital_circuits/digital_circuits_useful_resources.htm

PROGRAM ELECTIVE

Course Code	Course Title	L	T	P	S	C
22EE101019	GENERATION OF ELECTRICAL POWER	3	-	-	-	3
Pre-Requisite	--					
Anti-Requisite	--					
Co-Requisite	--					

COURSE DESCRIPTION:

This course is an introductory course in the field of electric power systems. The course is emphasised on the various conventional base load generation plants such as hydro, thermal and nuclear power plants, and peak load power plants such as pumped storage, gas fired and diesel power plants. The course also emphasis on the economics of power generation, tariffs and power factor improvement aspects.

COURSE OUTCOMES: *After successful completion of the course, students will be able to:*

- CO1.** Understand the operational aspects of hydro, thermal power plants and their impacts on environment.
- CO2.** Understand the operational aspects of Nuclear power plants and their impacts on environment.
- CO3.** Understand the operational aspects of peak load power plants and their impacts on environment.
- CO4.** Understand the concepts of cogeneration and aspects of power factor and improvement of power factor for sustainable operation.
- CO5.** Understand the economics of power generation and determine the various factors of power generation and various methods of tariffs.

CO-PO-PSO Mapping Table:

Course Outcome	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	--	--	--	--	1	2	--	--	--	--	--	--	3	--
CO2	3	--	--	--	--	1	2	--	--	--	--	--	--	3	--
CO3	3	--	--	--	--	1	2	--	--	--	--	--	--	3	--
CO4	3	2	1	1	1	1	2	--	--	--	3	--	1	3	2
CO5	3	2	--	1	1	1	2	--	--	--	3	--	1	3	2
Course Correlati on Level	3	2	1	1	1	1	2	--	--	--	3	--	3	3	2

Correlation Levels: **3: High;** **2: Medium;** **1: Low**

COURSE CONTENT

Module 1: HYDRO POWER AND THERMAL POWER GENERATION (10 Periods)

Energy sources and their availability in India; Concept of grid—typical layout of power system.

Hydro power plant: Selection of site for hydroelectric power station, layout and classification of hydroelectric power station, available hydro power and mass curve.

Steam power plant: Layout of steam power plant -fuel handling, combustion equipment for steam boilers, fluidized bed combustion, ash handling, dust collectors, boilers, condenser, chimney and cooling towers.

Environmental impacts: effects of hydro-electric projects; GHG emission and its effects on environment.

Module 2: NUCLEAR POWER GENERATION

(06 Periods)

Nuclear power stations: Nuclear fission, chain reaction, site selection, layout of nuclear power station, nuclear reactors classification, components, PWR, BWR and breeder reactor; Safety of nuclear power reactor.

Environmental impacts: Atmospheric pollution, disposal of nuclear waste.

Module 3: PEAK LOAD POWER PLANTS

(08 Periods)

Hydro power plant: Concept of pumped storage plants, Operation; Introduction to the concept of distributed generation.

Diesel engine power plant: Introduction, applications, site selection, classification of internal combustion engines, essential components and operation of diesel power plant.

Gas turbine power plant: Gas turbines, site selection, simple gas turbine plant, energy cycle, layout and essential components of gas turbine power plant.

Environmental impacts: Atmospheric pollution.

Module 4: COGENERATION AND POWER FACTOR CORRECTION

(11 Periods)

Cogeneration- Electricity generating systems, Economic benefits, Environmental benefits. Operation modes of cogeneration systems, Factors to consider, project risks, cogeneration usage in different places, Practical aspects of installing a cogeneration plant.

Power factor correction: Causes of low power factor, methods of improving power factor -power capacitors, series and shunt capacitors for power factor correction. Most economical power factor.

Module 5: ECONOMIC ASPECTS OF POWER GENERATION AND TARIFF (10 Periods)

Introduction, terms and definitions - connected load, maximum demand, load factor, demand factor, diversity factor, plant capacity factor, utilization factor, Plant use factor, loss factor, coincidence factor and contribution factor. Relation between loss factor and load factor. Tariffs -simple, flat rate, block rate, maximum demand, two-part, three-part and power factor tariffs.

Total Periods: 45

EXPERIENTIAL LEARNING

1. Prepare a technical report on the present scenario of generation and current status of power demand in the country.
2. Prepare an article on the impact of conventional generation on environment and should recommend measures to sustain the environment.
3. Visit an industry/organization to review the scope for cogeneration and prepare a technical report to assess the possibilities of cogeneration in the industry.
4. Visit an industry/agricultural sector and should review the power consumption and should prepare the technical report to assess the possibilities for reduction of tariff.

(Note: It's an indicative one. The course instructor may change the activities and shall be reflected in the course handout.)

RESOURCES

TEXT BOOKS:

1. R. K. Rajput, *A textbook of power system engineering*, Laxmi publications (P) Ltd, 2016.
2. C.L. Wadhwa, *Generation Distribution and Utilisation of Electrical Energy*, New Age, International publishers, 3rd edition, 2015.

REFERENCE BOOKS:

1. D P Kothari, K C Singal and Rakesh Ranjan, '*Renewable Energy Sources and Emerging Technologies*' 2nd Edition, 2012.
2. S.Rao, Dr.B.B.Parulekar, *Energy Technology*, third edition, Khanna publications, 2013.
3. V.K.Mehta and Rohith Mehta, *Principles of Power Systems*, S Chand & Company Ltd, New Delhi, 4th Multi-color illustrative edition, 2006.
4. Tagare, Digambar M. *Electricity power generation: the changing dimensions*. John Wiley & Sons, 2011.

VIDEO LECTURES:

1. <https://nptel.ac.in/courses/121106014>
2. <https://www.youtube.com/watch?v=AXcb3TBLETY>

WEB RESOURCES:

1. <https://www.eia.gov/energyexplained/electricity/how-electricity-is-generated.php>
2. <https://www.endesa.com/en/discover-energy/energy-and-more/how-electricity-is-generated>
3. <https://pb.edu.pl/oficyna-wydawnicza/wp-content/uploads/sites/4/2018/12/Buildings-2020-part2-rozdz7.pdf>
4. <https://www.electrical-technology.com/2019/05/power-factor-correction.html>
5. <https://www.e-education.psu.edu/ebf483/node/517>