

# **MOHAN BABU UNIVERSITY**

Sree Sainath Nagar, Tirupati – 517 102



**MBU**  
**MOHAN BABU**  
**UNIVERSITY**

DREAM. BELIEVE. ACHIEVE

## **SCHOOL OF ENGINEERING**

**B.Tech. Mechanical 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 MECHANICAL ENGINEERING**

## **VISION**

To be a premier centre of excellence by synergizing interdisciplinary curriculum and innovative research to produce globally competent mechanical engineers contributing to society through entrepreneurship and technological leadership.

## **MISSION**

- ❖ Impart quality education to create globally competitive mechanical engineers for multicultural and multidisciplinary environments through the contemporary curriculum.
- ❖ Develop and maintain the state of art research facilities to enable the faculty and students to address the evolving needs of industry and society.
- ❖ Create and maintain a collegial, supportive, and diverse environment that encourages students, faculty, and staff to achieve to the best of their abilities.
- ❖ Instil entrepreneurial spirit in students through a multifaceted approach.
- ❖ Foster problem solving, leadership, teamwork skills, and the value of commitment, quality and ethical behavior in the students.

## **B.Tech. MECHANICAL ENGINEERING**

### **PROGRAM EDUCATIONAL OBJECTIVES**

After few years of graduation, the graduates of B.Tech. ME Program will be:

- PEO 1.** Pursuing higher education and research in Mechanical Engineering, business administration, or other disciplines.
- PEO 2.** Employed in the core, allied, and software companies.
- PEO 3.** Able to start entrepreneurial ventures in Mechanical Engineering and other interdisciplinary fields.
- PEO 4.** Engaged in lifelong learning through scientific temper to address changes in professional and social needs.

### **PROGRAM OUTCOMES**

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

### **PROGRAM SPECIFIC OUTCOMES**

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

- PSO1.** Design, develop, analyze and maintain of mechanical systems and processes by applying the concepts of material science, Design, Manufacturing and Computer aided Manufacturing technologies
- PSO2.** Apply the principles of thermodynamics, Fluid mechanics and Heat Transfer in the thermal design of various components of fluid thermal systems and assess its performance.
- PSO3.** Identify, define, analyze, formulate, and solve problems related to industrial systems and services for optimized conditions by applying tools of Industrial Engineering and management for effective decision making and support purposes.

## B.Tech. Mechanical Engineering

### Basket Wise - Credit Distribution

<b>Sl. No.</b>	<b>Basket</b>	<b>Credits (Min. – Max.)</b>
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
<b>TOTAL CREDITS</b>		<b>Min. 160</b>

## 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	-
22EE102401	Basic Electrical and Electronics Engineering	3	-	2	-	4	-
22CS102401	Programming in C and Data Structures	3	-	2	-	4	-
22ME105002	Engineering Workshop	-	-	2	-	1	-
22ME105001	Computer Aided Engineering Drawing	-	1	4	-	3	-
22ME111002	Technology Extension for Societal Problems	-	-	-	4	1	-
22AI105001	Design Thinking	-	1	2	-	2	-
22ME111001	Internship	-	-	-	-	2	-
22ME108001	Capstone Project	-	-	-	-	10	-
<b>Language Basket (Min. 4 Credits to be earned)</b>							
22LG102401	English for Professionals	2	-	2	-	3	-
22LG105402	Soft Skills	-	-	2	-	1	-
22LG101403	German Language	2	-	-	-	2	-
22LG101404	French Language	2	-	-	-	2	-
<b>Mathematics Basket (Min. 9 Credits to be earned)</b>							
22MM101402	Multivariable Calculus and Differential Equations	3	-	-	-	3	-
22MM101404	Transformation Techniques and Linear Algebra	3	-	-	-	3	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22MM101406	Special Functions and Complex Analysis	3	-	-	-	3	Multivariable Calculus and Differential Equations
22MM101405	Numerical Methods, Probability and Statistics	3	-	-	-	3	-
<b>Physics Basket (Min. 4 Credits to be earned)</b>							
22MM102452	Engineering Physics	3	-	2	-	4	-
22MM102451	Applied Physics	3	-	2	-	4	-
<b>Computing Tools (Min. 1 Credits to be earned)</b>							
22EE105405	MATLAB Practice for Engineers	-	-	2	-	1	-
22CS105401	Python Programming for Engineers	-	-	2	-	1	-
<b>Management Basket (Min. 5 Credits to be earned)</b>							
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	-
<b>Mandatory Courses (Min. 8 Credits to be earned - Earned Credits will not be considered for CGPA)</b>							
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	-



Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22LG107603	Spoken English	-	1	2	-	2	English for Professionals
22LG107602	Essential Life Skills for Holistic Development	2	-	-	-	2	-
22AB107601	NCC/NSS Activities	-	-	-	-	2	-
22AB107602	Yoga	-	-	-	-	2	-
22MG107401	Innovation, Incubation and Entrepreneurship	2	-	-	-	2	-
22EE107001	Intellectual Property Rights	2	-	-	-	2	-
22EE107002	Fundamentals of Research Methodology	2	-	-	-	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	
22ME101001	Basic Engineering Mechanics	3	-	-	-	3	-
22ME102001	Material Science and Engineering	3	-	2	-	4	-
22ME102002	Manufacturing Technology	3	-	2	-	4	-
22ME105003	Computer Aided Machine Drawing	-	1	2	-	2	Computer Aided Engineering Drawing
22ME101002	Engineering Thermodynamics	3	-	-	-	3	-
22ME101003	Kinematics of Machinery	3	-	-	-	3	-
22ME102003	Fluid Mechanics	3	-	2	-	4	-
22ME102004	Strength of Materials	3	-	2	-	4	Basic Engineering Mechanics
22ME102005	Dynamics of Machinery	3	-	2	-	4	Basic Engineering Mechanics
22ME102006	Machine Tools	3	-	2	-	4	Manufacturing Technology
22ME102007	Engineering Metrology	2	-	2	-	4	-
22ME102008	Thermal Engineering	3	-	2	-	4	Engineering Thermodynamics
22ME101004	Fundamentals of Machine Design	3	-	-	-	3	Strength of Materials
22ME101005	Industrial Engineering and Management	3	-	-	-	3	-
22ME101006	Applied Thermodynamics	3	-	-	-	3	Engineering Thermodynamics
22ME102009	Computer Aided Design and Manufacturing	3	-	2	-	4	-
22ME102010	Heat Transfer	3	-	2	-	4	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
22ME101007	Design of Machine Elements	3	-	-	-	3	Fundamentals of Machine Design
22ME101008	Operations Research	3	-	-	-	3	-
22ME101009	Operations Management	3	-	-	-	3	-

## 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	
22ME101010	Design Engineering	Tool Design	3	-	-	-	3	-
22ME101011		Composite Materials	3	-	-	-	3	Material Science and Engineering
22ME101012		Design of Transmission Systems	3	-	-	-	3	Fundamentals of Machine Design
22ME102011		Finite Element Method	3	-	2	-	4	-
22ME101013		Design of Automotive Components	3	-	-	-	3	-
22ME101014	Manufacturing Technology	Engineering Metallurgy	3	-	-	-	3	-
22ME102012		Mechatronics	3	-	2	-	4	-
22ME102013		Hydraulics and Pneumatics	3	-	2	-	4	-
22ME102014		Industrial Automation and Robotics	3	-	2	-	4	-
22ME101015		Non-Traditional machining processes	3	-	-	-	3	-
22ME101016	Thermal Engineering	Automobile Engineering	3	-	-	-	3	-
22ME101017		Internal Combustion Engines	3	-	-	-	3	-
22ME102015		Refrigeration and Air Conditioning	3	-	2	-	4	Thermal Engineering
22ME101018		Non-Conventional Energy Sources	3	-	-	-	3	-
22ME101019		Power Plant Engineering	3	-	-	-	3	-
22ME101020		Fundamentals of Management	3	-	-	-	3	-

Course Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
22ME101021	Industrial Engineering	Statistical Inference & Modeling	3	-	-	-	3	-
22ME101022		Quality Management and Reliability Engineering	3	-	-	-	3	-
22ME101023		Optimization Techniques	3	-	-	-	3	-
22ME101024		Supply Chain Management	3	-	-	-	3	-

## 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	
22ME101025	Design Engineering	Tribology	3	-	-	-	3	-
22ME101026		Mechanical Behavior of Materials	3	-	-	-	3	-
22ME101027		Design of Pressure Vessels and Piping Systems	3	-	-	-	3	-
22ME101028		Machinery Fault Diagnosis and Signal Processing	3	-	-	-	3	-
22ME101029		Fundamentals of Microelectromechanical Systems	3	-	-	-	3	-
22ME101030		Soft Computing Techniques in Mechanical Engineering	3	-	-	-	3	-
22ME101031		Mechanical Vibrations	3	-	-	-	3	-
22ME101032		Design for manufacturing and assembly	3	-	-	-	3	-
22ME101033		Theory of Elasticity and Plasticity	3	-	-	-	3	Strength of Materials
22ME101034		Product Design for Manufacturing	3	-	-	-	3	-
22ME101035	Manufacturing Technology	Advanced Casting Technology	3	-	-	-	3	Manufacturing Technology
22ME101036		Advanced Welding Technology	3	-	-	-	3	Manufacturing Technology
22ME101037		Sustainable Manufacturing	3	-	-	-	3	-
22ME101038		Rapid Prototyping	3	-	-	-	3	-
22ME101039		Surface Engineering	3	-	-	-	3	-

Course Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
22ME102016		Industrial Internet of Things	3	-	2	-	4	-
22ME101040		Flexible Manufacturing Systems	3	-	-	-	3	-
22ME101041		Micro and Nano Manufacturing	3	-	-	-	3	-
22ME101042		Non-Destructive Testing	3	-	-	-	3	Material Science and Engineering
22ME101043		Modern Manufacturing	3	-	-	-	3	Manufacturing Technology
22ME102017	Thermal Engineering	Compressible Fluid Flow	3	-	2	-	4	-
22ME101044		Gas Turbines and Jet Propulsion	3	-	-	-	3	-
22ME101045		Alternative Fuels	3	-	-	-	3	-
22ME101046		Fuels and Combustion	3	-	-	-	3	-
22ME101047		Automotive Electronics	3	-	-	-	3	-
22ME101048		Cryogenics	3	-	-	-	3	-
22ME101049		Turbo machines	3	-	-	-	3	-
22ME101050		Hybrid and Electric Vehicles	3	-	-	-	3	-
22ME101051		Instrumentation and Control Systems	3	-	-	-	3	-
22ME102018		Computational Fluid Dynamics	3	-	2	-	4	Heat Transfer, Fluid Mechanics and Multivariable Calculus and Differential Equations
22ME102019	Industrial Engineering	Design and Analysis of Experiments	3	-	2	-	4	-

Course Code	Knowledge Area	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
			L	T	P	S	C	
22ME101052		Simulation and Modeling Analysis	3	-	-	-	3	-
22ME101053		Management Information Systems	3	-	-	-	3	-
22ME101054		Agile Manufacturing	3	-	-	-	3	-
22ME101055		Lean Manufacturing Systems	3	-	-	-	3	-
22ME101056		E Commerce and Business Analytics	3	-	-	-	3	-
22ME101057		Enterprise Resource Planning	3	-	-	-	3	-
22ME101058		Financial Engineering	3	-	-	-	3	-
22ME101059		Industrial Safety and Maintenance Engineering	3	-	-	-	3	-
22ME101060		Marketing Management	3	-	-	-	3	-



## UNIVERSITY ELECTIVE (09-12 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	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
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	-
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	-

Course Code	Title of the Course	Lecture	Tutorial	Practical	Project based Learning	Credits	Pre-requisite
		L	T	P	S	C	
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

<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>C</b>
<b>22MM102451</b>	<b>APPLIED PHYSICS</b>	3	-	2	-	4
<b>Pre-Requisite</b>	-					
<b>Anti-Requisite</b>	-					
<b>Co-Requisite</b>	-					

**COURSE DESCRIPTION:** This course provides a detailed discussion on optical fibers with structure and classification, ideas for designing acoustically good halls, production and detection of ultrasonic's with suitable industrial applications, studying the different paths of the particles using kinetics and kinematics relations, heat transfer mechanisms in material media, characteristics, and applications of modern Engineering materials.

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

- CO1.** Demonstrate the concepts of electromagnetic wave propagation in optical fibers.
- CO2.** Apply the basic knowledge of acoustics and ultrasonics to provide solutions for various engineering problems.
- CO3.** Analyze and solve the problems associated with kinetics and kinematics.
- CO4.** Acquire basic knowledge in several heat transfer mechanisms and heat conduction through the compound media.
- CO5.** Understand the characteristics and applications of modern engineering materials.
- CO6.** Work independently and in teams to solve problems with effective communications.

### CO-PO Mapping Table:

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

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

## **COURSE CONTENT**

### **Module 1: FIBER OPTICS**

**(08 Periods)**

Introduction- Structure of optical fiber - Total internal reflection - Acceptance angle, acceptance cone - Numerical aperture - Modes of propagation - Classification of optical fibers - V-number (qualitative) - Fabrication of optical fiber by double crucible technique - Applications of optical fibers - Sensors (temperature, displacement, liquid level detector).

### **Module 2: ACOUSTICS AND ULTRASONICS**

**(09 Periods)**

**Acoustics:** Introduction - Classification of sound - Sound intensity level (decibel) - Reverberation - Reverberation time - Sabine's formula (qualitative) - Absorption coefficient and its determination - Factors affecting acoustics and their remedies - Basic requirements of an acoustically good hall.

**Ultrasonics:** Introduction to ultrasonic waves - Production of ultrasonic waves by magnetostriction method - Piezoelectric method - Detection of ultrasonics (qualitative) - Industrial applications (ultrasonic welding, ultrasonic soldering, and ultrasonic drilling).

### **Module 3: KINEMATICS AND KINETICS**

**(10 Periods)**

**Kinematics of particles:** Introduction - Rectilinear motion (displacement-time curve, velocity-time curve, acceleration-time curve) - Curvilinear motion (velocity and angle of projection, equation of trajectory path, horizontal range) - Inclined projection (equation of trajectory, maximum height, time of flight of projectile, horizontal range, angle of projection).

**Kinetics:** Bodies in rectilinear translation - Kinetics of bodies rotating about a fixed axis - Work, Energy, Power - Work-Energy equation for translation.

### **Module 4: THERMAL PHYSICS**

**(8 Periods)**

Introduction - Modes of heat transfer (conduction, convection, and radiation) - Coefficient of thermal conductivity - Rectilinear flow of heat along a uniform bar - Thermal conductivity of bad conductor (Lee's disc method) - Heat conduction through compound media (materials in series and parallel).

### **Module 5: MODERN ENGINEERING MATERIALS**

**(10 Periods)**

**Metallic glasses:** Introduction - Preparation of metallic glasses by RF sputtering technique - Properties (structural, thermodynamic, mechanical, electrical, chemical, and optical), Applications of metallic glasses.

**Shape memory alloys (SMA):** Introduction- Shape memory effect and its types - Characteristics of SMA - Properties of NiTi alloy - Applications of SMA.

**Composite materials-** Introduction- Types and applications of composite materials.

**Total periods: 45**

## EXPERIENTIAL LEARNING

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

1. Estimate the numerical aperture and acceptance angle of an optical fiber.
2. Determination of the moment of inertia of a bar and acceleration due to gravity by using a compound Pendulum.
3. Find the moment of inertia of a Flywheel.
4. Estimate the moment of inertia of a rectangular body using the Bifilar Pendulum.
5. Determine the frequency of electrically driven tuning fork in transverse and longitudinal modes of vibration using Melde's Experiment.
6. Determination of coefficient of thermal conductivity of a bad conductor using Lee's disc apparatus.
7. Verify Newton's Law of Cooling for any two liquids.
8. Estimate the number of charge carriers per unit volume and hall coefficients of a given material using the Hall Effect.
9. Calculate the rigidity Modulus of a material of a wire using Torsional Pendulum
10. Determine the energy gap of material by varying temperatures.
11. Verify the three laws of stretched strings using a sonometer.
12. Estimate the particle size using a monochromatic light source (LASER).

## RESOURCES

### TEXTBOOKS:

1. M. N. Avadhanulu, P. G. Kshirsagar, T. V. S. Arun Murthy, *A Textbook of Engineering Physics* - S. Chand Publications, 11<sup>th</sup> edition, 2019.
2. S. S. Bhavikatti and K. G. Rajashekarappa, *Engineering Mechanics*, New Age International Publishers, 2<sup>nd</sup> edition, 2015.
3. R.K. Gaur and S.L. Gupta, *Engineering Physics*, Dhanpat Rai Publications (P) Ltd, 2015.
4. Serway and Jewett, *Physics for Scientists and Engineers with Modern Physics*, 6<sup>th</sup> Edition, Thomson Brooks, 2007

### REFERENCE BOOKS:

1. B. K. Pandey and S. Chaturvedi, *Engineering Physics*, Cengage Learning, 2012.
2. Brij Lal and N. Subrahmanyam, *Heat and Thermodynamics*, S. Chand and Company Ltd., 1995.
3. William D. Callister Jr., David G. Rethwisch, *Material Science and Engineering*, 9<sup>th</sup> Edition, Wiley 2013.

### VIDEO LECTURES:

1. <http://nptel.ac.in/courses/112104212>
2. <http://nptel.ac.in/courses/105/106/105106053>
3. <https://nptel.ac.in/courses/115107095>
4. <https://archive.nptel.ac.in/courses/105/106/105106053/>

**WEB RESOURCES:**

1. <https://drive.google.com/file/d/1xd2jSCu9Q9SkNC0K6hEPJdwdJICHR5ZF/view>
2. <https://www.jntufastupdates.com/jntuk-r20-1-2-engineering-mechanics-material/>
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](https://www.researchgate.net/publication/344758634_Short_Notes_on_Engineering_Physics)

## SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
<b>22MM101402</b>	<b>MULTIVARIABLE CALCULUS AND DIFFERENTIAL EQUATIONS</b>	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:

- C01.** Determine the extreme values of functions of two variables.
- C02.** Evaluate multiple integrals in Cartesian, Polar and Spherical coordinates.
- C03.** Demonstrate gradient, directional derivative, divergence, curl and Green's, Gauss, Stoke's theorems.
- C04.** Solve higher order linear differential equations related to various engineering fields.
- C05.** 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
<b>C01</b>	2	3	-	2	1	-	-	-	-	-	-	-
<b>C02</b>	2	3	-	3	1	-	-	-	-	-	-	-
<b>C03</b>	3	2	-	3	1	-	-	-	-	-	-	-
<b>C04</b>	3	2	-	3	1	-	-	-	-	-	-	-
<b>C05</b>	3	3	-	3	1	-	-	-	-	-	-	-
<b>Course Correlation Mapping</b>	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. Course instructor may change the activities and the same shall be reflected in course handout)

## RESOURCES

### TEXT BOOKS:

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

### REFERENCE BOOKS:

1. Dennis G. Zill and Warren S. Wright, *Advanced Engineering Mathematics*, Jones and Bartlett, 6<sup>th</sup> 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> (MVC)
2. <https://nptel.ac.in/courses/111106100> (ODE)
3. <https://nptel.ac.in/courses/111103021> (PDE)

### WEB RESOURCES:

1. [http://www.efunda.com/math/math\\_home/math.cfm](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
<b>22BS102401</b>	<b>ENGINEERING CHEMISTRY</b>	3	-	2	-	4
<b>Pre-Requisite</b>	-					
<b>Anti-Requisite</b>	-					
<b>Co-Requisite</b>	-					

**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
<b>CO1</b>	3	3	-	-	1	-	2	1	-	-	-	-
<b>CO2</b>	3	-	-	-	-	-	2	-	-	-	-	-
<b>CO3</b>	3	-	-	-	1	-	1	-	-	-	-	2
<b>CO4</b>	3	-	-	-	2	-	-	-	-	-	-	1
<b>CO5</b>	3	2	-	-	-	-	1	-	-	-	-	-
<b>CO6</b>	3	3	-	-	1	1	2	-	3	3	-	1
<b>Course Correlation Mapping</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>2</b>

**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<sub>2</sub>-O<sub>2</sub> 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<sup>H</sup> 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, 16<sup>th</sup> 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 (MBU)

### REFERENCE BOOKS:

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

### VIDEO LECTURES:

1. [https://www.youtube.com/watch?v=ly\\_FS3LZXEY](https://www.youtube.com/watch?v=ly_FS3LZXEY)
2. [https://www.youtube.com/watch?v=0\\_ZcCqgpS2o](https://www.youtube.com/watch?v=0_ZcCqgpS2o)
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/](https://www.salon.com/2015/10/14/4_outlandish_things_our_ancestors_used_as_lube_partner/)

## PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
<b>22ME102001</b>	<b>MATERIAL SCIENCE AND ENGINEERING</b>	3	-	2	-	4
<b>Pre-Requisite</b>	-					
<b>Anti-Requisite</b>	-					
<b>Co-Requisite</b>	-					

**COURSE DESCRIPTION:** This course provides a detailed discussion and hands-on experience on materials structure and constitution of Alloys; also, it explicates different Heat treatment procedures. Further, it gives a comprehensive explanation on Properties of ferrous and non-ferrous materials and their alloys. In addition, it offers intricacies in Properties and applications of ceramics, polymers and composite materials.

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

- CO1.** Analyze the structural, constitutional characteristics, and defects of metals and alloys using appropriate tools and techniques.
- CO2.** Analyze the properties of materials and enhance the same through heat treatment processes.
- CO3.** Demonstrate knowledge of ferrous materials and its alloys for engineering applications.
- CO4.** Demonstrate knowledge of Non-ferrous materials and its alloys for engineering applications.
- CO5.** Demonstrate knowledge of Ceramics, Polymers, and Composite materials for suitable engineering applications.
- CO6.** Work individually or in a team 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
<b>CO1</b>	3	3	1	1	2	-	-	-	-	1	-	-	3	-	-
<b>CO2</b>	3	3	1	1	-	-	-	-	-	1	-	-	3	-	-
<b>CO3</b>	3	1	-	1	-	-	-	-	-	-	-	-	3	-	-
<b>CO4</b>	3	1	-	1	-	-	-	-	-	-	-	-	3	-	-
<b>CO5</b>	3	1	-	1	-	-	-	-	-	-	-	-	3	-	-
<b>CO6</b>	-	-	-	-	-	-	-	-	3	3	-	-	-	-	-
<b>Course Correlation Mapping</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>					<b>3</b>	<b>2</b>		<b>3</b>		

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

## **COURSE CONTENT**

### **Module 1: MATERIALS STRUCTURE AND CONSTITUTION OF (10 Periods) ALLOYS**

**Materials Structure:** Classification of Engineering Materials, levels of structure, Space lattice, Unit cells and Metallic crystal structures (SC, BCC, FCC and HCP), Crystal defects: Point, Line, Interstitial and Volume, Primary and secondary bonding in materials.

**Constitution of Alloys:** Necessity of Alloying, Gibbs's phase and Hume Rothery rule, lever rule, Iron-Iron-carbide diagram and its micro-structural aspects.

### **Module 2: HEAT TREATMENT OF STEELS (09 Periods)**

Objectives of heat treatment, Annealing, Normalizing, Tempering, Carburization and Hardening- Austempering, Martempering, Carburizing, Nitriding, Cyaniding, Carbo-Nitriding, Flame and Induction Hardening, Vacuum and Plasma Hardening, Time-Temperature-Transformation Diagrams and Continuous Cooling Transformation Diagrams.

### **Module 3 FERROUS MATERIALS AND ALLOYS (09 Periods)**

**Steels:** Structure, properties, classifications and applications of plain steels, Specifications of steels, Structure, properties, classifications and applications of low alloy steels, Hadfield manganese steels, Stainless steel and Tool steels.

**Cast iron:** Structure, properties and applications of Gray cast iron, White cast iron, Malleable cast iron, Nodular cast iron and Alloy cast iron.

### **Module 4 NON-FERROUS MATERIALS AND ALLOYS (07 Periods)**

Structure, properties and applications of Copper and its alloys, Aluminium and its alloys, Titanium and its alloys, Nickel and its alloys, Magnesium and its alloys, Refractory and Precious metals.

### **Module 5 CERAMICS, POLYMERS AND COMPOSITES MATERIALS (10 Periods)**

Ceramics: Classifications, Properties and Applications, Glass-ceramics, Polymers: Classification, Properties and Applications, Composites: Classifications, Properties and Applications of Polymer matrix composites, Ceramic matrix composites, Metal matrix composites and Nano-composites.

**Total Periods: 45**

## **EXPERIENTIAL LEARNING**

### **LIST OF EXERCISES:**

#### **MATERIALS STRUCTURE AND CONSTITUTION OF ALLOYS**

1. Study the metallurgical instruments & microscope.
2. a) Preparation of specimen using cold setting die  
b) Preparation of specimen using hydraulic press
3. Experiment on Ultrasonic flaw detection
4. Experiment on Magnetic particle inspection
5. Experiment on Die-penetration
6. Study on Eddy current testing



## **HEAT TREATMENT OF STEELS**

1. Study of the microstructures of heat treated steels
2. Measurement of hardness of heat treated and untreated steels
3. Determination of hardenability of steel by Jominey End Quench Test
4. Preparation and study of the microstructure of Non-Ferrous Alloys

## **FERROUS MATERIALS AND ALLOYS**

1. Preparation and study of the microstructure of cast irons
2. Preparation and study of the microstructure of carbon steels
3. Determination of grain size, and phase distribution of specimens (any two ferrous materials) by Material Plus software

## **NON-FERROUS MATERIALS AND ALLOYS**

1. Preparation and study of the microstructure of Non-Ferrous Alloys
2. Determination of grain size, and phase distribution of specimens (any two Non-ferrous materials) by Material Plus software

## **CERAMICS, POLYMERS AND COMPOSITES MATERIALS**

1. Study on properties and applications of ceramics and polymers
2. Study on properties and applications of Metal matrix composites

## **RESOURCES**

### **TEXT BOOKS:**

1. V. Raghavan, *Materials Science & Engineering*, Prentice Hall of India, 5<sup>th</sup> edition, 2004.
2. R. Balasubramaniam, *Callister's Materials Science & Engineering*, John Wiley and sons, 2<sup>nd</sup> edition, 2014.

### **REFERENCE BOOKS:**

1. Sidney H. Avner, *Introduction to Physical Metallurgy*, Tata McGraw Hill, 2nd edition, 1997.
2. George E Dieter, *Mechanical Metallurgy*, Tata McGraw Hill, 3<sup>rd</sup> edition, 2013.
3. Kodigre V D, *Material Science and Metallurgy*, Everest Publishing House, 31st edition, 2011.

### **VIDEO LECTURES:**

1. <https://nptel.ac.in/courses/113102080>
2. <https://nptel.ac.in/courses/113107078>

### **WEB RESOURCES:**

1. <https://www.azom.com/articles.aspx>
2. <https://www.tandfonline.com/doi/abs/10.1081/CLT-100102421?journalCode=ictx19>
3. <https://www.chemistryworld.com/copper/2220.tag>

## SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
<b>22ME105002</b>	<b>ENGINEERING WORKSHOP</b>	-	-	2	-	1
<b>Pre-Requisite</b>	-					
<b>Anti-Requisite</b>	-					
<b>Co-Requisite</b>	-					

**COURSE DESCRIPTION:** Knowledge on various workshop hand and power tools; hands on experience in different manufacturing trades such as fitting, carpentry, sheet metal forming and foundry; Demonstration on dismantling and assembling of various two wheeler parts, power tools in machining and metal joining, basics of plumbing and working of 3D printer.

### COURSE OUTCOMES:

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

- CO1.** Design and model various basic prototypes in the trade of fitting such as square/half round mating, V- mating and dovetail mating from the given MS workpieces using fitting tools.
- CO2.** Develop different prototypes in the carpentry trade such as cross lap joint, dovetail / bridle joints and Mortise and Tenon joint using carpentry tools.
- CO3.** Design and model different prototypes in the sheet metal forming trade such as rectangular tray, square vessel/cylinder, Funnel as per the dimensions using sheet metal forming tools.
- CO4.** Develop sand mold using single piece pattern and split piece pattern in the foundry trade using foundry tools.
- CO5.** Develop electric circuits for series and stair case connections.
- CO6.** Demonstrate the knowledge on power tools, plumbing operation, 3D printing technology involved in different engineering applications.
- CO7.** Work independently or 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
<b>CO1</b>	3	3	3	1	-	1	-	-	-	-	-	-	3	-	-
<b>CO2</b>	3	3	3	1	-	1	-	-	-	-	-	-	3	-	-
<b>CO3</b>	3	3	3	1	-	1	-	-	-	-	-	-	3	-	-
<b>CO4</b>	3	3	3	1	-	1	-	-	-	-	-	-	3	-	-
<b>CO5</b>	3	3	3	1	-	1	-	-	-	-	-	-	3	-	-
<b>CO6</b>	3	1	1	1	1	1	-	-	-	-	-	-	3	-	-
<b>CO7</b>	-	-	-	-	-	-	-	-	3	3	-	-	3	-	-
<b>Course Correlation Mapping</b>	3	3	3	1	1	1	-	-	3	3	-	-	3	-	-

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

## EXPERIENTIAL LEARNING

### LIST OF EXERCISES:

- 1. FITTING:** Conduct a detailed study on various aspects in fitting trade which includes the details of fitting operations, safety precautions, types of tools, tool holders, miscellaneous tools, care and maintenance of hand tools, marking and measurement tool, and finishing tool.

Exercises :

- a) Make a square/half round mating from the given MS workpieces
- b) Make a V- mating from the given MS workpieces

- 2. CARPENTRY:** Conduct a detailed study on various aspects in carpentry trade which includes the details of types of wood, carpentry tools, wood working techniques, types of joints, safety precautions, and care and maintenance of tools.

Exercises:

- a) Prepare a cross lap joint
- b) Prepare dovetail / bridle joints

- 3. SHEET METAL FORMING:** Conduct a detailed study on various aspects in sheet metal forming which includes the details of sheet materials, hand tools, sheet metal fabrication, and safety and precautions

Exercises:

- a) Fabricate a rectangular tray as per the dimensions
- b) Fabricate square vessel/cylinder as per the dimensions

- 4. FOUNDRY:** Conduct a detailed study on various aspects in foundry which includes the details of moulding sand, properties of moulding sand, types of patterns and pattern, materials, foundry tools, and safety and precautions

Exercises:

- a) Prepare a sand mold, using the given single piece pattern (stepped pulley/cube)
- b) Prepare a sand mold, using the given split piece pattern (pipe bent/dumbbell)

- 5. ELECTRICAL WIRING:** Prepare electrical wiring with associated devices such as switches, distribution boards, sockets, and light fittings in a structure considering safety standards for design and installation.

Exercises:

- a) Prepare electrical circuits with Series.
- b) Prepare electrical circuits with Stair case connections.

- 6. DEMONSTRATION:**

- a) Demonstrate the usage of power tools.
- b) Demonstrate the plumbing operation and identify the essential tool and materials required for plumbing.
- c) Demonstrate the working of 3D printer

## RESOURCES

### REFERENCES:

1. P. Kannaiah and K. L. Narayana, *Workshop Manual*, SciTech Publishers, 2009.
2. K. Venkata Reddy, *Workshop Practice Manual*, BS Publications, 2008.
3. V. Ramesh Babu, *Engineering Workshop Practice*, V R B Publishers Private Limited, 2009.

### ADDITIONAL LEARNING RESOURCES:

1. R. K. Jain, *Production Technology*, Khanna Publishers, 17th edition, 2012.
2. Kalpakjian, Serope, *Manufacturing Engineering and Technology*, Pearson Education, 7th edition, 2014.

### VIDEO LECTURES:

1. <https://www.youtube.com/watch?v=ZyN9Tw9VTS0>
2. [https://www.youtube.com/watch?v=A9m\\_3onoVV8](https://www.youtube.com/watch?v=A9m_3onoVV8)
3. <https://www.youtube.com/watch?v=PkjpmPLNKZs>
4. <https://www.youtube.com/watch?v=IDajw2S78zg>

### WEB RESOURCES:

1. [https://www.jiit.ac.in/sites/default/files/Workshop\\_Lab.pdf](https://www.jiit.ac.in/sites/default/files/Workshop_Lab.pdf)
2. <https://mechanicalnotes.com/engineering-workshop/>
3. <https://www.studocu.com/in/document/indian-institute-of-technology-guwahati/engineering-mechanics/engineering-workshop/8571486>
4. <https://lecturenotes.in/download/note/25089-note-for-engineering-workshop-ew-by-technical-genius>

## SCHOOL CORE

<b>Course Code</b>	<b>Course Title</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>C</b>
<b>22ME105001</b>	<b>COMPUTER AIDED ENGINEERING DRAWING</b>	-	1	4	-	3
<b>Pre-Requisite</b>	-					
<b>Anti-Requisite</b>	-					
<b>Co-Requisite</b>	-					

**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) lines (1D) and planes (2D) (inclined to both planes of projection) located in first quadrants
- CO3.** 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)
- CO4.** Develop lateral surfaces of solids of given objects for engineering communication using principles of engineering drawing and CAD tools.
- CO5.** Understand 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												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
<b>CO2</b>	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
<b>CO3</b>	3	2	1	-	-	-	-	-	-	-	-	-	3	-	-
<b>CO4</b>	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
<b>CO5</b>	3	2	2	-	-	-	-	-	-	-	-	-	3	-	-
<b>CO6</b>	-	-	-	-	-	-	-	-	3	3	-	-	3	-	-
<b>Course Correlation Mapping</b>	3	2	1	-	-	-	-	-	3	3	-	-	3	-	-

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

## COURSE CONTENT

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

Introduction to Engineering graphics: Principles, significance -Conventions in drawing- lettering - BIS conventions-Dimensioning principles and conventional representations – Lettering and dimensioning - Scales: Representative Fraction, Type of Scale, Plain and Diagonal Scale, Scale of chords.

#### **Exercises:**

1. Practice exercise on Basic Lettering Practice, Dimensioning Practice,
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:**

1. Practice exercise with basic drawing commands
2. Practice exercise with editing commands

### **Module 2: CONICS, CURVES, PROJECTION OF POINTS, LINES AND (06 Periods) PLANES**

**Conics & Special Curves:** (a) Conic sections: Construction of ellipse, parabola and hyperbola including the rectangular hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle. Drawing of tangents and normal to the above curves.

#### **Exercises:**

1. Practice exercises on Ellipse, Parabola, Hyperbola and Rectangular Hyperbola
2. Practice exercises on Cycloid, epicycloids, hypocycloid and Involute
3. Practice exercises on Projection of points in 3rd angle projections

**Projection of points, lines and planes:** Projection of points in any quadrant, lines inclined to one or both planes, Traces, finding true lengths, angle made by line. Projections of regular plane surfaces and inclined to both the principal planes by rotating object method.

#### **Exercises:**

1. Practice exercises on Projection of points
2. Practice exercises on lines inclined to one plane
3. Practice exercises on lines inclined to both planes
4. Practice exercises on Projections of regular plane surfaces
5. Practice exercises on Projection of polygonal plane surfaces
6. Practice exercises on Projection of circular plane surfaces
7. Practice exercises on Projection of polygonal plane surfaces inclined to both principal planes
8. Practice exercises on Projection of circular plane surfaces inclined to both principal planes

### **Module 3 PROJECTION OF SOLIDS AND SECTION OF SOLIDS (8 Periods)**

**Projection of solids:** Projection of regular solids in simple position, Projection of solids with axes inclined to one of the reference planes and parallel to the other, Projections of solids with axes inclined to both H.P. and the V.P.

**Sections of solids:** Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone, True shapes of the sections. Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section.

**Exercises:**

1. Practice exercises on Projections of regular solids
2. Practice exercises on Sections of solids
3. Practice exercises on Projection of pentagonal pyramids
4. Practice exercises on Projection of Hexagonal pyramids
5. Practice exercises on Projection of pentagonal pyramids inclined to both principal planes
6. Practice exercises on Projection of Hexagonal pyramids inclined to both principal planes
7. Practice exercises on Projection of pentagonal prism
8. Practice exercises on Projection of Hexagonal prism
9. Practice exercises on Projection of pentagonal prism inclined to both principal planes
10. Practice exercises on Projection of Hexagonal prism inclined to both principal planes

### **Module 4 DEVELOPMENT OF SURFACES (6 Periods)**

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

**Exercises:**

1. Practice exercises on Development of surfaces of right regular solids
2. Practice exercises on Development of surfaces of pentagonal pyramids
3. Practice exercises on Development of surfaces of hexagonal pyramids
4. Practice exercises on Development of surfaces of pentagonal prism
5. Practice exercises on Development of surfaces of hexagonal prism

### **Module 5 ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS (10 Periods)**

#### **ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS**

**Orthographic Projections:** Systems of projections, conventions and application to orthographic projections. Projections of regular plane surfaces-triangle, square, rectangle, pentagon, hexagon and circle-in simple positions inclined to both the planes; planes in different positions by change of position method only.

**Isometric Projections:** Principles of isometric projection- of simple solids and truncated solids – Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Isometric scale; Isometric views: lines, planes, simple solids.

**Exercises:**

1. Practice exercises on Orthographic Projections
2. Practice exercises on Isometric Projections

**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.
3. T.Jeyapooan, *Engineering Drawing and Graphics Using AutoCAD*, Vikas Publishing House, 3rd Edition, 2010.
4. Jolhe, *Engineering Drawing*, Tata McGraw Hill Education Private Limited, 1st Edition, 2007.
5. Basant Aggarwal, *Engineering Drawing*, Tata McGraw Hill Education Private Limited, 1st Edition, 2008

### VIDEO LECTURES:

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



## SCHOOL CORE MANDATORY COURSE

<b>Course Code</b>	<b>PROFESSIONAL ETHICS AND HUMAN VALUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>S</b>	<b>C</b>
<b>22LG107601</b>		2	-	-	-	2
<b>Pre-Requisite</b>	-					
<b>Anti-Requisite</b>	-					
<b>Co-Requisite</b>	-					

**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
<b>CO1</b>	3	-	-	-	-	2	2	2	2	-	-	-
<b>CO2</b>	2	3	2	-	2	2	2	2	2	-	-	-
<b>CO3</b>	2	-	3	-	2	2	2	2	2	-	-	-
<b>CO4</b>	2	-	-	-	-	2	2	2	2	-	3	-
<b>CO5</b>	2	2	3	2	-	3	2	2	2	-	-	-
<b>Course Correlation Mapping</b>	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. Course instructor may change the activities and the same shall be reflected in 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, 3<sup>rd</sup> 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, 2<sup>nd</sup> Edition, 2004.
4. R. Subramanian, *Professional Ethics*, Oxford Higher Education, 2013.

### VIDEO LECTURES:

1. [https://www.youtube.com/watch?v=jfGIq\\_EiXzI](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](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
<b>22EE102401</b>	<b>BASIC ELECTRICAL AND ELECTRONICS ENGINEERING</b>	3	-	2	-	4

**Pre-Requisite**      --

**Anti-Requisite**    --

**Co-Requisite**      --

### **COURSE DESCRIPTION:**

This course is designed to provide an overview on the fundamentals of electrical and electrical engineering concepts and hands-on experience for non-electrical graduating students. The course address the fundamentals concepts of electrical circuits, operational aspects of motors, transformers and general electrical wiring systems. The course also emphasis on the illumination design, back-up supplies like UPS and Batteries, sensors and transducers, and principles of fundamental electronic devices and their applications.

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

- CO1.** Analyze the electrical circuits by applying the principles of electrical circuits.
- CO2.** Understand the operation of various motors used in domestic application, transformers and general wiring schemes.
- CO3.** Understand the operational aspects of UPS, batteries and design the appropriate lighting system for various industrial and domestic applications.
- CO4.** Understand the principle of various sensor and transducers to sense/measure various non-electrical parameters.
- CO5.** Understand the fundamentals of basic electronic devices, their characteristics and applications of electronic devices.
- CO6.** Work independently or in teams to solve problems with effective communication.

### **CO-PO Mapping Table:**

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

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

## **COURSE CONTENT**

### **Module 1: Fundamentals of Electric Circuits (10 Periods)**

Classification of network elements; Voltage-Current relations for passive elements; Kirchhoff's laws; Series-Parallel connection; Mesh and Nodal analysis (With DC Independent Sources only).

AC sources—Single loop generator, Phasor representation, Voltage, Current, Impedance, Power factor and Apparent power.

### **Module 2: Electrical Systems (09 Periods)**

**Motors:** Types of motors, working principle and applications—DC motor, Three Phase Induction motor, Synchronous motor, Stepper motor.

**Single Phase Transformer:** Construction, principle of operation; EMF equation.

**Electrical wiring:** Methods of electrical wiring systems; Earthing procedure, Switch fuse unit (SFU), Operation of MCB and Relays.

### **Module 3: Utilization of Electrical Systems (09 Periods)**

**Illumination:** Light sources, Terminologies, Laws of illumination; Types of lamps, Lighting calculations; Interior Lighting - Industrial lighting; Exterior lighting- Street lighting and Flood lighting.

**Uninterruptible Power Supply (UPS)** - Components in UPS, Functionality and Calculation of ratings for UPS components to a specific load.

**Emergency supply:** Batteries -Types of batteries, Elementary calculations for energy consumption for a specified application.

### **Module 4: Sensors and Transducers (08 Periods)**

**Sensors-** Light sensor, Voltage sensor, Temperature and Humidity sensor, Motion detection sensors, Wireless bluetooth sensors and Distance measurement with Ultrasound sensor.

**Transducers** -Basic requirements of transducers, Passive transducers - Strain gauge, Hall-Effect transducer, LVDT and Active transducers- Piezoelectric and Thermocouple, Data acquisition system (overview and concept only).

### **Module 5: Fundamentals of Electronics Engineering (09 Periods)**

Half wave and full wave rectifier, Zener diode, characteristics, application – Regulator. BJT -operation; Introduction to Operational amplifier: Inverting and non-inverting amplifier. Application - Adder, Comparator, Integrator and Differentiator; Analog to Digital Convertors - Flash type and Successive approximation types; Digital to Analog converters - Weighed resistor and R-2R types.

**Total Periods: 45**

## **EXPERIENTIAL LEARNING**

### **LIST OF EXERCISES:**

1. Verification of Kirchhoff's laws (Mesh and Nodal Analysis).
2. Performance evaluation by brake test on DC Shunt Motor.
3. Performance evaluation of a 1-Phase Transformer by Load test.
4. Practicing plate and pipe earthing system.
5. Operation and testing of Fuse, MCB and Relays.
6. Design and estimation of wiring for a typical house: One lamp controlled by one switch, Two lamp controlled by two switch and stair case wiring.
7. Calibration of LVDT for linear displacement measurement.
8. Analyze the characteristics of Resistance Temperature Detector (RTD) sensor.
9. Analyze the characteristics of piezoelectric sensor.
10. Investigate ripple factor and load regulations of rectifier with and without filters.
11. Design of inverting and non-inverting amplifiers using op-amp.
12. D-A converter (R-2R ladder) using Op-Amp 741 with required voltage levels.

### **TEXT BOOKS:**

1. Ashfaq Hussain, *Fundamentals of Electrical Engineering*, Dhanpatrai & Co. (P) Ltd., 3<sup>rd</sup> Edition, New Delhi, 2009.
2. R. L. Boylestad and Louis Nashelsky, *Electronics Devices and Circuits*, PHI, 11<sup>th</sup> edition, 2009.

### **REFERENCE BOOKS:**

1. Wadhwa, C. L., *Basic Electric Engineering*. 4<sup>th</sup> Edition, New Age International Private limited.
2. D. Patranabis, *Sensors and Transducers*, PHI Learning Private Limited, 2<sup>nd</sup> Edition, 2003.
3. A.K.Sawhney, *A Course in Electrical and Electronic Measurements and Instrumentation*, Dhanpat Rai & Co., 19<sup>th</sup> Edition, 2015.
4. C.L. Wadhwa, *Generation, Distribution and Utilization of Electrical Energy*, New Age International Private Limited, 2015.

### **VIDEO LECTURES:**

1. <https://nptel.ac.in/courses/108108076>
2. <https://nptel.ac.in/courses/108105061>
3. <https://nptel.ac.in/courses/108108147>
4. <https://nptel.ac.in/courses/108101091>

## **WEB RESOURCES:**

1. <https://www.electrical4u.com/electric-circuit-or-electrical-network/>
2. <https://www.electronicshub.org/dc-circuits-basics/>
3. <https://www.electrical4u.com/working-of-electric-motor/>
4. <https://electricalbaba.com/what-is-ups-working-types-of-ups-explained/>
5. <https://www.lrc.rpi.edu/resources/publications/pdf/illuminationfund.pdf>
6. [https://www.sitsitamarhi.ac.in/wp-content/uploads/2020/04/file\\_5e8ef00b06190.pdf](https://www.sitsitamarhi.ac.in/wp-content/uploads/2020/04/file_5e8ef00b06190.pdf)
7. [https://www.electronics-tutorials.ws/io/io\\_1.html](https://www.electronics-tutorials.ws/io/io_1.html)
8. <https://www.homemade-circuits.com/making-ups-tutorial/>
9. <https://www.engineersgarage.com/introduction-to-uninterruptible-power-supply-ups-and-its-design-part-1-17/>
10. <https://www.dfliq.net/blog/the-basics-of-electrical-components/>

## SCHOOL CORE

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

**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
<b>CO1</b>	3	-	-	-	-	-	-	-	-	3	-	2
<b>CO2</b>	-	3	2	-	-	-	-	-	-	3	-	2
<b>CO3</b>	3	2	-	-	-	-	-	-	-	3	-	2
<b>CO4</b>	-	-	-	-	3	-	-	-	-	3	-	2
<b>CO5</b>	-	-	-	-	3	-	-	-	-	3	-	2
<b>Course Correlation Mapping</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>3</b>	<b>-</b>	<b>2</b>

**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. *Quicksteps 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](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/](https://www.fluentu.com/blog/english/professional_english/)
4. [https://learnenglish.britishcouncil.org/business\\_english](https://learnenglish.britishcouncil.org/business_english)

## SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
<b>22CS102401</b>	<b>PROGRAMMING IN C AND DATA STRUCTURES</b>	3	-	2	-	4

**Pre-Requisite** -

**Anti-Requisite** -

**Co-Requisite** -

**COURSE DESCRIPTION:** This course provides a detailed introduction and hands-on experience to programming in C language. Topics covered in the course include Algorithms, Flowcharts, Operators and expressions, Input and output functions, Control statements, Arrays, Strings, Functions, Pointers, User-defined data types, Linked lists, Overview of data structures, Stack, Queue, Searching algorithms, Sorting algorithms.

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

- CO1.** Develop flowcharts, algorithms for given problems.
- CO2.** Design algorithmic solutions by analyzing programming problems and using appropriate C language constructs.
- CO3.** Apply linear data structures such as arrays, linked lists, stacks, queues for efficient data organization and manipulation.
- CO4.** Select and apply appropriate techniques for searching and sorting problems.
- CO5.** Work independently and communicate effectively in oral and written forms.

**CO-PO Mapping Table:**

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

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

## COURSE CONTENT

### **Module 1: INTRODUCTION TO C PROGRAMMING (08 Periods)**

**Introduction to Algorithms and Flowcharts:** What is an algorithm, Different ways of stating algorithms, Key features of algorithm, What are variables, Subroutines, Flowcharts, Strategy for designing algorithms, Tracing an algorithm to depict logic, Specification for converting algorithms into programs.

**Basis of C Programming:** Introduction, Structure of a C program, Concept of a variable, Data types in C, Program statement, Declaration, How does the computer store data in memory, Tokens, Operators and expressions, Expressions revisited, Type conversion in C.

### **Module 2: INPUT AND OUTPUT, CONTROL STATEMENTS (09 Periods)**

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

**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.

### **Module 3: ARRAYS AND STRINGS, FUNCTIONS (10 Periods)**

**Arrays and Strings:** One-dimensional array – Declaration, Initialization, Manipulation; Multi-dimensional arrays – Declaration, Initialization, Manipulation; Strings – Declaration, Initialization, String input/output, Character manipulation, String manipulation; Arrays of strings – Declaration, Initialization, Manipulation.

**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, USER-DEFINED DATA TYPES, LINKED LISTS (10 Periods)**

**Pointers in C:** Understanding memory addresses, Address operator (&), Pointer, Arrays and pointers, Pointers and strings, Pointer arithmetic, Pointers to pointers, Array of pointers, Pointers to an array, Two-dimensional arrays and pointers, Dynamic memory allocation.

**User-Defined Data Types:** Structures - Declaration, Initialization, Accessing members, Arrays of structures, Arrays within structure, Structures and pointers, Structures and functions; Enumeration types.

**Linked Lists:** Single linked lists – Definition, Representation, Operations, Inserting a node, Deleting a node; Applications of linked lists, Disadvantages of linked lists, Array versus linked list revisited.

### **Module 5: DATA STRUCTURES (08 Periods)**

**Basic Data Structures:** Overview of data structures, Stack – Definition, Array representation, Implementation of stack operations using arrays; Queue - Definition, Array representation, Implementation of queue operations using array.

**Searching and Sorting:** Linear Search, Binary Search, Bubble sort, Selection sort.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. a) Let a and b are two integer variables whose values are 10 and 13 respectively. Write a program to evaluate the following arithmetic expressions.  
i)  $a + b$     ii)  $a - b$     iii)  $a * b$     iv)  $a/b$     v)  $a \% b$
- b) Write a program to evaluate the following algebraic expressions after reading necessary values from keyword.
  - i)  $(ax + b)/(ax - b)$
  - ii)  $2.5 \log x + \cos 32^\circ + |x^2 + y^2|$
  - iii)  $x^5 + 10x^4 + 8$  and  $x^3 + 4x + 2$
  - iv)  $ae^{kt}$
2. a) Mr. Gupta deposited Rs.1000 in a bank. The bank gives simple interest at the rate of 15% per annum. Write a program to determine the amount in Mr. Gupta's account at the end of 5 years. (Use the formula  $I = PTR / 100$ )
- b) A cashier has currency notes of denominations Rs.10, Rs. 50 and Rs. 100. If the amount to be withdrawn is input in hundreds, find the total number of notes of each denomination the cashier will have to give to the withdrawer.
- c) In a town, the percentage of men is 52. The percentage of total literacy is 48. If total percentage of literate men is 35 of the total population; write a program to find the total number of illiterate men and women if the population of the town is 8000.
3. a) Write a program that prints the given three integers in ascending order using if - else.
- b) Write a program to calculate commission for the input value of sales amount. Commission is calculated as per the following rules:
  - i) Commission is NIL for sales amount Rs. 5000.
  - ii) Commission is 2% for sales when sales amount is  $>Rs. 5000$  and  $\leq Rs. 10000$ .
  - iii) Commission is 5% for sales amount  $>Rs. 10000$ .
- c) If cost price and selling price of an item is input through the keyboard, write a program to determine whether the seller has made profit or incurred loss. Also determine how much profit or loss he incurred in percentage.
4. a) An insurance company calculates premium as follows:
  - i) 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 premium is Rs.4 per thousand and the policy amount cannot exceed Rs.2 lakhs.
  - ii) 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.
  - iii) 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.
  - iv) In all other cases the person is not insured.Write a 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.

- b) Write a program, which takes two integer operands and one operator as input from the user, performs the operation and then prints the result. (Consider the operators +, -, \*, /, %. Use switch statement)
5. a) Write a program to find the sum of individual digits of a positive integer.
- b) A Fibonacci sequence is defined as follows: The first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a program to generate the first N terms of the sequence.
6. a) Write a program to find the largest and smallest number in a given list of integers.
- b) Write a program to perform addition of two matrices.
- c) Write a program to determine whether the given string is palindrome or not.
7. a) Write a program using functions to perform the following operations:
- To convert a given decimal number into binary number
  - To convert a given binary number into decimal number
- b) Write a program using functions insert a sub-string in main string at a specified position.
8. a) Write a C program to print the elements of an array in reverse order using pointers.
- b) Write a program to accept the elements of the structure as: Employee-name, Basic pay. Display the same structure along with the DA, CCA and Gross salary for 5 employees.  
Note: DA=51% of Basic pay, CCA=Rs.100 consolidated.
9. A college has N number of students and the following details of all the students are maintained – register number, name, branch, phone number. Write a program to store the details of the students using a singly linked list. Develop functions to perform the following operations on the data.
- Insert new student's details
  - Display the details of the students
  - Delete a given student's information
10. a) Develop a menu driven program to perform the following operations on a stack of integers (Array implementation of stack with maximum size MAX)
- Push an element
  - Pop an element
  - Display the status
  - Demonstrate overflow and underflow situations
- b) Develop a menu driven program to perform the following operations on a queue of characters (Array implementation of queue with maximum size MAX).
- Insert an element
  - Delete an element
  - Display the status
  - Demonstrate overflow and underflow situations
11. Store register numbers of students who attended placement training program in a random order in an array. Write a function to search whether a student has attended placement training program or not using
- Linear Search
  - Binary Search

12. Given marks of N number of students in mathematics subject, write a program to display the marks of students in ascending order using
  - a) Bubble Sort
  - b) Selection Sort

## RESOURCES

### TEXT BOOKS:

1. Pradip Dey and Manas Ghosh, *Programming in C*, Oxford University Press, 2018.
2. Debasis samanta, *Classic Data Structures*, 2<sup>nd</sup> Edition, PHI Learning, 2009.

### REFERENCE BOOKS:

1. Byron S Gottfried and Jitender Kumar Chhabra, *Programming with C*, 4<sup>th</sup> Edition, McGraw Hill Education, 2019.
2. Yashavant Kanetkar, *Let Us C*, 17<sup>th</sup> Edition, BPB Publications, 2020.

### VIDEO LECTURES:

1. <https://nptel.ac.in/courses/106/104/106104128/>
2. <https://nptel.ac.in/courses/106/103/106103069/>
3. <https://www.digimat.in/nptel/courses/video/106105171/L01.html>
4. <https://nptel.ac.in/courses/106102064>
5. <https://nptel.ac.in/courses/106105171>
6. <https://archive.nptel.ac.in/courses/106/106/106106127/>
7. <https://www.youtube.com/watch?v=4OGMB4Fhh50>
8. <https://nptel.ac.in/courses/106105151>

### WEB RESOURCES:

1. <https://www.coursera.org/learn/data-structures>
2. <https://www.edureka.co/blog/c-data-structures/>
3. <https://www.coursera.org/specializations/data-structures-algorithms>
4. <https://www.udemy.com/course/data-structures-and-algorithms-in-c/>
5. <https://www.udemy.com/course/data-structures-and-algorithms-in-c-for-beginners/>
6. [http://www.java2s.com/Tutorial/C/0260\\_Data-Structure/Catalog0260\\_Data-Structure.htm](http://www.java2s.com/Tutorial/C/0260_Data-Structure/Catalog0260_Data-Structure.htm)
7. <https://www.programiz.com/dsa>

## SCHOOL CORE

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

**Pre-Requisite** -

**Anti-Requisite** -

**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
<b>CO1</b>	3	3	-	2	1	-	-	-	-	-	-	-
<b>CO2</b>	3	3	-	3	1	-	-	-	-	-	-	-
<b>CO3</b>	3	2	-	1	1	-	-	-	-	-	-	-
<b>CO4</b>	3	2	-	3	1	-	-	-	-	-	-	-
<b>Course Correlation Mapping</b>	<b>3</b>	<b>3</b>	-	<b>2</b>	<b>1</b>	-	-	-	-	-	-	-

**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  $C = \{x+iy/i^2 = -1, x, y \in \mathbb{R}\}$ , satisfy all of the conditions in the definition of vector space over  $C$ . 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. Course instructor may change the activities and the same shall be reflected in course handout)

## RESOURCES

### TEXT BOOKS:

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

### REFERENCE BOOKS:

1. Erwin kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 10<sup>th</sup> 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> (Module-1,2&3)
2. <https://nptel.ac.in/courses/111106051> (Module-4 & 5)

### WEB RESOURCES:

1. <https://www.coursera.org/learn/matrix-algebra-engineers> (Module-4 & 5)
2. <https://www-users.cse.umn.edu/~mille003/fouriertransform.pdf>
3. <https://nitkkr.ac.in/docs/12-%20Laplace%20Transforms%20and%20their%20Applications.pdf>

## PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
<b>22ME101001</b>	<b>BASIC ENGINEERING MECHANICS</b>	3	-	-	-	3
<b>Pre-Requisite</b>	-					
<b>Anti-Requisite</b>	-					
<b>Co-Requisite</b>	-					

**COURSE DESCRIPTION:** This course provides the fundamental concepts of different force systems and equilibrium of force systems, effect of friction, centroid, centre of gravity, moment of inertia of composite areas and bodies, basics of kinetics and mechanical vibrations.

### COURSE OUTCOMES:

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

- CO1.** Analyze the equilibrium of concurrent forces in static particles.
- CO2.** Analyze the equilibrium of non-concurrent forces in static rigid bodies.
- CO3.** Analyze the effect of friction by applying the principles of Engineering Mechanics.
- CO4.** Analyze composite areas and bodies to find centroid, Centre of gravity and moment of inertia.
- CO5.** Apply D'Alembert's Principle, basic principles of Simple Harmonic Motion and vibrations to solve problems in mechanical systems.

### 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
<b>CO1</b>	3	3	2	1	-	-	-	-	-	-	-	-	3	-	-
<b>CO2</b>	3	3	2	1	-	-	-	-	-	-	-	-	3	-	-
<b>CO3</b>	3	3	2	1	-	-	-	-	-	-	-	-	3	-	-
<b>CO4</b>	3	3	2	1	-	-	-	-	-	-	-	-	3	-	-
<b>CO5</b>	3	3	2	1	-	-	-	-	-	-	-	-	3	-	-
<b>Course Correlation Mapping</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>1</b>	-	-	-	-	-	-	-	-	<b>3</b>	-	-

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

## COURSE CONTENT

### **Module 1: EQUILIBRIUM OF SYSTEM OF COPLANAR CONCURRENT (09 Periods) FORCES**

Basic concepts, System of units, System of concurrent coplanar forces in plane, principle of transmissibility, Laws of mechanics, Resultant of forces, Parallelogram and triangular law of forces, Equilibrium of forces, Lami's theorem, Equilibrium of bodies, Equilibrium of connected bodies, Vectorial representation of forces, Vector operations of forces –addition, subtraction, dot product, cross product of vectors.

### **Module 2: EQUILIBRIUM OF SYSTEM OF COPLANAR NON- (09 Periods) CONCURRENT FORCES**

Moment of a force, Varignon's theorem, Moment of a couple, Vectorial representation of moments and couples, Coplanar non-concurrent forces, Resultant, Equilibrium of coplanar non-concurrent force system, Types of supports and loads, Types of frames, Perfect frame analysis, Method of joints, Method of sections.

### **Module 3: FRICTION (09 Periods)**

Frictional force, Types of friction, Laws of friction, Co-efficient of friction, Angle of friction, Angle of repose, Cone of friction, Applications: Body on horizontal/inclined plane, Two bodies in contact, Ladder friction, Wedge friction.

### **Module 4: CENTROID, CENTRE OF GRAVITY AND MOMENT OF (09 Periods) INERTIA**

Centroids of simple and composite areas, centre of gravity of bodies, Theorems of Pappus and Guldinus, Parallel axis and perpendicular axis theorems, Moment of Inertia of Composite areas, Radius of gyration – Section modulus, Mass Moment of Inertia of simple and composite masses.

### **Module 5: KINETICS AND MECHANICAL VIBRATIONS (09 Periods)**

#### **Kinetics of Rigid Bodies:**

Introduction, Problems on D'Alembert's principle, Impulse-momentum equation, Kinetics of circular motion, Rotation.

#### **Mechanical Vibrations:**

Definitions, Concepts – Simple Harmonic Motion – Free vibrations – Simple, compound and Torsional pendulum – Numerical problems.

**Total Periods: 45**

## EXPERIENTIAL LEARNING

1. List out the various examples of mechanics applications in daily life and explain them through Mechanics Principles.
2. Prepare models to show equilibrium of concurrent force system and nonconcurrent force system.
3. Visit Science centre, observe and experience the models related to Mechanics to gain practical knowledge and submit the reports.

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

### **CASE STUDIES/ ARTICLES:**

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

### **RESOURCES**

#### **TEXT BOOKS:**

1. S. S. Bhavikatti and K. G. Rajashekarappa, *Engineering Mechanics*, New Age International (P) Ltd., 3<sup>rd</sup> Edition, 2009.
2. A. K. Tayal, *Engineering Mechanics Statics and Dynamics*, Umesh Publications, Delhi, 14<sup>th</sup> edition, 2011.

#### **REFERENCE BOOKS:**

1. C. Lakshmana Rao, *Engineering Mechanics*, Prentice Hall India Learning Private Limited, 1<sup>st</sup> Edition, 2003.
2. J L Meriam and L G Kraige, *Engineering Mechanics - Statics*, 7<sup>th</sup> Edition, 2006.
3. K. Vijaya Kumar Reddy and J. Suresh Kumar, *Singer's Engineering Mechanics - Statics and Dynamics*, BS Publications, 3<sup>rd</sup> Edition, 2010.
4. S. Timoshenko, D. H. Young and J. V. Rao, *Engineering Mechanics*, Tata McGraw-Hill Education Pvt. Ltd., Revised 4<sup>th</sup> Edition, Special Indian Edition, 2007.

#### **WEB RESOURCES:**

1. <https://www.coursera.org/learn/engineering-mechanics-statics>
2. <https://nptel.ac.in/courses/112103109>
3. <https://www.youtube.com/playlist?list=PL63F5D8638872CC3E>
4. <https://www.youtube.com/watch?v=nGfVTNfNwnk>

## PROGRAM CORE

Course Code	Course Title	L	T	P	S	C
<b>22ME102002</b>	<b>MANUFACTURING TECHNOLOGY</b>	3	-	2	-	4
<b>Pre-Requisite</b>	-					
<b>Anti-Requisite</b>	-					
<b>Co-Requisite</b>	-					

**COURSE DESCRIPTION:** This course provides a detailed discussion and hands-on experience on fundamentals of manufacturing process such as casting, metal forming, metal joining, material preparation and polymer processing. This course also examines the knowledge with respect to forces distribution during various processes.

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

- CO1.** Apply knowledge to select suitable manufacturing process for a given product and understand the steps involved in metal casting, pattern making.
- CO2.** Analyse the working of cold working and hot working processes and evaluate the forces and power in rolling, forging and extrusion processes.
- CO3.** Analyse the working of various welding processes and summarize the applications, advantages of various welding processes.
- CO4.** Analyse the steps in making ceramics parts and manufacturing of powder metallurgy parts and demonstrate the application of plastic, ceramics and power metallurgy.
- CO5.** Apply knowledge to select appropriate methods of manufacturing plastics parts and demonstrate the application of plastic.
- CO6.** Work individually or in a team 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
<b>CO1</b>	3	1	-	-	-	1	1	-	-	-	-	-	3	-	-
<b>CO2</b>	3	2	1	-	-	1	1	-	-	-	-	-	3	-	-
<b>CO3</b>	3	1	-	-	-	1	1	-	-	-	-	-	3	-	-
<b>CO4</b>	2	1	-	-	-	1	1	-	-	-	-	-	3	-	-
<b>CO5</b>	2	1	-	-	-	1	1	-	-	-	-	-	3	-	-
<b>CO6</b>	2	2	1	-	-	-	-	-	-	3	3	-	3		
<b>Course Correlation Mapping</b>	<b>2</b>	<b>1</b>	<b>1</b>	-	-	<b>1</b>	<b>1</b>	-	-	<b>3</b>	<b>3</b>	-	<b>3</b>	-	-

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

## COURSE CONTENT

### **Module 1: PRIMARY MANUFACTURING PROCESSES (10 Periods)**

**Introduction:** Importance and selection of manufacturing processes.

**Casting Processes:** Introduction to casting process, process steps; pattern: types, materials and allowance; Cores: Types of cores, core prints, principles and design of gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

### **Module 2: METAL FORMING PROCESSES (09 Periods)**

**Introduction:** Introduction to metal forming, nature of plastic deformation, hot and cold working of metals, mechanics of metal forming.

**Rolling:** Principle, types of rolling mill and products, roll passes, forces in rolling and power requirements.

**Forging:** Principles of forging, tools and dies. Types: Smith forging, drop forging, forging hammers, rotary forging and forging defects. Sheet metal forming: Mechanics of sheet metal working, blanking, piercing, bending, stamping.

**Extrusion:** Basic extrusion process and its characteristics, hot extrusion and cold extrusion, wire drawing, tube drawing.

### **Module 3 METAL JOINING PROCESSES (09 Periods)**

**Metal Joining Processes:** Classification of welding processes, types of welds and welded joints and V-I characteristics, arc welding, weld bead geometry, submerged arc welding, gas tungsten arc welding, gas metal arc welding. Applications, advantages and disadvantages of the above processes, other fabrication processes. Heat affected zones in welding.

**Soldering and brazing:** Types and their applications, Welding defects: causes and remedies.

### **Module 4 CERAMICS AND POWDER METALLURGY (09 Periods)**

**Ceramics:** Classification of ceramic materials, properties and their application, ceramic powder preparation; Processing of ceramic parts: Pressing, casting, sintering; Secondary processing of ceramics: Coatings, finishing.

**Powder Metallurgy:** Principle, manufacture of powders, steps involved.

### **Module 5 PLASTIC PROCESSING (08 Periods)**

**Introduction to Plastics:** Types, properties and their applications.

**Processing of plastics:** extrusion of plastics, transfer molding and compression molding, injection molding, thermoforming, rotational molding and blow molding.

**Total Periods: 45**

## **EXPERIENTIAL LEARNING**

### **LIST OF EXERCISES:**

#### **1. METAL CASTING.**

- a) Gating Design and pouring time and solidification time calculations.
- b) Sand Properties Testing – Exercise for Strength and Permeability
- c) Gating Design and pouring time and solidification time calculations.
- d) Sand Properties Testing – Exercise for Strength and Permeability

#### **2. MECHANICAL PRESS WORKING.**

- a) Press Tool: Blanking and Piercing operation with Simple, Compound and Combination dies.
- b) Closed die forging, Deep Drawing and Extrusion operations.

#### **3. WELDING.**

- a) Lap joint and butt joint using arc welding process
- b) Lap joint and butt joint using arc welding process
- c) Lap joint by TIG and MIG welding process
- d) Simulation of welding

#### **4. MANUFACTURING PROCESSES.**

- a) Study of casting of ceramic parts
- b) Study of manufacturing of product through powder metallurgy route
- c) Additive manufacturing with 3D Printing
- d) Electro Discharge Machining (EDM)/ Wire cut EDM

#### **5. PROCESSING OF PLASTIC.**

- a) Producing a component using injection molding machine.
- b) Producing a component using blow molding machine

## **RESOURCES**

### **TEXT BOOKS:**

1. Rao P.N., "Manufacturing Technology – Volume I", 5th edition, McGraw-Hill Education, 2018.
2. Kalpakjian S and Schmid S.R., "Manufacturing Engineering and Technology", 7th edition, Pearson, 2018

### **REFERENCE BOOKS:**

1. Millek P. Groover, "Fundamentals of Modern Manufacturing": "Materials, Processes and Systems", 4<sup>th</sup> edition, John Wiley and Sons Inc, 2010.
2. Sharma P.C., "A Text book of Production Technology", 8th edition, S Chand Publishing, 2014.

### **VIDEO LECTURES:**

1. <https://nptel.ac.in/courses/112107219>
2. <https://nptel.ac.in/courses/112104195>



**WEB RESOURCES:**

1. <https://www.my-mooc.com/en/mooc/fundamentals-manufacturing-processes-mitx-2-008x/>
2. <https://www.udemy.com/course/fundamentals-of-manufacturing-materials-processes-systems/>
3. <https://www.sme.org/sme-store/fundamental-manufacturing-processes/>
4. <https://www.fcusd.org/cms/lib/CA01001934/Centricity/Domain/4529/Fundamentals%20of%20Modern%20Manufacturing%20Materials%20Processes%20and%20Systems%204th%20Edition.pdf>

## SCHOOL CORE

Course Code	Course Title	L	T	P	S	C
<b>22AI105001</b>	<b>DESIGN THINKING</b>	-	1	2	-	2
<b>Pre-Requisite</b>	-					
<b>Anti-Requisite</b>	-					
<b>Co-Requisite</b>	-					

**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

**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 Mapping Table:

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

**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.

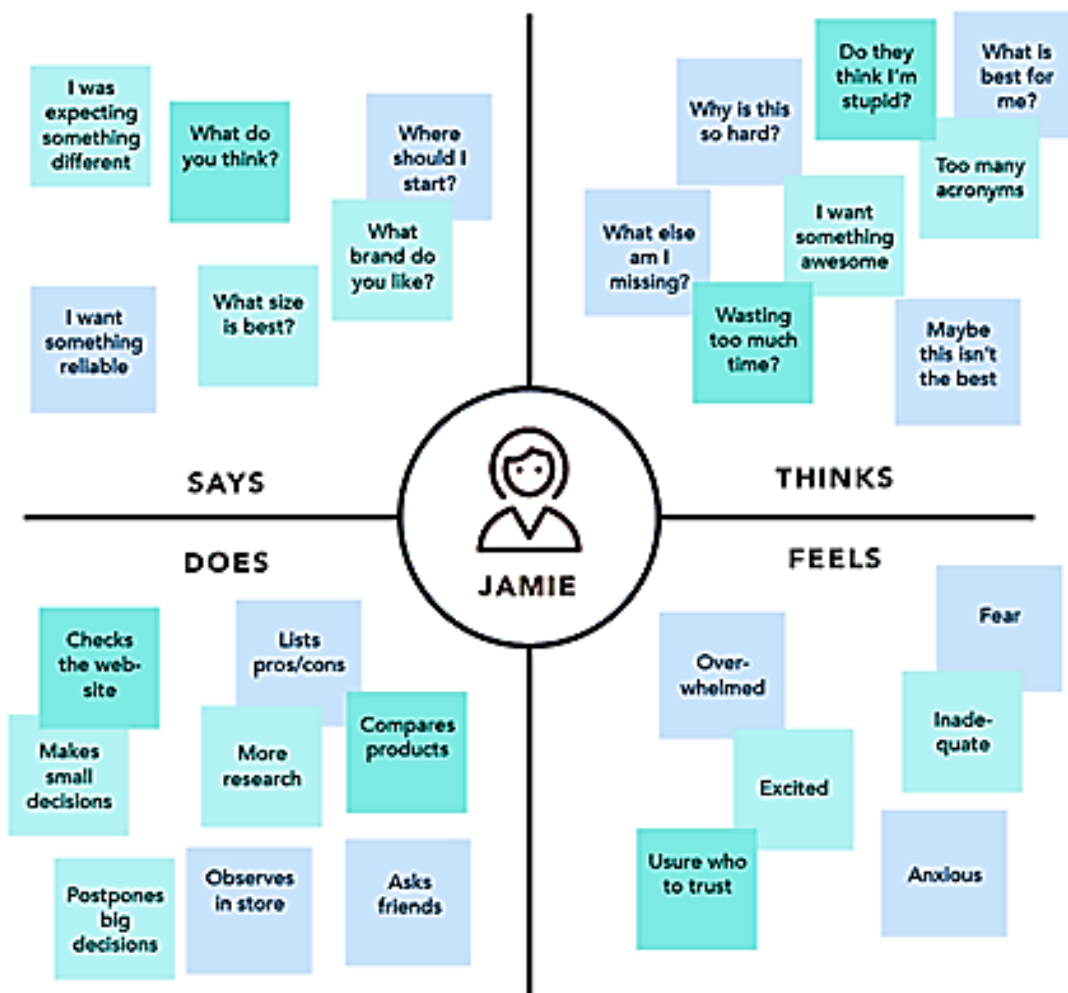
1. Conduct survey and identify the problem by either individual or group and frame a problem statement using AEIOU (Activities, Environment, Interactions, Objects, Users) framework.
2. Identify demographic or focus group for problem statement and create persona and explicitly define the characteristics of persona using Canva tool.

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

1. 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).
2. Create an Empathy Map using Coggle design thinking tool.

Sample Empathy Map:

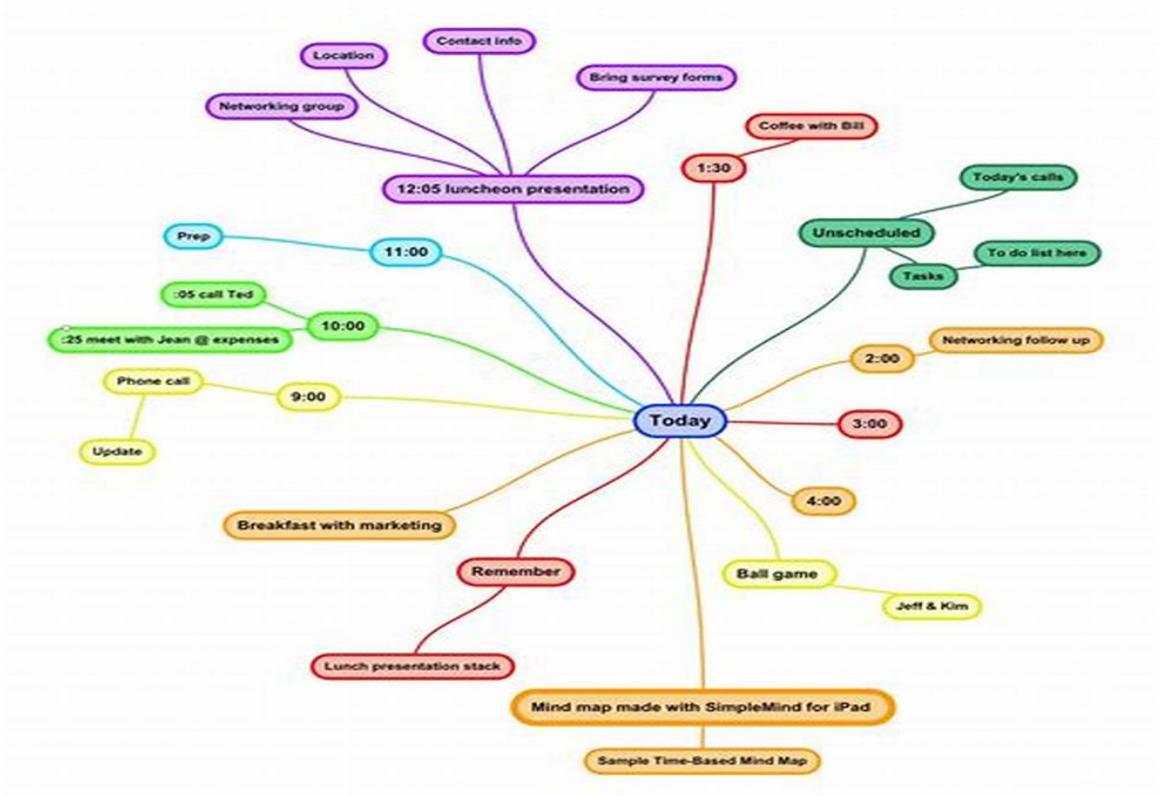
### EMPATHY MAP *Example (Buying a TV)*



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

1. 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.
2. Create Mind Map for your problem statement using Coggle.

Sample Mind Map:



3. 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.

1. Create an application prototype for product recommendation using **Marvel POP Software**.
2. Create a **low-fidelity paper prototype** by sketching out the product design and adding relevant functionality.
3. 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.

<b>What worked?</b>	<b>What could be improved?</b>
<b>Questions</b>	<b>Ideas</b>

## 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 Mc Graw Hill, First 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/>

### 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](https://www.mindtools.com/pages/article/newCT_02.htm)

## SCHOOL CORE MANDATORY COURSE

Course Code	Course Title	L	T	P	S	C
<b>22CE107601</b>	<b>ENVIRONMENTAL SCIENCE</b>	2	-	-	-	2
<b>Pre-Requisite</b>	-					
<b>Anti-Requisite</b>	-					
<b>Co-Requisite</b>	-					

**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
<b>CO1</b>	3	3	-	2	-	1	1	-	-	-	1	-
<b>CO2</b>	3	3	-	2	-	1	1	1	-	1	-	-
<b>CO3</b>	3	3	-	2	1	1	1	1	-	-	-	1
<b>CO4</b>	3	3	-	3	-	1	1	1	-	1	-	-
<b>CO5</b>	3	3	-	2	1	1	1	1	1	-	-	-
<b>Course Correlation Mapping</b>	<b>3</b>	<b>3</b>	<b>-</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>

**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. Course instructor may change the activities and the same shall be reflected in course handout)

## **RESOURCES**

### **TEXT BOOKS:**

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

### **REFERENCE BOOKS:**

1. Cunningham, W. P. and Cunningham, M. A., *Principles of Environmental Science*, Tata McGraw-Hill Publishing Company, New Delhi, 8<sup>th</sup> Edition, 2016.
2. Benny Joseph, *Environmental Studies*, Tata McGraw-Hill, 2<sup>nd</sup> 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, 3<sup>rd</sup> 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](https://www.tutorialspoint.com/environmental_studies/environmental_studies_environment.htm)