1. F.E Syllabus

Preface:

SEM I

Theme: "Engineering Foundations for Sustainable Futures"
Aligned with **UNSDG 4 – Quality Education, UNSDG 7: Affordable and Clean Energy, UNSDG 9: Industry, Innovation, and Infrastructure**. **UNSDG 12 – Responsible Consumption and Production**

Keywords: **core technical proficiency**, **hands-on learning**, and **computational thinking**

The theme "Engineering Foundations for Sustainable Futures" is a powerful and relevant framework for engineering education, deeply intertwined with the United Nations Sustainable Development Goals.

UNSDG 12: – Responsible Consumption and Production

- **Comprehensive Skill Development**: Projects under SDG 12 encourage students to apply a range of technical skills including mechanical design, electronics, software development, environmental science, and data analysis. These hands-on, real-world challenges help cultivate problem-solving, project management, teamwork, and innovation skills vital to future engineers.
- **Relevance and Future-Proofing**: With increasing regulations and global attention on sustainability, engineers who understand and implement responsible production strategies are highly valued. These projects expose students to global sustainability frameworks and prepare them for careers in green technology, sustainable infrastructure, and circular product design.
- **Innovation and Creativity**: Solving the challenges of sustainable production often requires out- of-the-box thinking. Students are encouraged to innovate by designing biodegradable products, improving recycling mechanisms, and rethinking traditional manufacturing systems in eco- friendly ways.
- **Interdisciplinary Approach**: SDG 12-based projects blend concepts from materials science, mechanical and electrical engineering, environmental studies, design thinking, and digital tools. This integrated learning fosters collaboration across disciplines, encouraging holistic problem- solving approaches that mirror real-world scenarios.

UNSDG 7: Affordable and Clean Energy

- **Renewable Energy Technologies:** Core technical proficiency provides the fundamental knowledge for understanding and developing renewable energy sources like solar, wind, geothermal, and hydropower. Hands-on learning allows students to build and test components of these systems, while computational thinking enables them to optimize their efficiency and integration into grids.
- **Energy Efficiency and Conservation:** Students learn to design systems and processes that minimize energy consumption. This includes optimizing building designs, developing more efficient manufacturing processes, and creating smart grids.
- **Energy Storage Solutions:** The theme supports the development of advanced energy storage technologies, crucial for the reliability of renewable energy sources. This involves understanding materials science, electrochemical processes, and computational modeling for battery design and management.

- **Policy and Economic Considerations:** While primarily technical, the theme indirectly promotes an understanding of the economic and policy landscapes surrounding affordable and clean energy, encouraging engineers to design solutions that are not only technically sound but also economically viable and accessible.

UNSDG 9: Industry, Innovation, and Infrastructure

- **Sustainable Infrastructure Design:** The theme promotes the design and construction of infrastructure that is resilient, resource-efficient, and has a minimal environmental footprint. This includes green buildings, smart cities, sustainable transportation networks, and water management systems.
- **Industrial Transformation:** Engineers with a strong foundation in this theme can drive innovation in industries by developing sustainable manufacturing processes, promoting circular economy principles, and integrating renewable energy into industrial operations.
- **Technological Advancement:** Computational thinking, in particular, drives innovation by enabling the development of advanced materials, AI-powered systems for resource optimization, and sophisticated simulations for testing new technologies before large-scale deployment.
- **Resilient Systems:** The focus on foundational engineering principles ensures that the innovations and infrastructure developed are robust and resilient, capable of withstanding environmental stresses and adapting to changing conditions. This is crucial for long-term sustainability.
- **Access to Technology:** By fostering a strong engineering foundation, the theme indirectly contributes to making technology more accessible and affordable, promoting inclusive industrialization and innovation.

Problem Statement: (^ problem statement based on theme)

Problem Statement 1: Simple Greywater Recycling for Gardens

Redirect and treat wastewater from sinks or bathrooms for gardening. Reduce freshwater use in urban homes and colleges..

Problem Statement 2: Composting Machine for College Canteen

Challenges with waste collection and disposal. Build a Prototype mechanical composter that processes daily food waste into fertilizer.

Problem Statement 3: Low-Cost Modular Bridge for Rural Roads

Design a scalable bridge model using bamboo or recycled plastic.

Problem Statement 4: Mini Wind Turbine for Urban Homes
Design a compact wind turbine for use on balconies or rooftops.

Problem Statement 5: Urban Vertical Farming Unit
Create a compact hydroponic or vertical garden for city apartments.

Problem Statement 6: Renewable Energy Air Purifier for smoking zones.

Monitor key air pollutants in smoking zones, providing clean air with a purification system based on renewable energy sources.

F.E SEM I

R-2025- Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
16111101	Linear Algebra and Calculus	2	1	--	30	15	--	45	90	3

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT 1	IAT 2	IAT1 +IAT 2					
16111101	Linear Algebra and Calculus	20	20	40	60	2	25	--	125

Rationale:

In Mechanical Engineering, matrices and systems of linear equations are essential tools for solving problems in structural analysis, thermal systems, and robotics, where multiple interdependent variables must be handled efficiently. Eigenvalues and eigenvectors are crucial for understanding natural frequencies and modes of vibration in mechanical systems such as beams, shafts, and automotive components. Similarity and diagonalization simplify the analysis of dynamic systems, enabling faster and more accurate simulations of mechanical structures and machinery. Partial differentiation is widely used in thermodynamics and fluid mechanics to study changes in variables like pressure, temperature, and volume in multivariable systems. Finally, analytic functions in complex variables support applications in vibration analysis and heat transfer, particularly in solving Laplace's and Poisson's equations under boundary conditions. Together, these mathematical concepts form the analytical backbone for modeling, analyzing, and optimizing real-world mechanical engineering systems.

R-2025- Mechanical Engineering

Course Objectives:

1. To understand matrix operations for modeling mechanical systems like trusses and linkages.
2. To learn to solve linear systems that arise in statics, thermal systems, and fluid mechanics.
3. To understand Eigen concepts for studying vibrations and dynamic behavior of mechanical structures.
4. To study diagonalization for simplifying coupled mechanical systems and dynamic analysis.
5. To understand partial derivatives for evaluating multivariable thermodynamic and stress functions.
6. To understand analytic functions for solving potential problems in heat and fluid flow.

Course Outcomes:

1**.** Students will be able to apply matrix algebra and use SCILAB to analyze equilibrium and load distribution in mechanical components

2. Students will be able to solve linear systems and use SCILAB to model heat conduction, force balance, and fluid networks in mechanical systems

3. Students will be able to analyze mechanical vibrations and use SCILAB to determine natural frequencies and modes using eigenvalue techniques.

4. Students will be able to diagonalizable matrices and use SCILAB to decouple system equations and evaluate mechanical system stability.

5. Students will be able to use partial differentiation and use SCILAB to analyze and optimize processes in thermodynamics and elasticity.

6. Students will be able to apply analytic functions and use SCILAB to model ideal fluid flow and solve 2D steady-state heat conduction problems

Prerequisite:

1. Addition, multiplication, transpose, and inverse of a matrix**.**

2. Review of Complex Numbers-Algebra of Complex Numbers, Cartesian, polar and exponential form of complex number.

R-2025- Mechanical Engineering

DETAILED SYLLABUS

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	Matrices	Types of Matrices (Symmetric, Skew- symmetric, Hermitian, Skew-Hermitian, unitary, orthogonal matrices and properties of matrices).	05	CO1
		Rank of a matrix using Echelon form, reduction to normal form and PAQ form.		
		Application of matrices to Coding and De-coding		
		Self-learning Topics: 1. PAQ form for rectangular matrices. 2. Reduction to normal form. 3. Theorems on sum of symmetric and skew symmetric matrices and similar theorems. 4. Properties of transpose, conjugate of matrices	08	
II	System of Linear Equations	System of Linear homogeneous and non–homogeneous equations, their consistency and solutions using rank.	05	CO2
		Linear dependence and independence of vectors. Linear combination of vectors		
		Solution of a system of linear algebraic equations, by (i) Gauss Jacobi Iteration Method, (ii) Gauss Seidel Iteration Method.		
		Self-learning Topics: 1. Vector Spaces 2. Linear Transformations. 3. Rank -Nullity theorems.	07	

III	Eigen values and Eigen vectors	Eigenvalues & eigenvectors of all types of matrices (symmetric, skew symmetric, orthogonal, triangular) and its properties (without proof).	05	CO3
		Cayley-Hamilton Theorem (without proof), verification and reduction of higher degree polynomials		
		Self-learning Topics: 1. Quadratic forms. 2. Reduction to quadratic forms 3. Rank, signature and index of a quadratic forms	08	
IV	Similarity and diagonalization of matrix	Similar matrices, diagonalizable matrices, orthogonally diagonalizable matrices and functions of square matrix.	05	CO4
		Minimal polynomial, Derogatory and non-derogatory matrices.		
		Singular value decomposition (SVD)		
		Self-learning Topics: 1. Functions of Square Matrix 2. Orthogonally diagonalization.	07	
V	Partial Differentiation	Function of two and three variables, Partial derivatives of first and higher order. Differentiation of composite function.	05	CO5
		Maxima and Minima of a function of two independent variables.		
		Lagrange's Multiplier method with one condition.		
		Self-learning Topics: 1. Euler's Theorem on Homogeneous functions with two independent variables. 2. Euler's Theorem on Homogeneous functions with three independent variables.	07	

		3. Deductions from Euler's Theorem. 4. Total differentials 5. Implicit Functions		
VI	Complex Variables – Differentiation	Circular functions of complex number and Hyperbolic functions. Analytic function, necessary and sufficient conditions for f(z) to be analytic (without proof),		
		Cauchy-Riemann equations in Cartesian coordinates (without proof, Polar form not included)	05	CO6
		Milne-Thomson method to determine analytic function f(z) when real (u)or imaginary part (v) is given.		
		Harmonic function, Harmonic conjugate, and orthogonal trajectories.		
		Self-learning Topics: 1. Expansion of $\sin^n\theta$, $\cos^n\theta$ in terms of sines and cosines of multiples of θ and Expansion of sinnθ, cosnθ in powers of sinθ, cosθ. 2. Powers and Roots of a complex number. 3. Logarithm of Complex Number 4. Inverse Hyperbolic Functions. Separation of real and imaginary parts of all types of Functions.	07	

Text Books:

1. Grewal B. S.: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.

2. Kreyszig E.: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

3. Dass H. K.: "Higher Engineering Mathematics", S Chand & Company Ltd, 12th Ed., 2004.

4. Narayan S.: "Differential Calculus", S.Chand Publications, 30th Ed., 2005.

References:

1. Strang G.: "Linear Algebra and its Applications", Cengage Publications, 4th Ed. 2022.
2. Stewart J.: "Multivariable Calculus" Cengage Publications, 7th Ed., 2019.
3. Jain M.K., Iyengar SRK, Jain R K,: "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers, 6th Ed., 2007.
4. Bali N.P and Goyal M.: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
5. Williams G.: "Linear Algebra with Applications", Jones Bartlett Publishers Inc., 6th Ed., 2017.
6. Wylie C. R, Barrett L.C..: "Advanced Engineering Mathematics" McGraw Hill Book Co., New York, 6th Ed., 2017.
7. Ramana B.V.: "Higher Engineering Mathematics", Tata McGraw-Hill Publishing Company Limited, 1st Ed., 2006.
8. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education, 2015.
9. Lay D. C: "Linear Algebra and its Applications", Pearson Publishers, 4th Ed., 2018.
10. Pal S. & Bhunia S. C.: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016

Online References:

Sr. No.	Website Name
1.	https://www.math.ucdavis.edu/~daddel/linear_algebra_appl/Applications/applications.html
2.	https://onlinelibrary.wiley.com/doi/10.1155/2016/4854759
3.	https://archive.nptel.ac.in/courses/111/108/111108066/
4.	https://archive.nptel.ac.in/courses/111/104/111104092/

- IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of syllabus content must be covered in First IA Test and remaining 40% to 50% of syllabus content must be covered in Second IA Test.

Term work (TW) for 25 marks:

1. Batch-wise tutorials are to be conducted.

2. Students must be encouraged to write SCILAB Programs in tutorial class only. Each Student has to write **at least 5 SCILAB tutorials** (including print out) and **at least 10** class tutorials on entire syllabus.

3. SCILAB Tutorials will be based on entire syllabus.

The distribution of Term Work marks will be as follows –

1. Regularity and active involvement (Theory and Tutorial) 05 marks

2. Class Tutorials on entire syllabus 10 marks

3. SCILAB Tutorials 10 marks

R-2025- Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
1611102	Applied Physics	2	--	--	--	30	–	30	60	2

Course Code	Course Name	Theory					Term work	Practical	Tutorial	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)				
		IAT 1	IAT 2	IAT1 +IAT 2						
1611102	Applied Physics	20	20	40	60	2.5	--	--	--	100

R-2025- Mechanical Engineering

Rationale:

1 Engineering Physics provides a strong grounding in fundamental concepts like mechanics, electromagnetism, thermodynamics, and optics, which are essential for understanding the scientific basis of all engineering disciplines.
2. The syllabus supports key subjects in all branches—such as strength of materials in civil and mechanical, circuits in electrical and electronics, and semiconductor physics in computer and IT—ensuring a smooth transition to branch-specific learning.
3. Physics fosters logical thinking, mathematical modelling, and problem-solving skills that are crucial for engineering analysis, system design, and innovation in every branch of engineering.
4. Topics like quantum mechanics, nanoscience, and wave phenomena prepare students for future technologies and interdisciplinary fields such as AI, robotics, renewable energy, and smart infrastructure, relevant across all engineering domains.

Course Objectives:

1. To build a foundation of quantum mechanics needed for modern technology.
2. To demonstrate principles of interference in thin film and diffraction..
3. To provide students with a basic understanding of laser operation basics of Optical fiber and its use in communication technology.
4. To familiarize students with the generation and applications of ultrasonic waves and the principles of architectural acoustics for effective sound control in engineering environments.
5. To introduce the basic principles of sensors and familiarize learners with their role and applications in modern technological systems.
6. To introduce the fundamental concepts of nanoscience and nanotechnology, enabling students to understand nanoscale phenomena

Course Outcomes:

1. Learners will be able to RELATE the foundations of quantum mechanics with the development of modern technology
2. Learners will be able to DEVELOP understanding of interference and diffraction; connect it to few engineering applications.
3. Learners will be able to ILLUSTRATE and APPLY the use of laser and OFC in engineering applications

4. Learners will be able to EXPLAIN the working of ultrasonic wave generators and apply acoustic principles to analyze and design acoustically efficient spaces.
5. Learners will be able to IDENTIFY the fundamentals of sensors and their applications in Advanced Technology.
6. Learners will be able to DESCRIBE the significance of nanoscience and nanotechnology, its applications.

Prerequisite: (For Theory **Course)**

1. Basic concepts of optics, including reflection, refraction, and interference using wave front analysis.
2. Application of Huygens' Principle and Snell's law in understanding light propagation.
3. Introduction to modern physics: dual nature of radiation, photoelectric effect, and matter waves.
4. Davisson–Germer experiment demonstrating wave nature of electrons.
5. Fundamentals of semiconductors: intrinsic and extrinsic types, electrical conductivity and resistivity.
6. Essential mathematical tools: vector algebra and partial differentiation used in physical analysis.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
	PREREQUISITE	Basic knowledge of optics and atomic structure, Wavefront and Huygens principle, reflection and refraction, Interference by division of wavefront, Refractive index of a material, Snell's law, Dual nature of radiation, Photoelectric effect, Matter waves, Davisson-Germer experiment. Intrinsic and extrinsic semiconductors, electrical resistivity and conductivity concepts,Basic understanding of wave motion, sound waves, oscillations, magnetism, and electric fields is	–	–

		essential to grasp concepts like ultrasonic wave generation and acoustics.		
I	QUANTUM PHYSICS	Introduction (Matter waves, De Broglie hypothesis, Wave Packet). Concept of Phase velocity and group velocity and relation with particle velocity. Heisenberg Uncertainty Principle. Wave function; Physical interpretation of wave function. Schrodinger's time dependent wave equation; time independent wave equation; Particle trapped in one dimensional infinite potential well. Basics of Quantum Computing. Concept of Qubits, Quantum Superposition Quantum Entanglement.	06	CO 1
		Self-learning Topics: Quantum Tunneling and real-life examples Operators in Quantum Mechanics (basic idea) Quantum States and Measurement concept Basic Quantum Gates (NOT, Hadamard, CNOT) Quantum Teleportation (concept only) Quantum Cryptography and secure communication	06	
II	OPTICS FOR ENGINEERS	Thin Film Interference: Introduction (division of amplitude & Stoke's relation) Interference in thin film of constant thickness in reflected light, Formation of colors in thin film; Interference in Wedge shaped film in reflected light; Formation of Newton's rings; Applications (Anti Reflecting & High reflecting films) Diffraction: Introduction to Fraunhofer diffraction at single slit, Amplitude equation of	05	CO 2

		double slit, Diffraction Grating (N slits), Determination of wavelength of light using plane transmission grating and numerical.		
		Self-learning Topics: Concept of Antireflecting coating, Highly reflecting films, Uses of Thin films, Measurement of optical flatness. Determination of refractive index of liquids using interference, Determination of wavelength of light using plane transmission grating and numerical,.	05	
III	LASERS, AND FIBER OPTIC SYSTEM	Laser: Spontaneous emission and Stimulated emission; Metastable state, Resonant cavity, Population inversion, three & four level lasers, types of pumping, Semiconductor Laser. Fiber optics: Structure of an optical fiber, Types: Single mode & Multimode, Step index & Graded index.	06	CO 3
		Self-learning Topics: Attenuation, Losses in Optical fiber due to Physics structure and Transmission of signal Application: Optical fibre Transmission, Holography, Barcode reader, LiDAR, Memory reading and writing applications.	06	
IV	SOUND AND ACOUSTICS	Ultrasonic Wave generation; Magnetostriction Oscillator; Piezoelectric Oscillator; Applications of ultrasonic: Eco sounding; NDT; ultrasonic cleaning(cavitation) ACOUSTICS: Conditions of good acoustics; Reflection of sound (reverberation and echo);	05	CO 4

		absorption of sound; absorption coefficient; Sabine's formula;		
		Self-learning Topics: Medical Imaging using Ultrasound (basic concept) Noise Pollution and Acoustic Insulation Application: Designing quiet spaces, sound proof rooms, urban noise control Design of Auditoriums (practical acoustic considerations) Application: Theater and hall design for clear sound quality	05	
V	PHYSICS OF SENSORS	Ultrasonic sensors: Ultrasonic transducer as distance meter, Strain gauges for stress measurement, LVDT for displacement sensing. Accelerometers for vibration and seismic monitoring.	03	CO 5
		Self-learning Topics: Thermocouples and RTDs (PT100) for temperature measurement.	03	
VI	NANOSCIENCE AND NANOTECHNOLOGY	Introduction to nano-science and nanotechnology, Surface to volume ratio, Two main approaches in nanotechnology -Bottom up technique and top down technique; Important tools in nanotechnology such as Scanning Electron Microscope, Transmission Electron Microscope, Atomic Force Microscope. Nano materials:	05	CO 6
		Self-learning Topics: Methods to synthesize nanomaterials (Ball milling, Sputtering, Vapour deposition, sol gel), properties and applications of nanomaterials.	05	

		Application:Lithography, Single Electron Transfer (SET), Spin Valves.		

Text Books:

1. A Text book of Engineering Physics -Dr. M. N. Avadhanulu, Dr. P. G. Kshirsagar, S. Chand, Revised Edition 2014
2. Modern Engineering Physics - A. S. Vasudeva, S. Chand, Revised Edition 2013
3. Engineering Physics D. K Bhattacharya,PoonamTandon, Oxford Higher Education, 1st Edition 2015-16
4. Engineering Physics -R. K. Gaur,S. L. Gupta, DhanpatRai Publications, 2012
5. Engineering Physics -V. Rajendran, McGraw Hill Educations, 2017
6. A Textbook of Nanoscience and Nanotechnology, T. Pradeep Tata McGraw Hill Education Pvt. Ltd., 2012

References:

1. Concepts of Modern Physics - ArtherBeiser, ShobhitMahajan, S. Choudhury, McGraw Hill, 7th Edition 2017
2. Fundamentals of optics - Francis A. Jenkins, Harvey E. White, McGraw Hill Publication, India, 4th Edition
3. Fundamentals of Physics, Halliday and Resnick, Wiley publication
4. Nanotechnology- Principles & Practices- Sulabha K. Kulkarni

Online References:

Sr. No.	Website Name
1.	1. https://archive.nptel.ac.in/courses/115/102/115102124/
2.	2. https://archive.nptel.ac.in/courses/115/102/115102025/
3.	3. https://archive.nptel.ac.in/courses/115/105/115105132/

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) Notional Learning Hour/30
16121103	**Engineering Mechanics**	3	-	-	45	-	-	45	90	3

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration(in Hrs)			
		IAT 1	IAT 2	IAT1 +IAT 2					
16121103	**Engineering Mechanics**	20	20	40	60	2.5	--	--	100

Rationale:

Engineering mechanics is a branch of science that deals with the behaviour of solid bodies when subjected to external forces or loads and the effects of these forces on the bodies. Though traditionally software-focused, Computer and IT engineers increasingly interact with physical systems through areas like robotics, virtual reality, gaming, digital twin technology, and simulation. Engineering Mechanics introduces the physical principles of force, motion, and equilibrium, which are essential for the development of realistic simulation engines, AI-based mechanical system models, and integration of software with hardware systems. This subject helps build computational models of mechanical phenomena and enhances interdisciplinary competence for modern applications.

Course Objectives

1	To acquaint with basic principles of Centroid and Moment of Inertia and its real-life significance
2	To familiarize with the concepts of force, moment, couple, resultant and system of coplanar and non-coplanar forces.
3	To familiarize with the concepts loads, beams, equilibrium conditions, friction and their real-life applications.
4	To understand the motion parameters required for quantification of Kinematics of Particle and Rigid body.
5	To understand the combination of force and motion parameters required for quantification of Kinetics of rigid body.
6	To acquaint with the basics of Robot kinematics

Course Outcomes

1 Demonstrate the understanding of Centroid and MI and locate the same.
2 Determine the resultant and equivalent force-couple system for a given system of forces.
3 Illustrate the concept of loads, supports, beams, conditions of equilibrium and apply the same in real life application to specific type of friction, estimate required force to overcome friction, and apply the equilibrium for trusses.
4 Determine the position, velocity, and acceleration of particle and rigid body using principles of kinematics for rectilinear, curvilinear and general plane motion.
5 Apply the principles of force and acceleration, work-energy and impulse- momentum to particles in motion.
6 Establish the relation between robot joints and parameters

Prerequisite: Student shall have passed HSC (Higher Secondary Certificate) along with basic understanding of physics and mathematics in following topics:-

1. **Basic Vector Algebra**
   – Understanding of vector addition, subtraction, scalar and vector products.
   – Ability to resolve vectors into components.
2. **Fundamentals of Classical Physics**
   – Concepts of force, motion, Newton's laws, equilibrium, and gravity.
   – Understanding of mass, weight, friction, and types of motion.
3. **Basic Trigonometry and Geometry**
   – Familiarity with sine, cosine, tangent functions.
   – Knowledge of angles, triangles, and coordinate systems.
4. **Problem-Solving and Logical Reasoning Skills**
   – Ability to approach real-world physical problems logically.
   – Basic analytical thinking and spatial reasoning.

Detailed Syllabus

Module no.	Module Name	Detailed content	Teaching hours	CO
0	**Prerequisite**	Statics, Dynamics, Kinetics, Kinematics, Rigid body, Deformable body, applying trigonometric functions, resolution of a vector (Force vector), Law of triangle, Polygon law of forces, Newton's laws of motion Velocity, acceleration, displacement, Uniform velocity and accelerated motion, Law of conservation of Energy, Law of conservation of Momentum, work-energy principle, impulse and momentum principle, and Coefficient of restitution		
1	**Centroid and Moment of Inertia**	i. Characteristics, and real-life significance for Centroid ii. Centroids of primary geometrical shapes and plane laminas	06	CO1

		iii. MI for primary geometrical shapes and plane laminas **Self-learning topic:** - Explore Center of gravity of simple solid objects - Apply parallel and perpendicular axis theorem for MI with simple geometrical shapes	06	
2	**Force and System of Forces**	i. Principle of transmissibility, Moment of force about a point and concept of couple ii. Classification of force systems iii. Resultant of coplanar system of forces and Varignon's Theorem iv. Resultant of non-coplanar system of forces **Self-learning topic:** - Exploring force and a couple system and real-life application of a force and a couple system - Resultant of non-coplanar parallel and general system of forces	07 07	CO2
3	**Equilibrium and Application of Equilibrium**	i. Conditions of equilibrium for system of forces and free body diagrams, Types of beams, loads, and support and its reaction ii. Equilibrium of beams, rollers, and system of bodies iii. Fundamentals of truss structures, Laws of friction. Cone of friction. angle of repose, and angle of friction iv. Application of equilibrium with friction on blocks on horizontal and inclined planes and ladders v. Application of equilibrium with trusses structures (Numerical on Method of joints and Method of section) **Self-learning topic:** - Equilibrium of connected bodies (beam and sphere), two force and three force members - Equilibrium of non-coplanar system of forces - Application of equilibrium with friction - Wedge and block - Exploring the concepts of trusses and friction in real life problems	15 15	CO3

4	**Kinematics of particles and rigid bodies**	i. Motion along plane curved path, Variable acceleration for rectilinear motion ii. Introduction to General plane motion, problem based on Instantaneous centre (ICR) method for general plane motion (up to 2 linkage mechanism and roller) **Self-learning topic:** - Application of motion graph for real-life problems - ICR for rollers, wheels and three links problems - ICR for system of rigid bodies	07 07	CO4
5	**Kinetics of particles**	- Introduction to D'Alembert's Principle (DAP), inertia force, dynamic equilibrium, Work done by active forces, impact and collision - Problems on DAP (single and double block), and WEP (single block) **Self-learning topic:** - Application of WEP to the real-life problems - Explore the concept of impact and collision for rigid bodies	06 06	CO5
6	**Introduction to Robot Kinematics**	- Fundamental of Robot Mechanics, Degree of Freedom, D-H Parameters, robot kinematics (Forward) - Homogeneous transformation (limited to 2 DOF Serial robot) **Self-learning topic:** - Derive and Analyze - Manual derivation of forward kinematics using D-H parameters - Explore online simulation tools such as MATLAB Robotics Toolbox Online and refer https://kinematicsplayground.org/ - Solve 2 numerical problems involving: Assigning D-H parameters and finding of end-effector pose using transformation matrices	04 04	CO 6

Text Books:

1. Engineering Mechanics by A K Tayal, Umesh Publication.
2. Engineering Mechanics by Kumar, Tata McGraw Hill
3. Engineering Mechanics by Beer &Johnston, Tata McGraw Hill

References:

1. Engineering Mechanics by R. C. Hibbeler.
2. Engineering Mechanics by F. L. Singer, Harper& Raw Publication
3. Engineering Mechanics by Macklin & Nelson, Tata McGraw Hill

Online References:

Sr. No.	Website Name
1	https://archive.nptel.ac.in/courses/112/106/112106286/
2	https://archive.nptel.ac.in/courses/112/106/112106180/

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) Notional Learning Hour/30
16121104	**Basic Electrical and Electronics Engineering**	2		--	30	-	--	30	60	3

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT 1	IAT 2	IAT1 +IAT 2					
16121104	**Basic Electrical and Electronics Engineering**	20	20	40	60	2.5	--	--	100

Rationale: This course equips Mechanical and Civil Engineering students with essential knowledge of electrical and electronic systems that are increasingly integral to modern infrastructure. From energy-efficient HVAC and automated construction equipment to smart buildings and sustainable power systems, understanding electrical circuits, machines, and controls enables engineers to design, operate, and maintain advanced infrastructure. The subject aligns with NEP 2020 goals by fostering interdisciplinary skills and promoting sustainable and intelligent engineering practices in line with UNSDGs.

Course Objectives:

1. To provide a foundation in DC and AC electrical circuit behavior applied in industrial systems.
2. To introduce transformer operation and efficiency for energy management.
3. To understand electric motors used in construction, HVAC, automation, and tools.
4. To explain diode and transistor applications in sensors and smart infrastructure.
5. To foster engineering decision-making involving electrical safety and sustainable power use.
6. To encourage interdisciplinary learning and practical problem-solving aligned with NEP 2020 goals.

Course Outcomes:

By the end of the course, students will be able to:
1. **Apply** basic laws (Ohm's law, Kirchhoff's laws) and theorems (Thevenin, Norton, Superposition) to analyse electrical circuits used in buildings and machines.
2. **Analyze** the behaviour of AC circuits, resonance, and power factor to improve energy efficiency in infrastructure systems.
3. **Explain** the operation of transformers and their applications in power distribution systems used in construction sites, elevators, and HVAC systems.
4. **Illustrate** the working of electrical machines (DC/AC motors, BLDC) in elevators, cranes, pumps, and other mechanical equipment.
5. **Evaluate** the role of special purpose diodes (Zener, LED) and transistors in lighting, instrumentation, and automation in smart buildings and factories.
6. **Demonstrate** use of transistors in switching and monitoring systems.

Pre-requisite: Fundamentals of Physics and Mathematics

Detailed Syllabus:

Sr. No.	Module Name	Detail Topics	Hours	CO Mapping
0	**Prerequisite**	Resistance, inductance, capacitance, series and parallel connections of resistance, concepts of Voltage, current, power and energy and its units. Magnetic circuits, MMF, Magnetic field strength, Reluctance.		
1	**DC Circuits and Energy Optimization Techniques**	• Kirchhoff's Laws, Source transformation, Star-delta Transformation, • Mesh and Nodal Analysis, • Network theorems: Superposition, Thevenin's, Norton, Maximum Power Transfer	**10**	**CO1**

		Self-Learning: ● **Application of Thevenin's & Norton's theorems** in troubleshooting electrical systems in cranes, pumps, and automated gates ● **Mesh and Nodal Analysis** applications in renewable energy installations for buildings (solar + DC microgrids) ● **Maximum Power Transfer applications** in solar panel circuits for mechanical ventilation and green buildings		
2	**AC Circuits and Power Quality in Infrastructure**	● AC signal characteristics: RMS, phasors ● Series/Parallel RLC circuits ● Real, reactive, apparent power and resonance ● Introduction to three-phase voltages (only star/delta theory)	**12**	**CO2**
		Self-Learning: ● **Power factor improvement techniques** used in HVAC systems and elevators ● **Energy-efficient design** of electrical distribution in large mechanical workshops and construction sites ● **Three-phase motor selection and balancing** in cranes, hoists, and conveyor systems ● RLC circuit applications	12	
3	**Single-Phase Transformers in Building and Utility Systems**	● Working principle, types, ideal vs practical transformer ● Losses, efficiency, application in SMPS, UPS	**04**	**CO3**
		Self-Learning: ● **Safety codes and guidelines** for transformer installations at industrial and construction sites ● Role of transformers in solar PV installations ● **Isolation transformers** for sensitive instruments	04	
4	**Electric Machines in Construction and Mechanical Systems**	● Overview of DC Motors, 1-Φ & 3-Φ Induction motors ● Introduction to **BLDC motors** used in robotics, drones, printers	**05**	**CO4**
		Self-Learning: ● **Energy-efficient motor selection** for HVAC, lifts, and pumps (impact on operating costs) ● Recent trends in smart motor monitoring	05	

		• **Motor maintenance strategies** (predictive vs preventive maintenance)		
5	**Diodes in Energy Management and Smart Lighting**	• Zener Diode: Voltage regulation • LED: Principles and display usage • Clipping, clamping circuits (brief intro)	**04**	**CO5**
		Self-Learning: • Solar-powered LED lighting • **Low-voltage DC lighting systems** for sustainable buildings • **Zener diode-based voltage protection** for sensitive sensors	**04**	
6	**Transistors for Automation and Control in Engineering Systems**	• BJT and FET (intro only), Common emitter configuration • Transistors as switches and basic amplifiers • Applications in logic gates, switching regulators	**04**	**CO6**
		Self-Learning: • **Transistors in sensor interfacing** • Applications of BJTs and FETs in robotics and automation in mechanical workshops • **Design of basic logic circuits** for automation of construction machinery		

Text Books:

1. V. N. Mittal and Arvind Mittal "Basic Electrical Engineering" Tata McGraw Hill, (Revised Edition)
2. Vincent Del Toro "Electrical Engineering Fundamentals", PHI Second edition, 2011
3. Edward Hughes "Hughes Electrical and Electronic Technology", Pearson Education (Tenth edition)
4. D P Kothari and I J Nagrath "Theory and Problems of Basic Electrical Engineering", PHI 13th edition 2011.
5. M. Naidu,S. Kamakshaiah "Introduction to Electrical Engineering" McGraw-Hill Education, 2004.
6. B.R Patil "Basic Electrical Engineering" Oxford Higher Education.
7. Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky

References:

1. B.L. Theraja "Electrical Engineering "Vol-I and II
2. S.N. Singh, "Basic Electrical Engineering" PHI , 2011Book

Online Resources:

Sr. No.	Website Name
1	https://www.allaboutcircuits.com/
2	https://nptel.ac.in/courses/108/105/108105053/
3	https://www.electronics-tutorials.ws/
4	https://www.edx.org/course/circuits-and-electronics-1-basic-circuit-analysis
5	https://www.falstad.com/circuit/

R-2025- Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30)
		L	T	P	L	T	P	SL	Notional Learning Hour	
16121105	C and C++ Programming	3	--	--	45	--	--	45	90	3

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Practical / Oral	Total
		Internal Assessment Test (IAT)			End Sem Exam	Exam Duration in Hrs.			
		IAT-1	IAT-2	IAT-1 + IAT-2					
16121105	C and C++ Programming	20	20	40	60	2.5	--	--	100

Rationale:

The C and C++ Programming course serves as a foundational pillar for first-year engineering students across all branches by developing essential problem-solving and programming skills. It introduces students to both structured and object-oriented programming paradigms, fostering logical thinking and algorithmic design. As C is widely used in system-level programming and C++ forms the basis for modern software development, this course ensures students gain proficiency in writing efficient, modular, and scalable code. Its relevance spans all engineering disciplines, supporting applications in simulation, automation, modeling, and control systems. By laying the groundwork for advanced subjects like data structures, algorithms, and embedded

systems, the course prepares students for future academic and professional challenges in an increasingly digital and automated world.

Course Objectives:

1 **To introduce** the fundamentals of programming using C and C++, focusing on syntax, semantics, and program structure for developing simple, efficient solutions.
2 **To develop** the ability to apply control structures, functions, arrays, and strings in solving computational and real-world engineering problems.
3 **To enable** students to understand and implement user-defined data types such as structures, unions, and enumerations for effective data management.
4 **To build** foundational knowledge of pointers, memory management, and file handling to facilitate low-level programming and system-level applications.
5 **To provide** a conceptual and practical understanding of object-oriented programming features in C++, including classes, objects, inheritance, polymorphism, and abstraction.
6 **To prepare** students for advanced computing courses by enhancing their analytical thinking, debugging skills, and ability to write modular, maintainable, and reusable code.

Course Outcomes:

Upon successful completion of the course, the learner will be able to:

1. **Understand and apply** the basic concepts of C programming, including algorithm development, structured programming, data types, operators, control structures, and input/output operations, to develop simple programs.
2. **Apply and analyze** the concepts of functions, arrays, and strings in C to solve computational problems using modular and structured programming techniques.
3. **Apply and analyze** the use of pointers, structures, and file handling techniques to manage memory efficiently and perform structured data operations in C programming.
4. **Understand and apply** the fundamental concepts of object-oriented programming in C++, including classes, objects, encapsulation, constructors, and member functions to design modular programs.
5. **Analyze and apply** advanced object-oriented programming concepts such as polymorphism, inheritance, virtual functions, and abstraction in C++ to develop flexible and reusable software components.

6. **Understand and evaluate** best programming practices, debugging techniques, and industry standards like MISRA guidelines, and **relate** C/C++ programming to real-world applications and emerging technologies.

Prerequisite: Nil.

Detailed Syllabus:

M. No.	Module Name	Detail Topics	Hours	CO Mapping
0	**Prerequisite**	• Basic familiarity with **fundamental mathematical** and **logical reasoning skills**. • **Understanding of basic computer operations** – such as using a keyboard, mouse, operating systems, and file handling. • **Logical thinking and problem-solving ability** – including flowcharting, algorithmic thinking, and basic decision-making. • **Basic English comprehension skills** – to read and write code, understand syntax, and follow programming logic.	**--**	**--**
1	**Fundamentals of C Programming**	• Introduction to Programming, algorithms and Flowcharts • Program Development Life Cycle (PDLC) - Structure of a C Program, Compilation, Execution • Concepts of Structured Programming in C • Data Types, Program Statements, Token, Identifiers, Keywords, Constants, Assignment, Declaration and Initialization, Variables, Operators and Expressions, Lvalue and Rvalues, • Input/Output Functions, Type Conversion and Typecasting • Control Structures: if, else, switch-case, loops (for, while, do-while), break, continue, goto	**8**	**CO1**

		Self-Learning Topics: • Write-up on history and evolution of programming languages • Practicing Non-Formatted Input & Output functions – getchar( ), putchar( ), getch( ), getche( ), putch( ), gets( ), puts( ) • Practicing Formatted Input & Output functions – printf( ) - % Format specifiers, formatting the output, escape sequences, Runtime adjustment and precision – Input Function scanf() – format specifiers, formatted input. • Preprocessor Directives in C • Implement pattern generation programs and logic puzzles • Research: Role of C in Embedded Systems • Practicing program development logic using Combines Multiple Control Statements: Number guessing game, ATM simulation program, Login system with 3 attempts limit, **Magic** number finder, Menu-driven bank management functions	**8**	
2	**Functions, Arrays, and Strings**	• **Functions:** Prototype Declaration, Definition, Function Calling, Passing Parameters to the Function, Scope of Variables, Call by Value. • **Storage Classes:** auto, static, register, extern • Recursive Functions, Recursion Vs Iteration • **Arrays**: 1D, 2D Arrays – Declaration, Initialization, Accessing Array Elements, Operations on Arrays, Applications • **Strings**: Declaration, Initialization, String Operations, Array of Strings, String manipulation Functions in string.h	**8**	**CO2**

		Self-Learning Topics: • Sorting an array, Binary searching • Declaration and Initialization of a Multidimensional Array • Matrix addition, multiplication • Arrays of strings: Two-dimensional character array • Passing Arrays to Functions • Character manipulation in the String using character functions in <ctype.h> • Implement recursive solutions (e.g., Fibonacci, Tower of Hanoi) • Comparison of recursion and iteration (mini presentation) • Industry application: Use of arrays/strings in data processing	**8**	
3	**Pointers, and Structures**	• **Pointers:** Basics, address operator (&), Declaring & initializing Pointer Variables, Indirection Operator and Dereferencing, Pointer Expressions and Pointer Arithmetic, Types of Pointers, Pointer to Pointers, Pointers and Arrays, Call. by value vs Call by address. • **Dynamic Memory Allocation** (malloc, calloc, realloc, free) • **Structures and Unions**, Declaring Structures and Structure Variables, Accessing the members of a structure, Initialization of Structures, typedef, Nested Structures, Arrays of Structures,	**7**	**CO3**
		Self-Learning Topics: • Call by address using pointers, returning more than one value from a function, returning pointer from a function, structures and pointers, passing structure to function • Structure versus Union, Enumeration types • Processing binary files	**7**	

		• Write mini programs for file encryption/decryption • Technical write-up: Memory leaks and how to avoid them • Tools: Memory debugging using Valgrind (demonstration/presentation)		
4	**Introduction to Object-Oriented Programming (C++)**	• Differences between Procedural and Object-Oriented Programming • Introduction to C++, Structure of a C++ Program • Classes and Objects, Standard input and output stream objects, Access Specifiers, Data hiding and Encapsulation, Array of Objects • Constructors and Destructors • Friend Functions, Inline Functions	**7**	**CO4**
		Self-Learning Topics: • Explore syntax differences between C and C++ • Implement class-based programs (Employee Management System, Account Management banking system, Addition of Complex Numbers, student management) • Defining the member functions outside the class • Research: Applications of OOP in industry tools (e.g., game development, simulations)	**7**	
5	**Advanced OOP Concepts (C++)**	• **Inheritance:** Creating a Parent-Child relationship between Classes, Types of Inheritance, Implementing Multilevel and Hybrid Inheritance • **Polymorphism:** Introduction of Polymorphism, Types of Polymorphism • **Compile time Polymorphism:** Function overloading, operator overloading, Rules for operator overloading	**8**	**CO5**

		• **Run time polymorphism:** Virtual functions, rules for virtual functions, pure virtual function.		
		Self-Learning Topics: • Working of Constructors with Multiple Inheritance Creating a "String" data type – An example using Operator and function overloading • Create inheritance-based applications (e.g., employee hierarchy system) • Mini project proposal based on OOP concepts • Read and summarize advanced topics like Templates or Exception Handling	**8**	
6	**Industry Applications and Programming Practices**	• Best Practices in Programming: Modularization, Comments, Code Reusability • Debugging Techniques, Error Handling • Applications in Embedded & Real-Time Systems • Introduction to Competitive Programming – Objectives, how it works, Benefits, platforms • Overview of Software Development Life Cycle (SDLC) • MISRA C and MISRA C++ Safe Coding Rules • Role of C/C++ in current technologies (AI, IoT, Game Development, System Software)	**7**	**CO6**
		Self-Learning Topics: • Research paper or technical write-up on advanced use of C/C++ (e.g., real-time systems, kernel dev) • Online platform practice (e.g., HackerRank, Codeforces, CodeChef, etc.) • Seminar/presentation on any emerging tech using C/C++	**7**	

Text Books

1. "Programming in C", by Pradeep Dey and Manas Ghosh, Oxford University Press.
2. “Object Oriented Programming with C++” by E. Balagurusamy, McGraw Hill Education**.**
3. "Basics of Computer Science", by Behrouz Forouzan, Cengage Learning.
4. "Programming Techniques through C", by M. G. Venkateshmurthy, Pearson Publications.
5. "Programming in ANSI C", by E. Balagurusamy, Tata McGraw-Hill Education.
6. "Let Us C", by Yashavant Kanetkar, BPB Publications.

Reference Books

1. "The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie,Prentice Hall.
2. “Programming: Principles and Practice Using C++” by Bjarne Stroustrup, Addison-Wesley
3. "C Programming: A Modern Approach" by K. N. King, W. W. Norton & Company.
4. "C Primer Plus" by Stephen Prata, Addison-Wesley Professional.
5. "Programming in C" by Stephen G. Kochan, Addison-Wesley Professional

Online Resources:

Sr. No.	Website Name
1	Learn C - This website offers a free, interactive tutorial to learn C programming, covering both basic and advanced topics.
2	Codecademy - Codecademy provides a comprehensive, interactive course for learning C, complete with real-world projects and skill paths.
3	Coursera - Coursera, in collaboration with Duke University, offers a specialization in C programming, including hands-on projects and a certificate upon completion.
4	edX - This course, offered by edX, covers C programming with a focus on Linux, including professional certification.

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30
16112106	Applied Physics Lab	--	--	1	--	--	1	–	15	0.5

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT 1	IAT 2	IAT1 +IAT 2				
16112106	**Applied Physics Lab**	--	--	--	--	25		25

Lab Objectives:

1. To BUILD a foundation of quantum mechanics needed for understanding and developing modern technology.
2. To DEMONSTRATE the principles of interference in thin films and relate them to optical phenomena.
3. To INTRODUCE the fundamentals of lasers and optical fibers along with their applications in communication technology.

4. To UNDERSTAND the working principle of an ultrasonic distance meter and to MEASURE distances using ultrasonic wave propagation.

5. To UNDERSTAND the operation of a Linear Variable Differential Transformer (LVDT) and to USE it for linear displacement measurement.

6. To EXPLAIN the basic operating principles of Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM), and to RECOGNIZE their applications in nanoscale material characterization.

Lab Outcomes:

LO1: Learners will be able to RELATE the foundations of quantum mechanics with the development of modern technology.

LO2: Learners will be able to DETERMINE the wavelength of light and EXPLAIN the interference phenomenon.

LO3: Learners will be able to ILLUSTRATE the use of lasers in applications and APPLY the fundamentals of fiber optics in modern communication technology.

LO4: Learners will be able to OPERATE an ultrasonic sensor to measure distance accurately and EXPLAIN its working based on the time-of-flight principle of sound waves.

LO5: Students will be able to INTERPRET voltage variation from the LVDT in response to physical displacement.

LO6: Learners will be able to EXPLAIN the working mechanisms of SEM and TEM and INTERPRET their role in analyzing surface morphology and internal structure of nanomaterials.

List of Experiments. (Minimum five experiments required)

Sr No	List of Experiments	Hrs	LO
01	Determination of Number of Lines in Diffraction Grating using He-Ne Laser	01	LO2
02	Determination of Radius of Curvature of Lens Using Newton's ring Set Up.	01	LO2
03	Determination of 'h' using LED/photocell	01	LO1
04	Determination of Divergence of LASER	01	LO3
05	Determination of Numerical of Aperture of OFC	01	LO3
06	Measurement LVDT for displacement sensing.	01	LO5

07	Determine RTDs (PT100) for temperature measurement.	**01**	**LO5**
08	Measurement of Distance using Ultrasonic Distance Meter.	**01**	**LO4**
09	Learning Basic operations of Scanning Electron Microscope and Transmission Electron Microscope	**01**	**LO6**

Text Books and References:

1. Ajoy Ghatak – ***Optics***
Excellent explanation of diffraction, laser interference, and grating equations.
2. C.L. Arora – ***B.Sc. Practical Physics***
Practical procedure and observation format for the experiment.
3. Jenkins & White – *Fundamentals of Optics*
4. Gerd Keiser – *Optical Fiber Communications*
5. R.S. Sedha – ***Applied Electronics***
6. Digital CMOS Design by Sung-Mo Kang

Online Resources:

Sr. No.	Website Name
1.	IEEE Xplore / Research Gate
2.	https://www.electronics-tutorials.ws/diode/diode_2.html
3.	https://circuitdigest.com.
4.	https://www.vlab.co.in/
5.	https://www.AMRITHA.vlab.co.in/

Assessment:

Term Work Marks: 25 Marks (Total marks) = 10 Marks (Experiment) + 10 Marks Project + 5 Marks (Attendance)

Project work: The project is to be completed within one semester. Students must execute the project as per the plan submitted at the beginning of the semester. The project outcome can be a working model, a simulation model, or a study report leading to the anticipated conclusion. Evaluation will be based on the quality of work and adherence to the submitted plan. A proper assessment rubric will be used for awarding marks.

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) Notional Learning Hour/30
16122107	**Engineering Mechanics**	-	-	2	-	-	30	-	30	1

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration(in Hrs)			
		IAT 1	IAT 2	Total.					
16122107	**Engineering Mechanics**	--	--	--	--	--	25	25	50

Lab Objectives:

1. To acquaint with basic principles of Centroid and its real-life significance
2. To familiarize with the concepts of force, moment, couple, resultant and system of coplanar and non-coplanar forces.
3. To familiarize with the concepts loads, beams, equilibrium conditions, friction and their real-life applications.
4. To understand the motion parameters required for quantification of Kinematics of Particle and Rigid body.
5. To understand the combination of force and motion parameters required for quantification of Kinetics of rigid body.
6. To acquaint with the basics of Robot kinematics

Lab Outcomes:

1. Demonstrate the understanding of Centroid locate the same.
2. Determine the resultant and equivalent force-couple system for a given system of forces.
3. Illustrate the concept of loads, supports, beams, conditions of equilibrium, and friction and apply the same in two dimensional systems with the help of FBD.
4. Determine the position, velocity, and acceleration of particle and rigid body using principles of kinematics for rectilinear, curvilinear, and general plane motion.
5. Apply the principles of force and acceleration, work-energy and impulse- momentum to particles in motion.
6. Establish the relation between robot joints and parameters

List of Experiments:

Minimum six experiments from the following list of which a minimum one should be from dynamics.

Sr. No.	List of Experiments	Hrs	CO mapping
1	Verification of Polygon law of coplanar forces (Universal force table apparatus)	02	CO2
2	Verification of the Principle of Moments (Bell crank lever)	02	CO2
3	Determination of Centroid of plane lamina made up of standard geometrical shapes	02	CO1
4	Determination of support reactions of a Simply Supported Beam.	02	CO3
5	Determination of coefficient of friction using inclined plane	02	CO3
6	Verification of the equations of equilibrium for non-concurrent non-parallel (General) force system.	02	CO3
7	Kinematics of particles. (Uniform motion of a particle, Projectile motion, motion under gravity)	02	CO4
8	Collision of elastic bodies (Law of conservation of momentum).	02	CO5
9	Kinetics of particles. (collision of bodies)	02	CO5

Sr No	List of Assignments / Tutorials	Hrs	CO mapping
01	Centroid and MI of composite plane laminas (6 Numerical)	01	CO1
02	Resultant of coplanar and non-coplanar system of forces (6 Numerical)	01	CO2
03	Equilibrium of beam, rollers, bodies on inclined plane with friction and ladders with friction (7 Numerical).	03	CO3
04	Kinematics of particles and rigid bodies (7 Numerical)	03	CO4
05	Kinetics of particles (5 Numerical)	01	CO5
06	Homogeneous transformation, and Direct Kinematics of robot (5 Numerical)	02	CO6
07	Resultant of Co-planar system of forces for concurrent system of forces using C programming language.	02	CO1
08	Equilibrium of beam for support reactions using C programming language	02	CO3

Assessment:

Term Work: Term Work shall consist of at least 06 practicals based on the above list. Also, Term work Journal must include all the assignments listed above.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical& Oral Exam: An Oral & Practical exam will be held based on the above syllabus.

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
16122108	**Basic Electrical and Electronics Engineering Lab**	-	-	2	-	-	30	-	30	1

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT 1	IAT 2	IAT1 +IAT 2					
16122108	**Basic Electrical and Electronics Engineering Lab**	-	-	-	-	-	25	25	50

Pre-requisite: Fundamentals of Physics and Mathematics

Lab Objectives:
Lab course aims to:

1. To **demonstrate** safe handling and measurement of electrical quantities using real-world instruments (voltmeter, ammeter, multimeter).
2. To **experiment** with DC and AC circuits and evaluate their behavior in energy-efficient systems.
3. To **visualize** the construction and operation of transformers and motors used in smart infrastructure and mechanical systems.

4. To **analyze** the application of diodes and transistors in lighting, control, and automation systems.
5. To **develop** a practical understanding of electrical systems integrated into buildings, machinery, and public infrastructure.

Lab Outcomes:

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

LO1: **Operate** and interpret electrical measuring instruments used in field applications and industry-grade machinery.

LO2: **Construct** and test basic DC and AC circuits and interpret the behavior of resistive, inductive, and capacitive loads..

LO3: **Demonstrate** the working of transformers and assess their role in decentralized and sustainable power distribution.

LO4: **Inspect** the construction and function of motors commonly used in HVAC, lifts, cranes, and water pumping systems.

LO5: **Use** diodes (Zener, LED) and transistors (BJT, FET) in control circuits for energy-efficient lighting and automation.

LO6: **Apply** safety protocols in handling and testing electrical systems in real-life civil/mechanical engineering contexts.

List of Experiments:

Sr No	List of Experiments	Hrs.	LO Mapping
1	Introduction to lab safety, measuring instruments (voltmeter, ammeter, DMM, oscilloscope).	2	**LO1**
2	Verification of mesh and nodal analysis using resistive networks.	2	**LO1**
3	Verification of Superposition, Thevenin's and Norton's theorems in DC circuits.	2	**LO1**
4	Analysis of single-phase RLC circuit to determine impedance and phase angle.	2	**LO2**
5	Observe three-phase voltage relationships in star and delta connections using simulation tools.	2	**LO2**
6	Demonstration of a cut-out section and working of a single-phase transformer.	2	**LO3**
7	To visualize and understand motor types used in mechanical systems	2	**LO4**
8	To study regulation capability of Zener diodes for stable power supply.	2	**LO5**
9	To explore LED behavior and suggest efficient lighting systems	2	**LO5**
10	To demonstrate transistor use in control and amplification.	2	**LO6**

11	Construct a common emitter amplifier and measure gain using a signal generator.	2	**LO6**
12	Optional: Design a Simple Relay-Based Automation Circuit	2	**LO6**

Online Resources:

Sr. No.	Website Name
1	All About Circuits (https://www.allaboutcircuits.com)
2	Circuit Lab (https://www.circuitlab.com)
3	Tinkercad (https://www.tinkercad.com)

Suggested assignments:

Sr. No.	List of Assignments(Any 6)	Hours
1	Solve numerical problems related to Mesh and Nodal analysis; include a task to simulate power-saving networks using simulation tools like Tinkercad/CircuitLab.	2
2	Assign real-world cases (like mobile chargers, IoT sensors) to relate theory with efficiency and power optimization.	2
3	Research and report on transformer use in smart grids and renewable energy systems. Include a simple design analysis of a power adapter.	2
4	Study use-cases of motors in electric vehicles, industry automation, and BLDC motors in smart homes. Include a comparative table of energy efficiency.	2
5	Assignment on Zener and LED diodes.	2
6	Explain BJT and FET in switching and amplification	2
7	**Case Study**: "Electrical Systems in Sustainable Campuses"	2
8	**Research Brief**: "Electronics Waste and Sustainability"	2

Assessment:

- **Term Work:** Term Work shall consist of at least 08 to 10 practical based on the above list. Also, Term work Journal must include at least 6 assignments.
- **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)
- **Practical & Oral Exam:** An Oral & Practical exam will be held based on the above syllabus.

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Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30)
16121105	C and C++ Programming Lab	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT 1	IAT 2	IAT1 +IAT 2				
16121105	C and C++ Programming Lab	--	--	--	--	25	25	50

Lab Objectives:

1. To introduce students to the fundamental programming constructs of C and provide hands-on experience with writing, compiling, debugging, and executing simple programs using an IDE.
2. To enable students to develop modular and efficient C programs by exploring functions, recursion, and arrays, enhancing their understanding of data management.
3. To familiarize students with advanced C programming concepts such as structures, pointers, dynamic memory allocation, for effective data storage and manipulation.
4. To provide comprehensive exposure to object-oriented programming in C++ focusing on classes, objects, constructors, destructors.

5. To deepen understanding of advanced object-oriented concepts in C++ including inheritance, polymorphism, virtual functions, and abstract classes for designing flexible software solutions.
6. To guide students in designing and implementing an object-oriented system in C++ that integrates key programming concepts for practical application.

Lab Outcomes: At the end of the course, the student will be able to

1. **Analyze and apply** fundamental programming constructs in C using Code::Blocks IDE to develop, compile, debug, and execute programs that implement input/output operations, operators, and control flow structures such as branching, looping, and nested decisions.
2. **Apply and evaluate** the use of functions, recursion, and arrays (including strings) in C programming to design modular and efficient programs that demonstrate data management and manipulation.
3. **Analyze and implement** advanced C programming concepts including structures, pointers with dynamic memory allocation, manage complex data efficiently in real-world applications.
4. **Apply and analyze** core object-oriented programming concepts in C++ including classes, objects, constructors/destructors, and implement polymorphism to develop reusable and efficient code.
5. **Analyze and implement** advanced object-oriented programming concepts in C++ including various inheritance types, virtual functions for runtime polymorphism, and abstract classes with pure virtual functions to create flexible and extensible software designs.
6. **Design, implement, and evaluate** a C++ object-oriented program that models an object-oriented system by applying advanced concepts for efficient data handling and processing.

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Suggested list of Experiments:

Sr No	List of Experiments	Hrs.
01	To understand the structure and features of the Code::Blocks Integrated Development Environment (IDE) and to use it effectively for writing, compiling, debugging, and executing C and C++ programs, which will serve as the foundational tool for all further experiments in the lab.	2
02	a) Program to demonstrate operations of Data Input and Output – getchar( ), putchar( ), scanf( ), printf( ), gets( ), puts( ) b) Program to demonstrate Operators-Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, other operators.	2
03	Program to demonstrate Branching - If statement, If-else Statement, Multiway decision.	2
04	Program to demonstrate Nested control structure- Switch statement, Continue statement, Break statement, goto statement	2
05	Program to demonstrate Looping – for and nested for loop	2
06	Program to demonstrate Looping – while, do-while	2
07	a) Implement an iterative function for factorial/ Fibonacci etc. b) Implement a recursive function for factorial/ Fibonacci etc.	2
08	Program to demonstrate Array 1D	2
09	Program to demonstrate Array 2D	2
10	Program to demonstrate String and arrays of string.	2
11	Program to demonstrate Structure: Write a program to store and display information of a student/employee etc. using structures a) Define a structure, b) Read and store details, c) Display the stored information.	2
12	Program to demonstrate call by value and call by reference.	2
13	Program to demonstrate the use of classes and objects, constructors and destructors in C++	2
14	Program to demonstrate Single, multilevel, and hybrid inheritance using classes	2
15	Create a system that stores and displays student records including name, roll number, marks for 3 subjects, and computes total marks, average, and grade. Implement the following: 1. A base class Person with attributes: name, roll_no 2. A derived class Student with: Subject marks (e.g., marks[3]) 3. Member functions to input and display data 4. Functions to calculate total, average, and assign grade 5. Use constructors for initialization and destructors to display a message upon object destruction. 6. Use function overloading for displaying summary (e.g., detailed vs	2

	short view). 7. Implement operator overloading (e.g., == to compare two students by roll number or marks). 8. Use virtual function in a base class ResultCalculator and override in Student class. 9. Use an array of objects to manage multiple student records.	

Sr No	List of Assignments / Tutorials	Hrs
01	Flowcharts for programs, input/output operations, operators, and control flow structures such as branching, looping, and nested decisions	2
02	Use of functions, recursion, storage classes, and arrays (including strings) in C programming	2
03	Structures, pointers with dynamic memory allocation	2
04	Core object-oriented programming concepts in C++	2
05	Advanced object-oriented programming concepts in C++ including various inheritance types, virtual functions for runtime polymorphism, and abstract classes with pure virtual functions	2
06	C++ object-oriented program that models an object-oriented system by applying advanced concepts for efficient data handling and processing	2

Text Books

1. "Programming in C", by Pradeep Dey and Manas Ghosh, Oxford University Press.
2. "Object Oriented Programming with C++" by E. Balagurusamy, McGraw Hill Education**.**
3. "Basics of Computer Science", by Behrouz Forouzan, Cengage Learning.
4. "Programming Techniques through C", by M. G. Venkateshmurthy, Pearson Publications.
5. "Programming in ANSI C", by E. Balagurusamy, Tata McGraw-Hill Education.
6. "Let Us C", by Yashavant Kanetkar, BPB Publications.

Reference Books

1. "The C Programming Language" by Brian W. Kernighan and Dennis M. Ritchie,Prentice Hall.
2. “Programming: Principles and Practice Using C++” by Bjarne Stroustrup, Addison-Wesley
3. "C Programming: A Modern Approach" by K. N. King, W. W. Norton & Company.
4. "C Primer Plus" by Stephen Prata, Addison-Wesley Professional.
5. "Programming in C" by Stephen G. Kochan, Addison-Wesley Professional

Online Resources:

Sr. No.	Website Name
1	Learn C - This website offers a free, interactive tutorial to learn C programming, covering both basic and advanced topics.
2	Codecademy - Codecademy provides a comprehensive, interactive course for learning C, complete with real-world projects and skill paths.
3	Coursera - Coursera, in collaboration with Duke University, offers a specialization in C programming, including hands-on projects and a certificate upon completion.
4	edX - This course, offered by edX, covers C programming with a focus on Linux, including professional certification.

Assessment:

- **Term Work:** Term Work shall consist of at least 10 to 12 practicals’ based on the above list. Also, Term work Journal must include at least 2 assignments.

- **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

- **Practical & Oral Exam:** An Oral & Practical exam will be held based on the above syllabus.

R-2025- Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30)
16612110	**IDEA LAB - (Innovation Design Engineering and Apply)**	1	--	2	15	--	30	15	60	2

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT 1	IAT 2	IAT1 + IAT 2				
16612110	**IDEA LAB - 1(Innovation Design Engineering and Apply)**	--	--	--	--	50	50	100

Rationale:

Aligned with the National Education Policy (NEP) 2020, the institution emphasizes experiential, interdisciplinary, and project-based learning through the IDEA Lab—a central hub for hands-on innovation.

To strengthen the undergraduate research ecosystem, the institution has adopted a theme-based academic model aligned with UN SGD. Each semester features six curated problem statements based on local need and aligned with core subjects in the same semester, enabling students to apply classroom knowledge to real-world challenges. Every student selects one problem and develops an individual, subject-integrated solution—enhancing both academic understanding and research skills.

The IDEA Lab supports this initiative with facilities for design thinking, prototyping, and product development. Students maintain a project logbook throughout the semester to track their progress and reflections.

To ensure academic accountability, a two-tier assessment framework is implemented:

- Project Assessment based on standardized IDEA Lab rubrics.
- Subject-Based Term Work Assessment focused on the application of same-semester subject knowledge in the project.

Lab Objectives:

1. To promote experiential and project-based learning that bridges theoretical knowledge with real-world problem-solving.
2. To encourage interdisciplinary integration by enabling students to apply concepts from multiple subjects within a single cohesive project.
3. To develop innovation and design thinking skills through hands-on activities and iterative solution development.
4. To foster critical thinking and creativity by engaging students in open-ended problems with multiple solution pathways.
5. To enhance communication, collaboration, and documentation skills essential for professional engineering practice.
6. To build an entrepreneurial and research mindset by guiding students to develop scalable, socially-relevant, and technically viable prototype

Lab Outcomes: Student will be able to

1. Recall and articulate key concepts from core and allied subjects relevant to the assigned project.
2. Explain the interdisciplinary nature of the problem and the role of each subject in addressing it.
3. Apply appropriate tools, techniques, and theoretical knowledge to develop project components.
4. Analyze problem constraints and user requirements to structure a feasible and efficient solution.
5. Evaluate multiple design options and justify the chosen solution based on technical and practical considerations.
6. Create a functional prototype or solution that demonstrates innovation, utility, and integration of interdisciplinary knowledge

1) Guidelines for IDEA Project

a) Project Guidelines (Interdisciplinary Project Execution in IDEA Lab)

- Each student works on an individual interdisciplinary project aligned with the semester theme.
- Faculty in-charges for the IDEA Lab are assigned according to the complexity of the project and the capacity of the respective departments.
- Faculty in-charges mentor both the academic and technical aspects, and track weekly progress.
- Project assessment will be rubric-based, ensuring depth, innovation, documentation, and ownership.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
- Faculty in-charges must attend relevant FDPs to ensure uniformity in mentoring and

evaluation.

b) Guidelines for same semester Subject Concepts Applied within the Project

- Termwork for each subject will partially reflect how well a student applies subject-specific concepts in their interdisciplinary project.
- Internal assessment panel will collaborate to align project components with subject learning outcomes.

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c) Role of Faculty In-Charges in IDEA Lab Projects

Faculty in-charges play a pivotal role in the success of interdisciplinary, theme-based projects under the IDEA Lab. Their responsibilities extend beyond technical supervision to include academic alignment, innovation facilitation, and active student engagement. Their key roles include:

1. **Motivating and Inspiring Students**
   - Encourage students to take ownership of their learning and projects.
   - Cultivate a mindset of curiosity, exploration, and social relevance.
   - Foster an environment where students feel empowered to take creative risks.
2. **Conducting Brainstorming and Ideation Sessions**
   - Organize structured brainstorming sessions at the start of the semester to help students define their problem statements and solution pathways.
   - Promote collaborative thinking, design exploration, and interdisciplinary integration.
3. **Arranging Guest Lectures and Expert Talks**
   - Identify and invite industry experts, researchers, and innovators for guest lectures aligned with the semester's theme or subject areas.
   - Facilitate exposure to real-world challenges, current trends, and future opportunities.
4. **Ensuring Uniqueness and Originality of Projects**
   - Actively review proposed ideas to ensure **no duplication of solutions** across students.
   - Encourage students to explore novel approaches, technologies, and perspectives.
5. **Promoting Discussion and Collaborative Learning**
   - Create platforms for students to present, discuss, and receive peer and mentor feedback.
   - Facilitate idea refinement through regular discussions and group engagement.

6. **Aligning Subject Content Beyond Syllabus**
    - Faculty in-charges must **align subject content beyond the syllabus of the same semester** with the **IDEA Lab theme and assigned problem statements**.
    - This ensures relevance, depth, and meaningful interdisciplinary integration.
7. **Same Semester Faculty Requirement**
    - Faculty in-charges must be teaching subjects in the **same semester** as the students' project to ensure seamless academic integration and contextual understanding.
8. **Monitoring and Documentation**
    - Oversee project logbook maintenance, milestone tracking, and submission of progress reports.
    - Provide ongoing feedback and ensure project alignment with learning outcomes.
9. **Coordination with Subject Faculty**
    - Work in collaboration with other subject faculty to help students embed theoretical and practical aspects of their coursework into the project.
    - Facilitate subject-term mapping and contribute to termwork assessment based on evidence.

2) Implementation Strategy

a) Project Implementation in IDEA Lab

Aspect	Implementation Strategy
Faculty in-charges	**Faculty in-charges assigned based on project nature and department capacity.**
Mentoring Role	**Faculty in-charges oversee academic/technical development, interdisciplinary integration, and timely documentation.**
Capacity Building	**Faculty in-charges undergo workshops on design thinking, innovation, assessment rubrics, and outcome-based mentoring.**
Assessment Contribution	**Faculty in-charges contribute to 25 marks allocated for the IDEA Lab project termwork. The remaining assessments are conducted by the external examiner.**
Recognition & Incentives	**Faculty in-charges receive workload credits or are formally acknowledged in performance reviews.**

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b) Implementation of Subject-Term Work Mapping within Projects

Aspect	Implementation Strategy
Mapping Subject Outcomes	**Faculty in-charges align their content beyond syllabus with the student's project by coordinating with the assigned project guide.**
Independent Evaluation	**Internal assessment panel evaluate students based on their application of subject-specific concepts within the project. This contributes to a** separate 25 marks allocated for termwork based on subject **application.**
Evidence Sources	**Evaluation is supported by project logbooks, subject-specific deliverables (e.g., tools, simulations, models), and review presentation inputs.**
Outcome Assurance	**Ensures practical demonstration of subject understanding and its integration into the interdisciplinary solution.**

Implementation Notes:

- Guide faculty assess their course's contribution using specific evidence such as:
  - Logbooks
  - Subject-specific outputs (e.g., simulations, designs)
  - Paper publications or review presentations

2) Guidelines for Assessment

Two-tier rubrics are applied independently to evaluate subject concept application and innovation within the project.

a) Assessment of IDEA Lab Projects (Individual Interdisciplinary Projects) (25 Marks)

Presentation-Based Assessment Structure (Total: 25 Marks)

Assessment Month	Weightage	Marks
Month 1 (Formative 1)	20%	5 marks
Month 2 (Formative 2)	40%	10 marks
Month 3 (Formative 3)	40%	10 marks

Rubric-Based Evaluation Criteria

Criteria	**Month 1 (5)**	**Month 2 (10)**	**Month 3 (10)**
Problem Understanding	Connects problem to subjects	Defines interdisciplinary scope	Demonstrates deep conceptual grasp
Subject Knowledge Application	Identifies relevant concepts	Applies principles in design	Integrates multiple subject areas correctly
Innovation & Design Thinking	Proposes creative idea	Develops and tests feasible solution	Final solution shows originality and utility
Documentation & Presentation	Logbook initiated, plan presented	Mid-design log and visuals	Final report and demo completed
Progress & Ownership	Meets deadlines, shows planning	Demonstrates self-motivation	Completes project independently with reflection

b) Term Work Assessment of Subject Concepts Applied in Projects (25 Marks)

Applicable to All Subjects Integrated with Interdisciplinary Projects

To reflect meaningful application of subject knowledge, each subject will be assessed through the following rubric:

Criteria	**Marks**	**Description**
Subject Knowledge Application	8	Depth and accuracy of concept integration into the project
Practical Design or Tool Usage	5	Use of subject-specific hardware/software/simulation/tools
Documentation	4	Quality and clarity of subject-related logs and reports
Viva/Presentation	4	Ability to explain subject's relevance and role in the project
Continuous Engagement	4	Evidence of consistent participation via logbooks and feedback

c) Total Assessment Structure

Component	Marks	Assessed By
Termwork – Project Execution	25 Marks	Project Guide
Termwork – Application of Subject Concepts	25 Marks	IDEA Lab Panel
Viva Voce (Final Evaluation)	50 Marks	External Examiner

R-2025- Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30)
16412111	Engineering Workshop I	--	--	2	--	--	30	15	45	1.5

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT 1	IAT 2	IAT1 +IAT 2				
16412111	Engineering Workshop I	--	--	--	--	25	—-	25

Lab Objectives:

1. To understand and apply the fundamental safety practices, rules, and precautions necessary for working in an engineering workshop environment.
2. To perform basic carpentry operations such as measuring, marking, cutting, chiseling, planning, and joining.
3. The objective is to enable students to understand the properties of sheet metal, practice precision in fabrication, and ensure adherence to safety procedures throughout the process.
4. To develop foundational skills in computer hardware assembly, maintenance, and troubleshooting, and managing computer networks.
5. To explore and develop proficiency in using Google Workspace tools and to create and publish a functional website using Google Sites.
6. To develop practical skills in using Microsoft Excel and to study and execute AI-powered features in Microsoft Excel.
7. To learn the basic concepts and perform steps of PCB fabrication in electronic circuits.

Lab Outcomes: At the end of the course, the student will be able to

1. Understand and follow standard safety rules and operating procedures for tools and machinery.
2. Able to Create basic carpentry joints (e.g., lap joint, mortise and tenon joint, dovetail joint) with proper fit and finish
3. Able to perform bending and folding operations to form the sides of a square tray with correct angles and dimensions.
4. Able to assembling and disassembling a personal computer and trouble shoot common hardware issues.
5. Able to navigate and utilize core google workspace and integrate google workspace tools into a google sites.
6. Able to use basic to advance excel function **and** to use AI-powered features in Excel
7. Able to understand basic components and demonstrate the process of PCB fabrication.

Detailed Syllabus

Sr No	Name of Module	Detailed content	Hours	Lo
	Safety and Precautions	Lab safety rules and personal safety rules.	**2**	**LO1**
1	**Fabrications**	Introduction to carpentry sections ● Introduction to carpentry tools, types of woods etc. ● TEE LAP joint experiment Introduction to Sheet metal section ● Introduction to sheet metal, materials and procedure etc. ● Square Tray Experiments.	**4** **4**	**LO2** **LO3**
		Self-Learning Tool Handling Techniques To study about the types of wood To study about different job in sheet metal To gain knowledge of tools and techniques used in Sheet metal process https://youtu.be/eoiwdcqHT8o?feature=shared https://youtu.be/jH8nSv-pNuw?feature=shared	**3**	
2	**Hardware and Networking**	Introduction to Computer Hardware ● Computer Fundamentals	**2**	**LO4** **LO5**

		Introduction to computers Types of computer Components of computer Input/output devices Storage devices ● Computer Hardware Motherboard architecture Processor types and features RAM types and installation Power supply and units Assembling a computer BIOS/UEFI Configuration Common Troubleshooting issues Installation of LINUX/WIN 11 (DUAL) VM WARE (Installation) Bootable PD (Installation) Google Workspace and Google Sites ● Introduction to google Workspace ● Gmail, Email etiquette, labels, filters ● Google Drive : Upload, organize, share ● Google Docs/slides:Collaborate in real time, insert images, comments and tables. ● Google Forms ● Getting Start with Google Sites ● Building basic website ● Creating Multiple pages Microsoft Excel For Engineers and integrate with AI ● Excel interface, data entry, formatting basics ● Formulas and fabrication ● Charts and graphs ● Data sorting and filtering ● Getting started with Excel ● Data Analysis and visualization ● AI in Excel	**2** **2** **2**	**LO6**
		Self-Learning **1.** Study and Report on Motherboard Components and Layout **2.** Create a Maintenance Plan for a Personal Computer	**6**	

		3. Research BIOS/UEFI Functions and Configuration Options (Provide screenshots and describe real-world use cases. **4.** Design a Small Office/Home Office **5.** Create and Share a Collaborative Google Doc **6.** Organize Files and Folders in Google Drive Design a Mini-Website for a School Club, Event, or Business Idea		
3	**Introduction to PCB**	Electronic Components and tools for measuring and debugging electronics circuits. ● Active and Passive components ● Breadboard to built simple circuits. ● Soldering Practices. ● Reading and interpreting circuit diagrams ● Multimeter ● Oscilloscope 8050 and DS0 ● Function generator ● Logic Probe/logic analyzer (demo) PCB Design and fabrication ● Wiring system ● Go-down wiring ● House Wiring ● Staircase wiring ● Introduction To PCB design Software ● Drawing a simple schematic PCB layout and routing techniques	**6** **6**	**LO7**
		Self-learning 1. Component Identification and Research (real –life example). 2. Resistor Color Code Practice (learn the resistor color code system) 3. Datasheet Study (Download the datasheet for any 1 component and identify write configuration) 4. Breadboard Familiarization (Watch a tutorial or read a guide on how a breadboard works.)	**6**	

Reference Books

1. A Course in Workshop Technology Vol. 1: Manufacturing Processes by B. S. Raghuwanshi
2. Elements of Workshop Technology Vol. 1: Manufacturing Processes by S. K. Hajra Choudhury & A. K. Hajra Choudhury
3. Complete PCB Design using or CAD Capture and PCB Editor by Kraig Mitzner.
4. Computer Hardware and Networking by Rajiv Chopra.
5. Google Sheets for Beginners: A Practical Guide to Mastering Google Sheets by Nathan George.
6. Google Workspace User Guide by Oliver Kent.

Online Resources

Sr No	Reference
1	https://onlinecourses.swayam2.ac.in/cec25_cs10/preview Computer Fundamentals, By Prof. Sanjay Tanwani.
2	https://onlinecourses.swayam2.ac.in/nou25_cs01/preview -CIT-001: Fundamentals of Computer Systems, By Dr. Mangala Prasad Mishra
3	https://onlinecourses.swayam2.ac.in/aic20_sp59/preview -ESim - EDA tool for circuit design, simulation, analysis and PCB design, By Prof Kannan Moudgalya
4	https://onlinecourses.nptel.ac.in/noc25_ee163/preview -Electronic Systems Design: Hands-on Circuits and PCB Design with CAD, By Prof. Ankur Gupta
5	https://onlinecourses.swayam2.ac.in/imb25_mg206/preview Excel for Finance - From Basics to Advanced, By Dr. Premalatha K P

Suggested list of Experiments:

Sr No	List of Experiments	Hrs.
01	Safety and precaution	2
02	TEE LAP Joint	4
03	Square tray	4
04	PCB Design and Fabrication	6

05	Assembling and dissembling of computer .(Demonstration)	2
06	To solve Common Troubleshooting problem solving.	2
07	Installation of LINUX/WIN 11 (DUAL) (Demonstration)	2
08	To create a google form for simple survey or quiz.	2
09	To create grade sheets or expense tracker	2

Assessment for Term Work (25 marks)

- **Term Work Marks:** 25 Marks (Total marks)
- **Job and Manual**:- 20 Marks
- **Regularity and active involvement:-** 5 Marks

R-2025Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C)
		L	T	P	L	T	P	SL	Notional Learning Hour	(Notional Learning Hour/30
98461112	Universal Human Values	2	-	-	30		-	30	60	2

		Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT 1	IAT 2	IAT1 +IAT 2					
98461112	Universal Human Values	-	-	-	-	-	25	-	25

Rationale: The goal of the education system is to cultivate well-rounded individuals who are capable of rational thinking and action, as well as empathy and compassion. It strives to nurture ethical values and principles, shaping responsible citizens who can contribute to creating an inclusive, equitable, and diverse society, as envisioned by our Constitution. Education should focus not only on intellectual growth but also on developing social, ethical, and emotional intelligence. Ultimately, education is essential for unlocking human potential and fostering a just and fair society. A fair combination of holistic and multidisciplinary education would develop human beings wide intellectual, deep aesthetic, social, physical, emotional, and moral in an integrated manner. UHV courses are intended to help students to develop a holistic, humane world vision for adopting fair technological advancements. The modules structured to be discussed are universal, rational, and verifiable, hence leads to harmony.

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Course Objectives:

1. To develop a holistic perspective based on self-exploration about them (human being),
2. To understand the meaning of harmony in relationship family with reverence and compassion
3. To explore a wide range of social networking ensuring mutual happiness and prosperity
4. To identify the urge to establish global peace and harmony to make the world a better place to live.
5. To understand the threats posed by human activities to biodiversity, and provide solutions
6. To develop understanding in implementing technologies to serve mankind.

Course Outcomes:

After successful completion of the course learner will be able:

1. Identify innate humanistic virtues and abilities as fundamentals to work as an individual.
2. Explore solutions to behavioral conflicts through family, a society in miniature with empathy.
3. Develop understanding to maintain human-human relationship for mutual happiness for building great teams.
4. Adapt for global pursuits in a peaceful co-existence with the entire mankind for global society uplift.
5. Acquire awareness of maintenance and conservation of biodiversity to provide sustainable solutions.
6. Evaluate the knowledge of 'Real Self ' augmenting universal human order to develop holistic technologies and creating congenial work environments.

Prerequisite: There is no prerequisite for this course.

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DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	There is no prerequisite for this course.		
I	Holistic Growth of Individual	Understanding the Human Being: Body, mind, and self – their roles and needs, Distinction between the self (conscious entity) and the body, Importance of self-reflection and self-awareness Developing clarity about personal goals and values, Emotional intelligence: managing thoughts and feelings. Lifestyle choices that support well-being Integrating knowledge with ethics and values **Self-Learning Topics**: Analyze yourself thoroughly and discover your personality traits: Behavioral, Habitual and Acquired traits and record the significance of the traits in handling diverse situations in your past and present life.	4 4	CO1
II	Self-Harmony & Family Values	Prosperity - a right identification of needs and fulfillment through right means What is *naturally acceptable* (permanent, universal) vs. what is acquired or conditioned. Family - a space for value cultivation and emotional support, Mutual fulfillment addressing Common Family Issues: Balancing individuality and togetherness, Misunderstandings due to Assumptions, Generational gaps and communication barriers. Trust empathy, and open communication in family relationships. Family as a Basic Unit of Society, Joint versus nuclear family structures and their social impact. **Self-learning Topics**: Importance of Respect and. Compassion in families, relations, neighborhood, how family harmony helps to progress and attain a worthy and respectable social and financial status. Togetherness and advancement, Conflict and resolution	4 4	CO2
III	Social Equilibrium	Human-Human relationship, Respecting others and their perspectives, Understanding the difference between *intention* and *competence.* Vision of a universal human order (Sarvabhauma Vyavastha) based on trust and mutual prosperity. Promotion of dialogue, cooperation, and peaceful coexistence. Individuals and groups work together for common goals and shared well-being. Visualizing a universal harmonious order in	5	

		society- Undivided Society, Universal Order from self to community Mutual Prosperity. Support and Empower marginalized communities **Self-Learning Topic:** A positive and unbiased Mediation and dialogue, and its importance Different communities' views for creating better communities & societies. Incidents happening around you which urgently require social equilibrium as a vision.	5	CO3
IV	Shared Values of Mankind	Values accepted and upheld by all human beings regardless of background, peaceful coexistence and global harmony. Role in addressing global challenges like conflict, inequality, and environmental crises, Philosophical and spiritual traditions worldwide. Human rights frameworks (e.g., Universal Declaration of Human Rights). Sensitizing individual towards Contemporary World Issues **Self Learning Topic:** India's relationships with other countries. Promoting peace and harmony hence preventing conflict situations. Conflict situations throughout the world where India as a one who maintained its integrity by following its traditional, philosophical and ethical standard.	6 6	CO4
IV	Human-Nature Relationship	Humans as caretakers of the Earth, not conquerors. Ethical choices like wildlife conservation, habitat preservation, and reducing pollution. Promoting humane treatment in agriculture, research, entertainment, and daily life. Sustainable living: reducing waste, recycling, and using renewable energy. Educating communities about the importance of biodiversity and ecosystem health. **Self-Learning Topics**: Practices adopted in ancient India for preserving the environment, Importance of rivers, trees, water mentioned in Indian scriptures and culture. Modern technologies/practices favoring ecosystem preservation. (Past Practices Vs, Present Practice)	6 6	CO5
VI	Integrating universal	Meaningful and Purposeful Work: Encouraging dignity in all types of jobs. Human creativity and contribution to society. Equal opportunities without discrimination. Prioritizing human well-being over mere profit.		

	human values in the workplace	Technical education is enriched with ethics and human-centric values. Ethical behavior includes not exploiting others for personal gain—whether as employers or consumers. Ability to identify and develop appropriate technologies and management patterns for production systems. Case studies of typical holistic technologies, management models and production systems. **Self-Learning Topics:** Contemporary workplace scenario Confronting challenges like globalization, technological advancement/disruption cultural diversity, workplace prejudice .unconscious bias. Hampering output and how universal human values helps erasing these complexities.	5 5	CO6

References:

1. Gaur, R. R., Sangal, R., & Bagaria, G. P. (2009). *A Foundation Course in Human Values and Professional Ethics*. New Delhi: Excel Books.
2. Ravindran, P. S. (2007). *Essence of Human Values and Professional Ethics*. Chennai: Sri Ramakrishna Math.
3. Gaur, R. R. (2011). *Human Values and Professional Ethics*. New Delhi: Dhanpat Rai Publishing Company.
4. Chitkara, M. G. (2002). *Education and Human Values*. New Delhi: A.P.H. Publishing Corporation.
5. Martin, M. W., & Schinzinger, R. (2005). *Ethics in Engineering* (4th ed.). New York: McGraw-Hill.
6. Gandhi, M. K. (1927). *The Story of My Experiments with Truth*. Ahmedabad: Navajivan Publishing House.
7. Vivekananda, S. (Compilation). (2001). *I and My Nation*. Kolkata: Advaita Ashrama.
8. AICTE (2020). *Towards a Holistic Development: A Collection of Good Practices in UHV*. New Delhi: All India Council for Technical Education.

Online References:

Sr. No.	Website Name
1.	https://uhv.org.in/

R-2025Mechanical Engineering

Term Work: 25 Marks

Assignments – 20 Marks

Attendance 5 Marks

Conduct Group Speaking Activities to explore and comprehend the basic human and global society issues.

(In group speaking activity, especially, conduct discussions on Contemporary World Issues, Contemporary workplace challenges enabling students to think and suggest solutions on humanitarian ground)

List of Assignments (Answer the questions about in 500 words)

1. Explain the process, content, and natural outcome of self-exploration with a neat diagram and two examples from your life.

2. Analyze the impact of compassion on mental health. Describe the role of family in the development of an individual.

3. Describe the concept of an undivided society and the universal order and explain how both these can help to create a world family.

4. What do we mean by holistic technologies, management models, and production systems? How are these useful for mankind?

5. Explain the concept of co-existence in nature. How can this understanding help in addressing environmental issues?

6. Design a program to promote respect in the workplace where people treat each other with respect and have equal opportunities for growth.

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Course Code	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C)
		L	T	P	L	T	P	SL	Notional Learning Hour	(Notional Learning Hour/30)
16421113	Strategic Communication & Management Skills	1	--	--	15	--	--	15	30	1

		Theory					Term Work	Pract Exam	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT 1	IAT 2	IAT1 +IAT 2					
16421113	Strategic Communication and Management Skills	20	20	40	40	1	-	-	80

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R-2025- Mechanical Engineering

Rationale:

The course has been redesigned specifically for mechanical and civil engineering students, equipping them with strategic oral and written communication skills necessary for today's enterprise and entrepreneurial environment. Students will learn to simplify complex engineering concepts and messages, understand key communication models. These skills are essential for mechanically and civilly focused professionals to confidently interact with project stakeholders, clients, and public audiences, while also reinforcing their organization's brand image and reputation through transparent and effective communication. The curriculum strengthens all four LSRW competencies—Listening, Speaking, Reading, and Writing—ensuring engineers communicate with clarity, confidence, and flair in professional contexts.

Course Objectives - The learners should be able to:

1. Effectively explore the dynamics of communication and navigate professional arenas
2. Competently acquire active listening skills by comprehending physical and digital content
3. Critically analyse communication barriers, audience and purpose to speak proficiently
4. Minutely comprehend extensive texts, technical and non-technical, to execute relevant tasks
5. Efficiently organize and create purposeful technical writing for professional transactions
6. Impact fully relate with other agencies with ethical standards to deliver synergistic solutions.

Course Outcomes - The learners will be able to:

1. Explore and adapt the dynamics of communication to navigate diverse professional arenas.
2. Acquire active listening skills by practicing different Speech Acts physically and digitally.
3. Analyse communication barriers, methods, audience and purposes for mastering eloquent and persuasive speaking.
4. Synthesize extensive technical and non-technical texts for reflective learning through reading and summarization.
5. Design digital, ethical technical and business content for professional transactions.
6. Advocate technical excellence and interpersonal acumen to disseminate relevant sustainable community solutions.

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R-2025- Mechanical Engineering

Prerequisite: Basic knowledge of English language

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Basic knowledge of English language.		
I	Communication Dynamics	Foundations of Communication Dynamics: Objectives Linear vs. Transactional Models Encoding, Decoding, and Feedback, Interpersonal Communication in Groups: Verba interaction : Meetings & Presentations, Teleconferences & Calls and Non-Verba Interactions: Proxemics, Haptics Oculesics Kinesics Digital Interaction: virtual teams, vide calls Formal and Informal communication Communication Channels . Barriers: Physical Semantic Psychological & Emotional Barriers Cultural & Contextual Barriers Silos mentality Hierarchical layers, Rigid policies, unclear channels, and outdated tech. **Self Learning Topics** Communication at Workplace &Outer Agencies Internal communications Regular email updates, Video conferencing and face to face sessions External Communication craft compelling narratives, multichannel fluency,Open dialogues, Trust and Transparency	5 5	CO1

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II	Active Listening	Active Listening: Discussions, and note-taking techniques. -book listening, Understanding colleagues' and clients during meetings Types of Listening Comprehensive Listening , Critical Listening and Reflective /Empathetic **Self-Learning Topics:** Listening kryptonite : Thought Distractions Semantic Jargons information overload, speaker pace, Pseudo listening & Interruptions Time Pressure, Fatigue/Emotions	2 2	CO2
III	Conversational Proficiencies	Technical Communication Skills Technical Discussion, delivering technical oral presentations inside and outside organizations Q&A, Design Review meetings, team coordination, troubleshooting and site visits **Self Learning Topics:** Mentoring and peer support , conflict resolutions and feedback conversations Grooming and Self Development: Interpersonal Engagement, Field and site interaction, Foster collaborations	2 2	CO3

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IV	Text Interpretation Expertise	Reading Proficiency Intensive Reading, ExtensiveReadingSkimming,Scanning,SQ5R Method *(Survey, Question, Reading, Recording, Recall, Review and Revise)*Industry Related Articles and Report, .Summarizing text to Graphic Organizers (GO) Cause and effect diagram, sequence chart and flow charts, Hierarchy or Tree Diagrams Problem–Solution Charts , Mind Maps Leveraging Online Resources Technical Reports ,Articles, Manuals, Product design specifications ,Tender documents, Infrastructure project reports **Self-Learning**: Manufacturing process flow descriptions, Technical proposals and feasibility reports, Professional and Industry News	2 2	CO4
V	Technical & Managerial Skills	Seven Cs of Business Writing Completeness, Conciseness, Consideration, Concreteness, Clarity, Courtesy, Correctness. Format & Types of Formal Letters : Cover Letter, Inquiry Letter Quotation/Order Letters Grievance Letter Short And Long Reports/ Proposals and business Cases Technical Manuals & Operating Guide Standard Operating Procedures (SOP) Tender notices **Self-Learning** : Studio Activities Content Creation for Social Media and e-Commerce Platforms Blogs, Vlog Keynote speeches Podcast titles Landing pages	3 3	CO5

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VI	Community Communication and Ethics	Communicating clearly with non-technical users and stakeholders Building supportive networks Promoting innovation and problem-solving Participating in user groups or tech meetups Gain encouragement and advice on technical or career challenges. Disaster management , Training of local public ,Rural Tech Projects Communication Transparency and Honesty Accountability Avoiding Misuse of Information Uphold **ethical standards** in all written, verbal, and digital communication. **Self-Learning** ethical decisions in materials sourcing or manufacturing, Client demo, Communicating during production failures, safety incidents, or delays	1 1	CO6

References:

1. Communication Skills by Sanjay Kumar & Pushp Lata
2. Business Communication with Writing Improvement Exercises. Hemphill, McCormick &Hemphill
3. Business Communication: Building Critical Skills by Locker, Kitty O. Kaczmarek, Stephen Kyo
4. Effective Business Communication by Herta Murphy
5. Technical Communication: Principles and Practice by Raman and Sharma
6. Effective Technical Communication: A Guide for Scientists and Engineers by Rizvi
7. Oxford Guide to Effective Writing & Speaking by John Seely
8. English Grammar by Raymond Murphy
9. Word Power Made Easy by Norman Lewis

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Online References:

Sr. No.	Website Name
1.	https://bbclearningenglish.org
2.	https://www.bbc.co.uk/learningenglish
3.	https://www.anmconsultants.com/role-communication-indian-corporate-culture/
4.	https://venngage.com/blog/white-paper-examples/

Assessment

IAT -I 20 marks

IAT-II 20 Marks

IAT -I - Independent Speaking Activity, where a student will deliver a three mins. Prepared speech on a Technical topic related to his program and a two mins. Impromptu speech on general topics.

IAT -II - Group speaking activity, Effective presentations on well-known company case studies, Industry reports and articles . Group members limit, 4-5 students in each group.

End Semester Exam will be of 40 marks. It will be a written exam that will cover all six modules
Question Paper will comprise a total of five questions each carrying 10 marks. Q.1 will be compulsory and should cover the maximum contents of the syllabus. Remaining questions will be mixed in nature (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)

A total of four questions need to be answered.

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Course Code	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C)
		L	T	P	L	T	P	SL	Notional Learning Hour	(Notional Learning Hour/30)
16422114	Strategic Communication and Management Skills LAB	-	-	2		-	30	-	30	1

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT 1	IAT 2	IAT1 +IAT 2					
16422114	Strategic Communication and Management Skills LAB	-	-	-	-	-	25	-	25

Lab Objectives: The learners should be able to:

1. Effectively explore the dynamics of communication for academic and professional excellence in diverse settings.
2. Positively acquire active listening skills through Speech Acts in different modes.
3. Thoroughly analyse communication barriers, audience and purpose to speak effectively at the workplace.
4. Minutely demonstrate technical and non-technical text to comprehend and discern the exact purposes.
5. Efficiently organize and create purposeful technical and business writings.
6. Successfully manage teams and individual tasks by applying ethical standards to execute the tasks.

Lab Outcomes: The learners will be able to:

1. Apply communication principles for excellence in academic and professional excellence in diverse setting.
2. Test listening capabilities for advanced listening strategies in physical and digital mode.
3. Evaluate and present ideas precisely to the audience in a confident way.
4. Demonstrate reflective learning through practicing extensive technical and non-technical texts.
5. Design digital technical and business write ups for professional and business transactions
6. Implement technical and managerial skills for future entrepreneurial prospects by confronting local communities and industries problems.

DETAILED SYLLABUS

Sr. No.	Module	Detailed Content	Hours	LO Mapping
0	Prerequisite	Basic knowledge of English language and ICT enabled media		

I	Communication Dynamics	Application of Communication Dynamics .Key Components of Strategic Communication, Shannon- Weaver Model at workplace. Strategic communication: Project Collaboration Platforms,Industry Reports, and Articles ,News Letter, Brand messaging paid media	4	LO1
II	Active Listening	Comprehensive Listening and Applications: Technical or Business podcasts, Youtube lecture on academic stuff/ processes/ procedures/ Development Plans Critical Listening: Cross disciplinary Listening (manufacturing, quality control marketing), Listening for safety: safety instructions and protocols. Warnings or risk factors Listening in Team Meetings: team updates and deadlines.	4	LO2
III	Conversational Proficiencies	Conversational Activities -I Self Introduction, Prepared Speech on Technical Topics and Impromptu Speech on General Topics Conversational Activities-II Simulation in communication:Role Play Activity for Client Interaction, Negotiation and Persuasion, Safety Communication Conversational Activities -III customer Communication, Cross-Cultural communication, Marketing & Brand Communication Handling Q&A in Presentation	8	LO3

IV	Text Interpretation Expertise	Prepare Diagram Organizers on: Summarising text to Graphic Organisers (GO) Cause and effect diagram, sequence chart and flow charts, Hierarchy or Tree Diagrams Problem–Solution Charts , Mind Maps Summarising text in point form after,Tender documents, Infrastructure project reports Manufacturing process flow descriptions, Professional and Industry News	4	LO4
V	Technical Writing Skills	Technical content: Technical Blog Short And Long Reports (PPT using Canva) Installation GuidesWriting Cover Letter, Inquiry Letter Quotation/Order Letters Grievance Letter Short Technical Manuals & Tender notices, Safety Signage Text Studio Activities: Content Creation for Social Media CMS - Wordpress to create, manage and publish content. e-Commerce Platforms Blogs, Vlog Podcast titles, Landing pages Social media posts	6	LO5

VI	Community Communicatio n and Management Skills	Local Area Visit, Field Visits. Local Manufacturing projects partnership with local groups , stem education Free workshop for residents of sustainable practices Surveys Feedback Analysis and Report Writing ,Providing solutions for Technical issues	4	LO6

Reference Books:

1. Communication Skills by Sanjay Kumar & Pushp Lata

2. Business Communication with Writing Improvement Exercises. Hemphill, McCormick & Hemphill

3. Business Communication: Building Critical Skills by Locker, Kitty O. Kaczmarek, Stephen Kyo

4. Effective Business Communication by Herta Murphy

5. Technical Communication: Principles and Practice by Raman and Sharma

6. Effective Technical Communication: A Guide for Scientists and Engineers by Rizvi

7. Oxford Guide to Effective Writing & Speaking by John Seely

8. English Grammar by Raymond Murphy

9. Word Power Made Easy by Norman Lewis

Online Resources:

Sr. No.	Website Name
1.	https://bbclearningenglish.org
2.	https://www.bbc.co.uk/learningenglish
3.	https://www.anmconsultants.com/role-communication-indian-corporate-culture/

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List of Experiments.

Sr. No	Name of Experiment	Hours
1.	Prepare a case study on strategic Communication in Select Indian Companies: Siemens ,Caterpillar Inc. Bosch AECOM, Jacobs Engineering Group	02
2	Listening Skill Activity Sheet containing minimum three types of listening activities from Lab Syllabus.	02
3	A. Continuous Evaluation of at least three types of the activities from Lab Syllabus for proficiency in oral communication/presentation	02
4.	a. Summary report and Graphic Organizers for the relevant scenario or situation b. Powerpoint / Slide Preparation on Industry Cases studies available online.	02
5.	Three Types of Letter Writing in prescribed format (Full Block) along with impressive email messaging Technical Writing , Manuals , Safety Instructions Digital Content Creation from Lab syllabus (Minimum two activities for writing skills should be done with documentation).	02
6.	Conduct field visits and local area visits Government and non-Government bodies, manufacturing plants, Green Building Projects ,Construction sites and ensure the implementation of your subject completely or partially for the smooth functioning. Conduct a Survey or get a feedback from outside agencies regarding the future inputs for synergistic solutions	02

Term Work - 25

Experiments/Practicals

10 experiments from all six modules will be conducted using a language lab , open source and must be documented well for final submission as a part of term work at term end. **20 marks**

Attendance -5 Marks

Shree Rahul Education Society's (Regd.)
SHREE L. R. TIWARI
COLLEGE OF ENGINEERING
An Autonomous Institute Affiliated to University of Mumbai,
Approved by AICTE & DTE, Maharashtra State | NAAC Accredited, NBA Accredited Program | ISO 9001:2015 Certified |
DTE Code No: 3423 | Recognized under Section 2(f) of the UGC Act 1956 | Minority Status (Hindi Linguistic)

F.E SEM II

SEM 2

Theme: "**Building Resilient and Resource-Efficient Systems for Sustainable Development**"

Aligned with **UNSDG 6- Clean Water and Sanitation, UNSDG 7: Affordable and Clean Energy, and UNSDG 11: Sustainable Cities and Communities**

Keywords: **core technical competence, practical experience, and computational thinking**

The theme " **Building Resilient and Resource-Efficient Systems for Sustainable Development** " is a powerful and relevant framework for core technical thinking in order to equip students with a solid foundation in engineering, deeply intertwined with the United Nations Sustainable Development Goals.

UNSDG 6- Clean Water and Sanitation

- **Comprehensive Skill Development:** The theme directly supports quality education by fostering a holistic set of skills: foundational knowledge, practical application, and analytical thinking. This goes beyond rote memorization, encouraging deep understanding and the ability to apply learning to complex real-world challenges.
- **Relevance and Future-Proofing:** By focusing on "sustainable futures," the curriculum becomes highly relevant to global challenges. It equips students with the skills needed to address critical issues like climate change, resource scarcity, and equitable access to resources, making their education future-proof and impactful.
- **Innovation and Creativity:** Hands-on learning and computational thinking encourage innovative problem-solving and creative design. Students are empowered to not just understand existing solutions but to develop new ones that are more sustainable and efficient.
- **Interdisciplinary Approach:** Addressing sustainable futures often requires interdisciplinary collaboration. A strong engineering foundation, coupled with an understanding of sustainability principles, prepares students to work across disciplines to find integrated solutions.

UNSDG 7: Affordable and Clean Energy

- **Comprehensive Skill Development:** To advance affordable and clean energy, individuals must be trained in a range of competencies including renewable energy technologies (solar, wind, bioenergy), energy efficiency strategies, smart grid systems, and sustainable infrastructure planning. Additionally, soft skills like project management, stakeholder engagement, and policy advocacy are crucial to drive implementation and scale-up of clean energy initiatives.
- **Relevance and Future-Proofing:** As the global energy landscape shifts towards sustainability, skill development must anticipate the rising demand for green jobs. Programs should integrate real-time industry needs and prepare individuals for evolving roles in energy storage, electric mobility, carbon-neutral systems, and energy equity. Future-proofing means equipping the workforce with adaptive learning strategies to remain resilient amid rapid technological and regulatory changes.
- **Innovation and Creativity:** Solving energy access challenges, especially in off-grid and underserved areas, requires innovative thinking. Creative solutions like decentralized renewable systems, energy-as-a-service models, and clean-tech startups are vital. Encouraging innovation enables the design of context-specific technologies that are affordable, scalable, and sustainable.

- **Interdisciplinary Approach:** Achieving SDG 7 demands collaboration across engineering, environmental science, economics, social policy, and data science. Energy solutions must integrate technical design with policy frameworks, community behavior, and financial models. This interdisciplinary approach ensures more inclusive and effective energy systems that consider environmental, social, and economic dimensions.

UNSDG 11: Sustainable Cities and Communities

- **Comprehensive Skill Development:** Creating sustainable cities requires a diverse set of skills across urban planning, sustainable architecture, green infrastructure, transportation systems, waste management, and disaster resilience. Additionally, skills in stakeholder engagement, data analysis, and community participation are essential to ensure that development is inclusive, equitable, and responsive to local needs.
- **Relevance and Future-Proofing:** Urban populations are growing rapidly, and cities must adapt to challenges such as climate change, migration, housing shortages, and infrastructure strain. Equipping professionals and citizens with future-oriented skills—like smart city technologies, climate-resilient design, and circular economy principles—ensures urban systems remain livable and resilient in the face of uncertainty and change.
- **Innovation and Creativity:** Sustainable urban development thrives on innovative approaches to housing, mobility, public space, and resource use. Solutions like green roofs, community-driven urban farming, micro-mobility, and digital urban management tools rely on creative thinking to reimagine how cities can function more sustainably while enhancing quality of life.
- **Interdisciplinary Approach:** Sustainable cities are shaped at the intersection of multiple fields: urban planning, engineering, public health, environmental science, economics, and social policy. An interdisciplinary approach allows for holistic planning that integrates infrastructure, environment, governance, and culture—ensuring urban development is both human-centered and ecologically sound.

Problem Statement 1: Rainwater Harvesting and Distribution System for Drought Resilience

A semi-arid community frequently faces water shortages due to erratic rainfall and dwindling groundwater.

Problem Statement 2: Waterlogging at Andheri subway in Mumbai:

Urban disruptions: Closures lead to severe local traffic congestion, spilling onto main roads like Western Express Highway and causing widespread delays.

Problem Statement 3: Bridges are vulnerable to the monsoon

The bridge, narrow and overloaded with two-wheelers and pedestrians, should show warning signs of deterioration, sensor deployment, materials upgrades, and emergency protocols

Problem Statement 4: Uttarakhand's infrastructure is highly vulnerable to natural disasters, requiring resilient development.

A riverbank in a flood-prone area is experiencing severe erosion, threatening nearby agricultural land and infrastructure.

Problem Statement 5: Alternative energy-efficient arrangement for rural areas.

An Alternative energy-efficient arrangement is required for rural areas. A small stream or river, capable of providing electricity for basic needs in a remote location, for frequent power cuts.

Problem Statement 6: Increase of Asthma Patients due to Air Pollution in Urban Areas

Low-cost, automated air quality monitoring stations for an urban area, focusing on key pollutants (e.g., PM2.5, NO2, SO2)for high pollution levels, aiding in public health and environmental management.

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Course Code	Course Name	Teaching Scheme (Contact Hours Per week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) (Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
16111201	Differential Equations and Integral Calculus	2	1	--	30	15	--	45	90	3

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Semester Exam	Exam Duration (in Hrs)			
		IAT 1	IAT 2	IAT1 +IAT 2					
16111201	Differential Equations and Integral Calculus	20	20	40	60	2.5	25	--	125

Rationale:

In a first-year Mechanical Engineering course, a solid understanding of advanced calculus and differential equations is essential for building problem-solving skills required in core engineering subjects. Higher-order linear differential equations are fundamental in modeling dynamic mechanical systems such as vibrations of beams, spring-mass-damper systems, and control systems in automation. Double and triple integrals are widely used to calculate areas, volumes, mass, and center of gravity—important in designing machine components, tanks, and structural elements. Vector calculus, including concepts like gradient, divergence, and curl, is crucial for understanding fluid flow, heat transfer, and force fields, which form the basis of thermodynamics and fluid mechanics. Complex integration supports the solution of certain real-world boundary value problems and is also applicable in the analysis of stress and strain in rotating machinery. Numerical methods such as root-finding algorithms, interpolation, and numerical integration are indispensable for solving engineering problems that cannot be addressed analytically—such as simulating heat conduction in materials or estimating stress in irregular geometries. These

mathematical tools equip first-year mechanical engineering students with the analytical foundation necessary to tackle complex engineering problems in higher semesters.

Course Objectives:

1. To introduce higher-order linear differential equations for modeling dynamic systems like mechanical vibrations.
2. To explain the use of double integrals in computing physical quantities over planar regions.
3. To demonstrate the application of triple integrals for 3D volume and mass calculations.
4. To introduce vector operators (gradient, divergence, curl) used in physical field analysis.
5. To teach complex integration methods for evaluating integrals in harmonic and fluid systems.
6. To present numerical techniques for solving engineering problems where analytical solutions are difficult.

Course Outcomes:

1. Students will be able to solve and interpret differential equations and use SCILAB in systems such as spring mass-damper models.
2. Students will evaluate double integrals and use SCILAB to calculate areas, mass, and centroids in mechanical components.
3. Students will apply triple integrals and use SCILAB to determine volumes and mass distributions in mechanical parts like castings or tanks.
4. Students will analyze heat flow, fluid motion, and force fields using concepts of vector calculus.
5. Students will solve and interpret problems involving oscillatory systems and wave analysis using complex integration.
6. Students will use numerical methods and use SCILAB to approximate solutions in applications like heat conduction and stress analysis.

R-2025- Mechanical Engineering

Prerequisite:

1. Basics of integration and it's properties**.**

2**.** Linear differential equations

DETAILED SYLLABUS

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	Differential Equation	Exact differential Equations, Equations reducible to exact form by using integrating factors.	05	CO1
		Equation reducible to linear form, Bernoulli's equation.		
		Linear Differential Equation with constant coefficient-complementary function, particular integrals of differential equation of the type f(D)y = X where X is e^{ax} , sin(ax + b), cos(ax +b), x^m.		
		Self-learning topics: 1. Method of variation of parameter 2. Particular integrals for $e^{ax}V$ and xV. 3. Cauchy's homogeneous linear differential equation. 4. Legendre's differential equation. 5. Applications of first order and first degree and also Higher order differential equation.	08	
II	Multiple Integral-I	Beta and Gamma functions and its properties.	05	CO2
		Double integration-definition, Evaluation of Double Integrals.(Cartesian & Polar)		
		Change the order of integration (No Evaluation)		

		Self-learning topics: 1. Rectification of curves. (Cartesian, Polar and Parametric) 2. Application of double integrals to compute Area and Mass of lamina.	07	
III	Multiple Integral-II	Evaluation of double integrals by changing to polar coordinates	05	CO3
		Evaluation of integrals over the given region (Cartesian and polar).		
		Triple integration definition and evaluation (Cartesian, cylindrical and spherical polar coordinates).		
		Self-learning topics: 1. Application of triple integrals to compute volume. 2. Triple integrals over a volume bounded by a plane. 3. Triple integrals over a volume bounded by a paraboloid. 4. Triple integrals over a volume bounded by a cone. 5. Triple integrals over a volume bounded by an ellipsoid.	07	
IV	Vector Calculus	Scalar and vector fields. Differentiation of vectors	05	CO4
		Directional derivative, Gradient, divergence and curl		
		Scalar potential function		
		Self-learning topics: 1. Line integrals – definition and problems. 2. Green's theorem in a plane, 3. Stokes' theorem (without Proof) 4. Gauss' Divergence theorem (without proof) and problems (only evaluation). 5. Angle between surfaces.	07	

V	Complex Integration	Cauchy's Integral theorem and formula,	05	CO5
		Taylor's series and Laurent's series - radius of convergence		
		Singularities and Poles, Cauchy Residue theorem.		
		Self-learning topics: 1. Line Integral in cartesian and parametric form. 2. Application of Residue Theorem to evaluate real integrations. 3. Conformal Mappings.	08	
VI	Numerical Methods	Numerical integration-by (a) Trapezoidal (b) Simpson's 1/3rd (c) Simpson's 3/8th rule (all without proof)	05	CO6
		Interpolation by Newton's and Lagrange polynomials		
		Numerical solutions of transcendental equations by Newton Raphson method and Regula –Falsi method.		
		Self-learning topics: 1. Indeterminate forms, L- Hospital Rule, 2. Gauss Elimination Method, Gauss Jordan Method. 3. Maclaurin Series 4. Numerical solution of ordinary differential equation using (a) Euler's method (b) Modified Euler method, (c) Runge-Kutta fourth order method	08	

Text Books:

1. Grewal B. S.: "Higher Engineering Mathematics", Khanna Publishers, 44th Ed., 2021.

2. Kreyszig E.: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed., 2018.

3. Dass H. K.: "Higher Engineering Mathematics", S Chand & Company Ltd, 12th Ed., 2004.

4. Narayan S.: "Differential Calculus", S.Chand Publications, 30th Ed., 2005.

References:

1. Stewart J.: "Multivariable Calculus" Cengage Publications, 7th Ed., 2019.
2. Jain M.K., Iyengar SRK, Jain R K,: "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers, 6th Ed., 2007.
3. Bali N.P and Goyal M.: "A Textbook of Engineering Mathematics" Laxmi Publications, 10th Ed., 2022.
4. Wylie C. R, Barrett L.C..: "Advanced Engineering Mathematics" McGraw Hill Book Co., New York, 6th Ed., 2017.
5. Ramana B.V.: "Higher Engineering Mathematics", Tata McGraw-Hill Publishing Company Limited, 1st Ed., 2006.
6. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc-Graw Hill Education, 2015.
7. Pal S. & Bhunia S. C.: "Engineering Mathematics" Oxford University Press, 3rd Ed., 2016

Online References:

Sr. No.	Website Name
1.	https://archive.nptel.ac.in/courses/111/105/111105122/
2.	https://www.youtube.com/watch?v=T6jHXD78dBI
3.	https://www.youtube.com/watch?v=KgItZSst2sU
4.	https://www.youtube.com/watch?v=w_KiHgultbM

Assessment:

R-2025- Mechanical Engineering

Internal Assessment (IA) for 20 marks:

- IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of syllabus content must be covered in First IA Test and remaining 40% to 50% of syllabus content must be covered in Second IA Test.

Term work(TW) for 25 marks:

1. Batch-wise tutorials are to be conducted.

2. Students must be encouraged to write SCILAB Programs in tutorial class only. Each Student has to write **at least 05 SCILAB tutorials** (including print out) and **at least 10** class tutorials on entire syllabus.

3. SCILAB Tutorials will be based on entire syllabus

The distribution of Term Work marks will be as follows –

1. Regularity and active involvement (Theory and Tutorial) 05 marks

2. Class Tutorials on entire syllabus 10 marks

3. SCILAB Tutorials 10 marks

R-2025 Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C)
		L	T	P	L	T	P	SL	Notional Learning Hour	(Notional Learning Hour/30)
16111202	Engineering Chemistry	2	--	--	30	--	--	30	60	2

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT 1	IAT 2	IAT1 +IAT 2					
16111202	**Engineering Chemistry**	15	15	30	45	2	--	--	75

R-2025 Mechanical Engineering

Rationale:

1. Chemical science has contributed in many ways to most of the Engineering branches where "engineering chemistry" is the modern approach to learn impact of Technology on habitat and can be common to all Core Groups,
2. "Engineering Chemistry" can be prerequisites to impact of corrosion on metals as many civil engineering materials is the important area of concern.
3. "Conventional and Non-Conventional Energy Study" is the matter of general approach to all but especially to Mechanical group as energy issue is the most recent concern even for designing the energy efficient IC engine.
4. Chemical science has contributed in many ways to most of the Engineering branches where "Engineering Materials" such as water, polymers, fuel, lubricants and cement, can be prerequisites to many subjects of all core groups from the perspective of applications as a build material for structural as well as mountainous component

Course Objectives:

1. To study effect of hardness of water on various materials used in civil structures and machine design.
2. To introduce important properties of polymers as engineering material.
3. To study the effect of corrosion by different mechanisms on metals and methods of corrosion control
4. To study energy efficacies of various conventional and non-conventional source of energy.
5. To study mechanism and various lubricants used in engineering applications.
6. To recognize importance of alloys and can apply the phase rule on it to study the effect of temperature and composition
7. To recognize the composition, properties and functions of various cements used in civil engineering.

Course Outcomes:

Student will be able to –

1. Determine the hardness of water and various method of water hardness removal.
2. Use the polymers for specific engineering applications on the basis of the properties.
3. Understand the causes of corrosion and apply different methods to minimize corrosion.
4. Determine the quality of fuel and quantitative estimation of fuel.
5. Understand the role of lubricants in corrosion prevention.
6. Understand the various alloys and to interpret various phase transformations of alloy using thermodynamics.
7. identify different types of cement and their specific role as structural materials for engineering applications

Prerequisite:

1. Knowledge about basic concept of hardness of water.
2. Knowledge of basic properties of polymers
3. Knowledge of concepts of Electrochemistry.
4. Knowledge of basic difference in Conventional and non-conventional energy sources.
5. Knowledge of basic mechanism and use of lubricant.
6. Knowledge of basic properties of metals and nonmetals and purpose of making alloys
7. Knowledge of Constituents of Cement and their functions.

R-2025 Mechanical Engineering

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Knowledge about basic concept of hardness of water, properties of polymers, concepts of Electrochemistry, basic difference in Conventional and non-conventional energy sources, mechanism and use of lubricant, properties of metals and nonmetals and purpose of making alloys, Constituents of Cement and their functions.		
I	Water	1. Impurities in water, Hardness of water 2. Determination of hardness of water by EDTA method and numerical problems, 3. softening method of water and numerical based on it –i) Ion exchange process ii) electro dialysis iii) reverse osmosis iv) ultrafiltration.	05	CO1

		4. Definition, significance and numerical problems based on BOD and COD.		
		Self-learning Topics: **1.** Industrial applications of water treatment in power plants and manufacturing. **2.** Comparative study of water purification technologies (e.g., UV vs RO). **3.** Municipal water treatment plants. Environmental impact of untreated water discharge. **4.** Latest advancements in membrane filtration (e.g., nano filtration).	05	
II	Introduction to polymers.	**1.** Macro-molecular science, basic concept of polymers, Chemical bonding in polymers, Classification of Polymers. **2.** Properties of Polymers:- i) Molecular weight - Number average molecular weight,	05	CO2

		Weight average molecular weight, Numerical, ii) Crystallinity - Crystalline and amorphous polymers – Glass transition temperature, iii) Mechanical Properties: Hardness, tensile strength, creep, fatigue, impact resistance (introduction), iv) Electrical properties: dielectric strength, insulation resistance, surface resistivity (Introduction), v) Optical properties: refractive index, transmittance, photoelectric property, colour **3.** Advanced polymers: i) Intelligent (smart) polymers ii) Biopolymers		
		Self-learning Topics: **1.** Applications of smart polymers in medical and aerospace industries. **2.** Recycling of polymers: techniques and challenges.	05	

		3. 3D printing and polymer materials. **4.** Use of biopolymers in packaging. **5.** Role of polymer composites in automotive design.		
III	Corrosion	**1.** Introduction: Definition, Types of Corrosion – i) Dry or Atmospheric Corrosion, ii) Wet or Electrochemical corrosion (In Acidic medium, In Neutral medium) **2.** Factors affecting rate of corrosion: i) Position of metal in galvanic series, ii) Purity of Metal, iii) Nature of Corrosion product, iv) Temperature, v) pH of medium, vi) concentration of medium, vii) moisture, viii) Relative Cathodic and Anodic area, ix) overvoltage **3.** Methods to control corrosion: i) Selection of metal, ii) Proper Designing, iii) Cathodic protection, iv) Use of Corrosion	05	CO3

		Inhibitors, v) Metallic Coating- metal cladding, galvanization, tinning, metal spraying.		
		Self-learning Topics: **1.** Corrosion failures in historical structures. **2.** Protective coatings used in marine and oil industries. **3.** Cathodic protection systems used in pipelines. **4.** Advanced corrosion monitoring techniques. **5.** Corrosion management in reinforced concrete structures.	05	
IV	Fuels	**1.** Introduction**:** i) Definition, Characteristics of good fuel. ii) Calorific value: Definition, Types, Determination, Dulong's formula, Numerical) iii) Solid fuel: Coal: - Analysis of coal – Proximate analysis, Ultimate analysis, Numerical, Combustion of coal – Numerical	05	CO4

		iv) liquid fuel: petroleum oil-composition, mining and refining of petroleum. **2.** Petroleum products: i) refining of petroleum, ii) advantages of unleaded petrol, iii) MTBE: its uses, advantages and disadvantages iv) power alcohol, v) knocking in petroleum products, antiknocking agents, octane number of petrol, Diesel: cetane number. **3.** Green fuel for sustainable development: Synthesis and Advantages of i) Biodiesel, ii) Ethanol		
		Self-learning Topics: **1.** Biofuel usage in Indian Railways or airlines. **2.** Life cycle assessment of fossil vs. alternative fuels. **3.** Energy policies promoting ethanol and biodiesel.	05	

		4. Innovations in fuel cell technology. **5.** Environmental impacts of coal combustion.		
V	Lubricants and Alloys	Lubricants: **1.** Introduction- definition, mechanism and classification of lubricants, **2.** Types of lubricants: solid lubricants- graphite and molybdenum disulphide, semisolid lubricant, liquid lubricant, additives in blended oils, **3.** Important properties of lubricants- definition and significance of –viscosity, viscosity index, flash point and fire point, Claude point and pour point, oiliness, emulsification, acid value and numerical, saponification and numerical Alloys:	06	CO5, CO6

		1. Ferrous alloys – i) Plain-carbon steels ii) Heat and Shock resisting steels iii) Stainless steels iv) Effect of the alloying element- Ni, Cr, Co, Mn, Mo, W and V. **2.** Non Ferrous alloys: A) Aluminum alloys – Composition, properties and uses of i) Duralumin, ii) Magnalium B) Copper alloys – Composition, properties and uses of a) Brass – i) Dutch Metal ii) German Silver b) Bronze – i) Gun metal ii) Nickel bronze. C) Alloys of Pb – Composition, properties and Uses of i) Wood's metal ii) Tinman's solder. **3.** Numerical: i) based on Composition, ii) based on density iii) based on weight of an alloy.		

		Self-learning Topics: **1.** Lubricant selection for heavy machinery. **2.** Nano-lubricants and their industrial relevance. **3.** Smart lubricants and real-time condition monitoring. **4.** Applications of specific non-ferrous alloys in aerospace. **5.** Advances in high-performance alloys (e.g., Inconel, Titanium alloys).	06	
VI	Important Engineering materials	**1.** Introduction, **2.** Manufacturing of Portland cement, **3.** Chemical composition and constituent of Portland cement, **4.** Setting and hardening of Portland cement, concrete, RCC **5.** Decay process of cement.	04	CO7

		Self-learning Topics: **1.** Use of green cement and eco-concrete in construction. **2.** Failure analysis of concrete structures. **3.** Cementitious materials in 3D printed buildings. **4.** Sustainable alternatives to Portland cement. **5.** Chemical admixtures in concrete and their mechanism.	04	

References:

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publication
2. A textbook of Engineering Chemistry, S. S. Dara, S. Chand and Company
3. Polymer science: Vasant Gowarikar, Wiley Estern Ltd, new Delhi
4. Green Chemistry: V. K. Ahluwalia
5. Textbook of Polymer science: F.W. Billmeyer
6. Fundamentals of Polymer science & Engineering- Anilkumar & S K Gupta, Tata McGraw Hill, New Delhi
7. Engineering Chemistry, O. G. Palana, Tata McGraw Hill Publication
8. Environmental Chemistry, A. K. De, Tenth edition, New Age International,
9. P. W. Atkins, Physical Chemistry, Oxford University Press, 7th edition. 5. J. D. Lee Concise Inorganic Chemistry, Oxford University Press, 5 th edition

Online References:

Sr. No.	Website Name
1.	https://archive.nptel.ac.in/courses/103/106/105106205/
2.	https://courses.nptel.ac.in/noc20ch41/preview
3.	https://www.researchgate.net/
4.	https://www.sciencedirect.com/topics/engineering/polymer-material
5..	https://www.sciencedirect.com/topics/chemistry/nanomaterial

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) Notional Learning Hour/30
16112203	**Engineering Graphics**	2	-	-	30	-	-	-	30	2

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration(in Hrs)			
		IAT 1	IAT 2	IAT1 +IAT 2					
16112203	**Engineering Graphics**	20	20	40	60	2.5	--	--	100

Rationale:

Engineering Graphics develops spatial visualization and technical drawing skills essential for modern computing applications. It bridges the gap between digital systems and the physical world, supporting areas like embedded systems, IoT, and robotics. The course enhances understanding of 3D modeling, essential for AR/VR, digital twins, and simulation-based tools. It prepares students to work effectively in interdisciplinary teams involving hardware-software integration. Concepts like projections and solid modeling are foundational for CAD software, PCB design, and interface development. It supports UI/UX development for 3D applications, gaming, and visualization platforms. Engineering graphics aids in documenting and communicating design ideas clearly and accurately. Overall, it fosters analytical thinking and design communication, crucial for innovation in intelligent computing systems.

Course Objectives

1	To impart and inculcate proper understanding of the theory of projection.
2	To impart the knowledge to read and interpret a drawing.
3	To improve the visualization skill.
4	To enable students to represent three-dimensional objects on a two-dimensional surface in a way that accurately conveys their shape, size, and orientation.
5	To acquaint students with representing internal features of a three-dimensional object by way of section that accurately conveys their internal orientation.

Course Outcomes

1	Apply basic concepts of geometrical constructions to create engineering curves.
2	Apply the basic principles of projections in Projection of Lines and Planes
3	Apply the basic principles of projections in Projection of Solids.
4	Apply the basic principles of sectional views in Section of solids.
5	Apply the basic principles of projections in converting pictorial views into orthographic Views.
6	Apply the basic principles of projections in converting orthographic views into isometric drawing.

Detailed Syllabus

Module no.	Module Name	Detailed content	Teaching hours	CO
	Pre-requisite	To draw basic geometric shapes like circle, pentagon, hexagon, and square with different orientation. Divide a line, circle, etc. into equal number of parts.	01	
1	**Introduction to Engineering Drawing and Engineering curves**	**1.1** Introduction to Engineering Graphics and its significance in Engineering domain. **1.2** Types of Lines, Dimensioning Systems as per IS conventions. **1.3 Engineering Curves**: Basic construction of Conics, Cycloid, Involutes and Helix (cylinder only). **Self-learning topic:** - Explore the concepts of eccentricity, focus, vertex, axis, directrix - Explore other conics - ellipse, parabola and hyperbola using directrix-focus method	03 03	CO1
2	**Projections of Points, Lines and Planes**	**2.1 Projections of points** in all four quadrants as well as lying on the planes. **2.2 Projections of lines** inclined to both the reference planes (Excluding Traces of lines). Simple application-based problems on projection of lines. **2.3 Projection of planes** (only standard geometrical shapes like square, triangle, pentagon, circle, etc.) inclined to one of the reference planes only. **Self-learning topic:** - Explore the projection of lines for mixed quadrants - Explore the projection of planes for planes inclined to both the reference planes	05 05	CO2
3	**Projections of Solids**	**3.1** Projections of solids with the axis inclined to one reference plane include prism and cylinder **3.2** Projections of solids with the axis inclined to both reference planes include pyramid, and cone (Use change of position or Auxiliary plane method) **Self-learning topic:** - Explore the cuboid and tetrahedron solids inclined to one or both the reference planes.	06 06	CO3

		- Explore the applications of solid projection in machine components, structure, and packaging and manufacturing.		
4	**Sections of Solids and Development of Surfaces**	**Sections of Solids** Sections of Prism, Pyramid, Cylinder, & Cone cut by plane perpendicular to only one reference plane. Use change of position or Auxiliary plane method. **Self-learning topics:** - Explore the development of lateral surface for regular solids - Prism, Pyramid, Cylinder, & Cone - Explore the real-life application of solids cut with section planes inclined to one plane.	04 04	CO4
5	**Orthographic and Sectional Orthographic Projections**	Fundamental concepts of orthographic and sectional orthographic projections like Positioning of quadrants, observer, horizontal, vertical and profile plane, symbol etc., Different orthographic views, First and Third angle method of projection, different section (cutting) plane, its representation, importance of sectional views, rib and web in section. Views of simple machine parts as per the first angle projection method recommended by I.S. for Orthographic and Sectional Orthographic projection **Self-learning topics:** - Explore the third angle method of projection for orthographic views. - Explore half sectional and offset sectional views - Practice simple machine components with half section and offset section	06 06	CO5
6	**Isometric Views**	Introduction to isometric projections and Fundamental concepts of Isometric projection - isometric and non-isometric lines, axes, and planes. Concept of isometric scale. Difference between isometric projection and isometric views. Conversion of orthographic views to isometric views **Self-learning topics:** - Explore the concepts of isometric scale and isometric projection - Practice isometric projection of simple objects using isometric scale - Explore the isometric views and projections of holes and slots on an inclined plane	05 05	CO6

Text Books:

1. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd.
2. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.

References:

1. Narayana, K.L. & P Kannaiah (2008), Textbook on Engineering Drawing, Scitech Publisher.
2. Prof. Sham Tickoo (Purdue University) & Gaurav Verma, "(CAD Soft Technologies).
3. Auto CAD 2012 (For engineers and Designers)", Dreamtech Press New Delhi.
4. Dhananjay A Jolhe, "Engineering Drawing" Tata McGraw Hill.

Online References:

Sr. No.	Website Name
1	https://archive.nptel.ac.in/courses/112/105/112105294/
2	https://nptel.ac.in/courses/112103019
3	https://archive.nptel.ac.in/courses/112/102/112102304/

R-2025- Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30
16211204	Basic Fluid mechanics	3	--	--	45	--	--	45	90	3

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-1	IAT-2	IAT-1 + IAT-2					
16211204	Basic Fluid mechanics	20	20	40	60	2.5	--	--	100

Rationale:

Fluid Mechanics is a fundamental subject in the field of Civil and Mechanical Engineering as it forms the foundation for understanding the behavior and movement of fluids—liquids and gases—through various systems. This syllabus has been designed to help students grasp basic fluid properties, static and dynamic fluid behavior, and the principles governing real-life engineering applications such as water supply, hydraulic machines, and cooling systems. It incorporates

sustainability and innovation to reflect modern engineering challenges like climate resilience, water conservation, and clean energy.

Course Objectives:

1. To introduce students to the fundamental properties.
2. To enable students to understand and apply fundamental principles of fluid behavior, pressure, and fluid motion to analyze basic flow systems and fluid-related engineering problems.
3. To introduce students to the applications of fluid mechanics in engineering systems, emphasizing how fluids function in infrastructure, machinery, and energy systems across civil and mechanical disciplines.
4. To introduce students to innovative and sustainable applications of fluid mechanics in civil and mechanical engineering through real-world systems, emerging technologies, and smart solutions.
5. To study the basic difference between incompressible and compressible flow, Propagation of pressure waves and stagnation points.
6. To introduce students to the sustainable use of fluid systems in engineering, highlighting their role in climate-resilient infrastructure, efficient water and energy systems, and modern smart technologies.

Course Outcomes:
After completing this course, students will be able to:

1	Identify and describe fundamental fluid properties.
2	Explain the behavior of fluids under static and dynamic conditions, and apply basic fluid mechanics principles to pressure measurement, flow visualization, and fluid force estimation.
3	Explain the role of fluids in engineering systems and differentiate between static and dynamic fluid behavior in civil and mechanical applications.
4	Illustrate how fluid mechanics principles are applied in innovative civil and mechanical engineering solutions related to water systems, automation, energy, and smart technologies.
5	Explain the compressible flow, propagation of pressure waves and stagnation properties.

6 Describe and apply fluid mechanics concepts to analyze sustainable engineering solutions like greywater recycling, buoyant foundations, and smart fluid-based energy systems.

Prerequisite: Mathematics and Physics

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	**Prerequisite**	Basic algebra and physics, Units and dimensions, Algebraic manipulation of equations, Differentiation, Integration of simple functions	-	-
I	**Basics of Fluids**	Difference between solids, liquids, and gases; Definition of fluid and fluid mechanics; Physical properties of fluids: density, specific weight, specific volume, relative density and viscosity. Newton's law of viscosity, classification of fluids, Real-life Applications ; Units and measurement	8	CO1
		Self-learning Topics: Temperature effect on fluid viscosity, Measurement of fluid properties, Fluids in daily life and machines, Units and conversion practice, fluid in cars and properties, 10 fluids used at home and their classification	8	
II	**Fluid Behavior and Flow Systems**	Basic concept of pressure, Pressure head, Types of pressure, Hydrostatic law, pressure measurement	8	CO2

		Total pressure and Centre of pressure on plane surfaces, Conditions of flotation, Applications Velocity and acceleration, Streamline, path line, streak line – flow visualization, Flow classification Bernoulli's equation (concept only)		
		Self-learning Topics: Pressure head use in dams/reservoirs, streamlines & vortex, Flow Nets & Seepage, TEL/HGL in Pipelines	8	
III	**Fluids in Engineering**	Role of fluids in engineering infrastructure and machinery, Difference between static and dynamic fluid systems, Fluids in Civil Engineering Applications: Water Supply Systems, Hydraulic Structures, Storm water Management, Sewage and Wastewater Handling, Soil and Groundwater Flow Fluids in Mechanical Engineering Applications: Internal Combustion Engines, Pumps and Compressors, Heat Exchangers, Hydraulic and Pneumatic Systems, Refrigeration and Air Conditioning (HVAC)	8	CO3
		Self-learning Topics: water supply systems work in buildings and cities, Hydraulic systems in construction and transport, Cooling systems using fluids	8	

IV	**Fluids and Innovation in Engineering**	Civil Engineering Innovations Using Fluids: Smart water systems, Urban flood mitigation, Sustainable water harvesting and reuse Mechanical Engineering Innovations Using Fluids: Hydraulic automation, Energy innovations, Fuel & coolant efficiency AI-enabled water meters, Zero-energy cooling using water/air flow	8	CO4
		Self-learning Topics: flowchart of a smart water pipeline, maps of flood-prone areas, hydraulic arms/lifts: identification of components and fluid role, smart fluids-based systems for improvement of urban and mechanical performance	8	
V	**Compressible Flow**	Basic equation of flow (elementary study), velocity of sound or pressure wave in a fluid, Mach number, propagation of pressure waves, area-velocity relationship, Stagnation properties.	6	CO5
		Self-learning Topics: Mach number for subsonic/supersonic flows, speed of sound in air and water, stagnation properties using online simulators	6	
VI	**Fluids and Sustainable Future**	Role of fluid systems in climate resilience, water conservation, and clean energy, Greywater recycling in buildings, Flood proof structures using	7	CO6

		buoyant foundations, Smart HVAC systems and district cooling, Fluid-based solar water heaters, Real-time monitoring of fluid systems, Smart irrigation using weather prediction		
		Self-learning Topics: Extreme Rainfall: Case Studies in Indian Cities, Smart Drainage Systems, Green Infrastructure for Urban Flood Management	7	

Text Books:

1. Hydraulics & Fluid Mechanics by Dr. P. N. Modi and Dr. S. M. Seth, Standard Book House.
2. Fluid Mechanics by Dr. A. K. Jain, Khanna Publishers.
3. Fluid Mechanics and Fluid Machinery by R. K. Bansal, Laxmi Publications.
4. A Textbook of Fluid Mechanics and Hydraulic Machines, Rajput, R. K, S. Chand Publishing

References:

1. Fluid Mechanics and Hydraulic Machines by McGraw Hill Education (India).
2. Fluid Mechanics by Yunus Cengel, Jhon Cimbala, Tata MacGraw Hill, New Delhi.
3. Fluid Mechanics by R. J. Garde, A. J Mirajgaonkar, SCITECH Publication.
4. Fluid Mechanics by Streeter & Wylie, Tata McGraw Hill.
5. Fluid Mechanics by K. Subramanya, McGraw Hill.
6. Fluid Mechanics by Frank White, McGraw Hill.

Online References:

Sr. No.	Website Name
1.	NPTEL – https://nptel.ac.in
2.	ASCE Sustainable Infrastructure Resources – https://www.asce.org

R-2025- Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30)
16112205	Engineering Chemistry Lab	--	--	1	--	--	15	--	15	0.5

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT 1	IAT 2	IAT1 +IAT 2				
16112205	Engineering Chemistry Lab	--	--	--	--	25	-	25

Lab Objectives:

1. To apply knowledge acquired during the theory class in carrying out the experiments for qualitative and quantitative determination.
2. To analyze experimental results and write laboratory report.

Lab Outcomes: After completion of experiment, the learners will be able to

1. Estimate the type of water hardness and calculate it.
2. Synthesize UF/PF resin at laboratory level.
3. Learn the effect of various factors on the rate of corrosion.
4. Understand the significance of proximate analysis of coal and determine quality of coal sample.
5. Understand causes of the detoriation of lubricant and its extent.
6. Learn volumetric quantitative analytical techniques to determine % of elements from alloy samples.
7. Learn various instrumental quantitative analytical techniques to determine % of elements from alloy samples.

List of Experiments:

Sr No	List of Experiments	Hrs
01	Determination of Total, Temporary and Permanent hardness of water by EDTA method	**01**
02	Synthesis of Urea formaldehyde Resin.	**01**
03	Synthesis of Phenol formaldehyde resin.	**01**
04	To compare rate of corrosion of various metals in acidic medium.	**01**
05	Determination of moisture content of coal.	**01**

06	Estimation of acid content in the given lubricant oil.	**01**
07	Estimation of saponification value the given lubricant oil.	**01**
08	Determination of % purity of iron.	**01**
09	Determination of Sn from solders volumetrically.	**01**
10	Determination of unknown concentration of Cu in the given sample by colorimetry	**01**

List of Assignments:

Sr No	List of Assignments	Hrs
01	Numerical on determination of hardness of water	**01**
02	Green Solvents: - characteristics and applications of Supercritical solvents and ionic liquids Green Fuels:- Synthesis and Advantages of i) Biodiesel, ii) Ethanol Calculation of % Atom economy of the given chemical reaction	**01**
03	Numerical based on calorific value determination, proximate and ultimate analysis of coal, Acid value and Saponification value in the given lubricants.	**01**
04	Concept, of Smart polymers: some examples of smart polymers with their properties and uses. Note on Liquid Crystal polymers	**01**
05	Composition, Properties of any 4 alloys	**01**
06	Note on Portland cement	**01**

References:

1. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publication
2. A textbook of Engineering Chemistry, S. S. Dara, S. Chand and Company
3. Polymer science: Vasant Gowarikar, Wiley Estern Ltd, new Delhi
4. Green Chemistry: V. K. Ahluwalia
5. Textbook of Polymer science : F.W. Billmeyer
6. Fundamentals of Polymer science & Engineering- Anilkumar & S K Gupta, Tata McGraw Hill, New Delhi
7. Engineering Chemistry, O. G. Palana, Tata McGraw Hill Publication
8. Environmental Chemistry, A. K. De, Tenth edition, New Age International,
9. P. W. Atkins, Physical Chemistry, Oxford University Press, 7th edition. 5. J. D. Lee Concise Inorganic Chemistry ,Oxford University Press, 5 th edition.
10.

Online Resources:

Sr. No.	Website Name
1.	https://archive.nptel.ac.in/courses/103/106/105106205/
2.	https://courses.nptel.ac.in/noc20ch41/preview
3.	https://www.researchgate.net/
4.	https://www.sciencedirect.com/topics/engineering/polymer-material
5.	https://www.sciencedirect.com/topics/chemistry/nanomaterial

Assessment:

Term Work: Term Work shall consist of at least 10 practical based on the above list. Also, Term work Journal must include at least 6 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					Total Credits (C) Notional Learning Hour/30
		L	T	P	L	T	P	SL	Notional Learning Hour	
16122206	**Engineering Graphics**	-	-	2	-	-	30	-	30	1

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration(in Hrs)			
		IAT 1	IAT 2	IAT1 +IAT 2					
16122206	**Engineering Graphics**	--	--	--	--	--	25	25	50

Lab Objectives:

1. To impart and inculcate proper understanding of the theory of projection.
2. To impart the knowledge to read and interpret a drawing.
3. To improve the visualization skill.
4. To enable students to represent three-dimensional objects on a two-dimensional surface in a way that accurately conveys their shape, size, and orientation.
5. To acquaint students with representing internal features of a three-dimensional object by way of section that accurately conveys their internal orientation.
6. To impart basic AutoCAD skills.

Lab Outcomes:

1. Apply the concepts of Draw, Modify and basic concepts of ACAD to draw basic geometries and diagrams of simple engineering parts.
2. Apply the concepts of layers, and dimensions to create engineering drawing for a part drawing.
3. Create, Annotate, Edit and Plot drawings using basic AutoCAD commands and features.
4. Apply the basic principles of projections in 2D drawings using a CAD software.
5. Apply basic AutoCAD skills to draw different views of a 3D object.

6 Apply basic AutoCAD skills to draw the isometric view from the given two views.

List of Experiments:

Component: 01 – ACAD Print outs (activities to be completed in the CAD Laboratory - All printouts to be the part of Term Work.)

Sr. No.	List of Experiments	Hrs	CO mapping
1	Redrawing simple machine parts as given (05 problems)	04	CO1, CO2, and CO3
2	Orthographic projections (with and without section) (05 problems)	04	CO4 and CO5
3	Isometric Drawing – 3 problems.	04	CO6

Component: 02 – Drawing Sheets

01	Two problems on Engineering Curves	02	CO1
02	Two problems each on Projection of Lines and Planes	02	CO2
03	Two problems on Projection of Solids	02	CO3
04	Two problems on Section of Solids with DLS	02	CO4
05	Two problems each on Orthographic and Sectional Orthographic projection	02	CO5
06	Two problems on Isometric projection	02	CO6

Component: 03 – A3 size Sketch book

Sr No	List of Assignments	Hrs	CO mapping
01	Engineering Curves. (2 problems)	01	CO1
02	Projection of Lines and Planes (2 problems each)	02	CO2
03	Projection of solids. (2 problems)	02	CO3
04	Section of solids (2 problems)	02	CO4
05	Sectional Orthographic and Orthographic Projections (2 problems each)	04	CO5
06	Isometric Drawing. (3 problems)	03	CO6

Assessment:

Term Work: Term Work shall include all the drawings, assignments, and printouts listed above.

Term Work Marks: 25 Marks (Total marks) = 10 Marks (Drawing sheets and ACAD printouts) + 10 Marks (Assignments) + 5 Marks (Attendance)

Practical& Oral Exam: Practical exam on ACAD will be held based on the above syllabus.

R-2025- FE Mechanical and Civil

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30)
16122207	Programming Lab (Python)	--	--	4	--	--	60	--	60	2

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term work	Practical/ Oral	Tut.	Total
		Internal assessment			End Sem. Exam				
		IAT- 1	IAT-2	IAT-1 + IAT-2					
16122207	Programming Lab (Python)	--	--	--	--	25	25	--	50

Lab Objectives:

1. To familiarize learners with Python's basic syntax, variables, data types, operators, and input/output functions.
2. To reinforce the understanding and application of conditional statements, loops, and functions in Python programming.
3. To instill learners on file handling, exception management, and Python packaging.
4. To introduce object-oriented programming principles and their application in Python.
5. To explore advanced topics such as regular expressions, pattern matching, and GUI development.
6. To introduce and demonstrate the use of popular Python libraries for data handling.

Lab Outcomes: After completion of experiment, the learners will be able to

1. Demonstrate the proficiency in basic python programming or Create and perform various operations on data structures like list, tuple dictionaries and strings.
2. Apply Control Flow and Functions for efficient coding to solve problems.
3. Demonstrate proficiency in handling file operations, managing exceptions, and developing Python packages and executable files for modular programming.
4. Illustrate the concept of Object-Oriented Programming used in python.
5. Design Graphical User Interface (GUI) applications, utilizing appropriate Python libraries to create user-friendly interfaces.
6. Investigate and apply popular python libraries to conduct efficient data handling tasks.

Prerequisite:

1. Logical Thinking & Problem Solving: Ability to break down problems into smaller parts. Basic understanding of flowcharts or algorithmic thinking.
2. Mathematical Reasoning: Basic arithmetic operations (addition, subtraction, multiplication, division).
3. Understanding of variables, functions, and formulas (from school-level math).
4. Analytical Skills: Ability to spot patterns, debugs issues, and evaluates outputs.

Text Books:

1. Core Python Programming, Dr. R. Nageswara Rao, Second Edition, Dreamtech Press.

2. Beginning Python: Using Python 2.6 and Python 3.1. James Payne, Wrox Publication.

3. Python Programming, Anurag Gupta and G. P. Biswas, First Edition,McGraw-Hill Education.References:

1. Learn Python the Hard Way, Zed Shaw, Third Edition, Addison-Wesley.
2. Python Projects, Laura Cassell,Alan Gauld, First Edition, Wrox Publication.
3. Introduction to computing and problem-solving using python, Balagurusamy, First Edition, McGraw Hill Education.

Online Resources:

Sr. No.	Website Name
1.	https://nptel.ac.in/courses/106106145
2.	https://onlinecourses.swayam2.ac.in/cec22_cs20/preview
3.	https://www.researchgate.net/
4.	https://www.sciencedirect.com/science/article/pii/S2666920X24001127
5.	https://www.sciencedirect.com/search?qs=python%20programming

Suggested List of Experiments: (Expected Minimum 15 Experiments to be performed)

Sr No	List of Experiments	Hrs
01	To understand the structure and features of the Code::Blocks Integrated Development Environment (IDE) and to use it effectively for writing, compiling, debugging, and executing python programs, which will serve as the foundational tool for all further experiments in the lab.	**02**
02	Personalized Greeting Generator* - Write a python code to generate Personalized Greeting.	**02**
03	Calculating Areas of Geometric Figures* - Write a python program to calculate areas of any geometric figures like circle, rectangle and triangle.	**02**
04	Calculating Gross Salary of an Employee*: Write a Python program to calculate the gross salary of an employee. The program should prompt the user for the basic salary (BS) and then compute the dearness allowance (DA) as 70% of BS, the travel allowance (TA) as 30% of BS, and the house rent allowance (HRA) as 10% of BS. Finally, it should calculate the gross salary as the sum of BS, DA, TA, and HRA and display the result.	**02**
05	Task List Manager*: Develop a Python program to manage a task list using lists and tuples, including adding, removing, updating, and sorting tasks.	**02**
06	Student Record Keeper *: Write a Python program to create, update, and manipulate a dictionary of student records, including their grades and attendance.	**02**

07	Triangle Pattern Generator Using Loops: Write a Python program to print a triangle pattern (give any), emphasizing the transition from C to Python syntax.	**02**
08	Number Type Identifier*: Develop a Python program that takes a numerical input and identifies whether it is even or odd, utilizing conditional statements and loops.	**02**
09	**Grade Evaluator:** Develop a Python program that takes marks and evaluates grade using if-elif-else	**02**
10	**Fibonacci Sequence Generator:** Write a Python program to generate the first N terms of the Fibonacci series using loops.	**02**
11	Multiplication Table Generator: Write a Python program to take a numerical input from the user and generate its multiplication table using loops.	**02**
12	Extracting Words from Text File *: Develop a Python program that reads a text file and prints words of specified lengths (e.g., three, four, five, etc.) found within the file.	**02**
13	Basic Exception Handling*: Write a Python program that takes two numbers as input and performs division. Implement exception handling to manage division by zero and invalid input errors gracefully.	**02**
14	Online ATM System: Develop classes for ATM. Include methods for withdraw, deposit and check balance.	**02**
15	Password Strength Checker: Write a Python script that prompts the user to enter a password. Use regular expressions to validate the password based on these criteria: At least 8 characters long, Contains at least one uppercase letter, one lowercase letter, one digit, and one special character.	**02**

Assessment: List of Assignments (Any 4)

Sr No	List of Assignments / Tutorials	Hrs
01	Write a Python program to find the largest of three numbers using if-else.	**02**
02	Create a calculator using Python functions (Addition, Subtraction, Multiplication, Division).	**02**
03	Write a program to check whether a number is prime or not.	**02**
04	Develop a program to generate Fibonacci series using **for** and **while** loops.	**02**
05	Create a menu-driven program using functions for basic mathematical operations.	**02**
06	Write a program to sort a list using Bubble Sort and explain each step.	**02**
07	Create a Python program using lists to manage student records (Add, Delete, Search).	**02**
08	Write a Python program using dictionaries to store and display employee details.	**02**
09	Create a Python script to read and write data from/to a text file.	**02**
10	Write short notes on NumPy, Pandas, and Matplotlib with small sample codes.	**02**

Term Work: Term Work shall consist of at least 12 to 15 practicals based on the above list. Also, Term work Journal must include at least 4 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical & Oral Exam: An Oral & Practical exam will be held based on the above syllabus

R-2025- Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30)
16122208	**IDEA LAB - (Innovation Design Engineering and Apply)**	1	--	2	15	--	30	15	60	2

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		Test1	Test 2	Avg. of 2 Tests				
16122208	**IDEA LAB - 1(Innovation Design Engineering and Apply)**	--	--	--	--	50	50	100

Rationale :

Aligned with the National Education Policy (NEP) 2020, the institution emphasizes experiential, interdisciplinary, and project-based learning through the IDEA Lab—a central hub for hands-on innovation.

To strengthen the undergraduate research ecosystem, the institution has adopted a theme-based academic model aligned with UN SGD. Each semester features six curated problem statements based on local need and aligned with core subjects in the same semester, enabling students to apply classroom knowledge to real-world challenges. Every student selects one problem and develops an individual, subject-integrated solution—enhancing both academic understanding and research skills.

The IDEA Lab supports this initiative with facilities for design thinking, prototyping, and product development. Students maintain a project logbook throughout the semester to track their progress and reflections.

To ensure academic accountability, a two-tier assessment framework is implemented:

- Project Assessment based on standardized IDEA Lab rubrics.

- Subject-Based Term Work Assessment focused on the application of same-semester subject knowledge in the project.

Lab Objectives:

1. To promote experiential and project-based learning that bridges theoretical knowledge with real-world problem-solving.
2. To encourage interdisciplinary integration by enabling students to apply concepts from multiple subjects within a single cohesive project.
3. To develop innovation and design thinking skills through hands-on activities and iterative solution development.
4. To foster critical thinking and creativity by engaging students in open-ended problems with multiple solution pathways.
5. To enhance communication, collaboration, and documentation skills essential for professional engineering practice.
6. To build an entrepreneurial and research mindset by guiding students to develop scalable, socially-relevant, and technically viable prototype

Lab Outcomes: Student will be able to

1. Recall and articulate key concepts from core and allied subjects relevant to the assigned project.
2. Explain the interdisciplinary nature of the problem and the role of each subject in addressing it.
3. Apply appropriate tools, techniques, and theoretical knowledge to develop project components.
4. Analyze problem constraints and user requirements to structure a feasible and efficient solution.
5. Evaluate multiple design options and justify the chosen solution based on technical and practical considerations.
6. Create a functional prototype or solution that demonstrates innovation, utility, and integration of interdisciplinary knowledge

1) Guidelines for IDEA Project

a) Project Guidelines (Interdisciplinary Project Execution in IDEA Lab)

- Each student works on an individual interdisciplinary project aligned with the semester theme.
- Faculty in-charges for the IDEA Lab are assigned according to the complexity of the project and the capacity of the respective departments.
- Faculty in-charges mentor both the academic and technical aspects, and track weekly progress.
- Project assessment will be rubric-based, ensuring depth, innovation, documentation, and ownership.
- Students shall convert the best solution into working model using various components of

their domain areas and demonstrate.

- Faculty in-charges must attend relevant FDPs to ensure uniformity in mentoring and evaluation.

b) Guidelines for same semester Subject Concepts Applied within the Project

- Termwork for each subject will partially reflect how well a student applies subject-specific concepts in their interdisciplinary project.
- Internal assessment panel will collaborate to align project components with subject learning outcomes.

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c) Role of Faculty In-Charges in IDEA Lab Projects

Faculty in-charges play a pivotal role in the success of interdisciplinary, theme-based projects under the IDEA Lab. Their responsibilities extend beyond technical supervision to include academic alignment, innovation facilitation, and active student engagement. Their key roles include:

1. **Motivating and Inspiring Students**
   - Encourage students to take ownership of their learning and projects.
   - Cultivate a mindset of curiosity, exploration, and social relevance.
   - Foster an environment where students feel empowered to take creative risks.
2. **Conducting Brainstorming and Ideation Sessions**
   - Organize structured brainstorming sessions at the start of the semester to help students define their problem statements and solution pathways.
   - Promote collaborative thinking, design exploration, and interdisciplinary integration.
3. **Arranging Guest Lectures and Expert Talks**
   - Identify and invite industry experts, researchers, and innovators for guest lectures aligned with the semester's theme or subject areas.
   - Facilitate exposure to real-world challenges, current trends, and future opportunities.
4. **Ensuring Uniqueness and Originality of Projects**

- Actively review proposed ideas to ensure **no duplication of solutions** across students.
- Encourage students to explore novel approaches, technologies, and perspectives.

5. **Promoting Discussion and Collaborative Learning**
   - Create platforms for students to present, discuss, and receive peer and mentor feedback.
   - Facilitate idea refinement through regular discussions and group engagement.
6. **Aligning Subject Content Beyond Syllabus**
   - Faculty in-charges must **align subject content beyond the syllabus of the same semester** with the **IDEA Lab theme and assigned problem statements**.
   - This ensures relevance, depth, and meaningful interdisciplinary integration.
7. **Same Semester Faculty Requirement**
   - Faculty in-charges must be teaching subjects in the **same semester** as the students' project to ensure seamless academic integration and contextual understanding.
8. **Monitoring and Documentation**
   - Oversee project logbook maintenance, milestone tracking, and submission of progress reports.
   - Provide ongoing feedback and ensure project alignment with learning outcomes.
9. **Coordination with Subject Faculty**
   - Work in collaboration with other subject faculty to help students embed theoretical and practical aspects of their coursework into the project.
   - Facilitate subject-term mapping and contribute to termwork assessment based on evidence.

2) Implementation Strategy

a) Project Implementation in IDEA Lab

Aspect	Implementation Strategy
Faculty in-charges	**Faculty in-charges assigned based on project nature and department capacity.**
Mentoring Role	**Faculty in-charges oversee academic/technical development, interdisciplinary integration, and timely documentation.**
Capacity Building	**Faculty in-charges undergo workshops on design thinking, innovation, assessment rubrics, and outcome-based mentoring.**

Aspect	Implementation Strategy
Assessment Contribution	**Faculty in-charges contribute to 25 marks allocated for the IDEA Lab project termwork. The remaining assessments are conducted by the external examiner.**
Recognition & Incentives	**Faculty in-charges receive workload credits or are formally acknowledged in performance reviews.**

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b) Implementation of Subject-Term Work Mapping within Projects

Aspect	Implementation Strategy
Mapping Subject Outcomes	**Faculty in-charges align their content beyond syllabus with the student's project by coordinating with the assigned project guide.**
Independent Evaluation	**Internal assessment panel evaluate students based on their application of subject-specific concepts within the project. This contributes to a** separate 25 marks allocated for termwork based on subject **application.**
Evidence Sources	**Evaluation is supported by project logbooks, subject-specific deliverables (e.g., tools, simulations, models), and review presentation inputs.**
Outcome Assurance	**Ensures practical demonstration of subject understanding and its integration into the interdisciplinary solution.**

Implementation Notes:

- Guide faculty assess their course's contribution using specific evidence such as:
  - Logbooks
  - Subject-specific outputs (e.g., simulations, designs)
  - Paper publications or review presentations

2) Guidelines for Assessment

Two-tier rubrics are applied independently to evaluate subject concept application and innovation within the project.

a) Assessment of IDEA Lab Projects (Individual Interdisciplinary Projects) (25 Marks)

Presentation-Based Assessment Structure (Total: 25 Marks)

Assessment Month	Weightage	Marks
Month 1 (Formative 1)	20%	5 marks
Month 2 (Formative 2)	40%	10 marks
Month 3 (Formative 3)	40%	10 marks

Rubric-Based Evaluation Criteria

Criteria	Month 1 (5)	Month 2 (10)	Month 3 (10)
Problem Understanding	Connects problem to subjects	Defines interdisciplinary scope	Demonstrates deep conceptual grasp
Subject Knowledge Application	Identifies relevant concepts	Applies principles in design	Integrates multiple subject areas correctly
Innovation & Design Thinking	Proposes creative idea	Develops and tests feasible solution	Final solution shows originality and utility
Documentation & Presentation	Logbook initiated, plan presented	Mid-design log and visuals	Final report and demo completed
Progress & Ownership	Meets deadlines, shows planning	Demonstrates self-motivation	Completes project independently with reflection

b) Term Work Assessment of Subject Concepts Applied in Projects (25 Marks)

Applicable to All Subjects Integrated with Interdisciplinary Projects

To reflect meaningful application of subject knowledge, each subject will be assessed through the following rubric:

Criteria	**Marks**	**Description**
Subject Knowledge Application	8	Depth and accuracy of concept integration into the project
Practical Design or Tool Usage	5	Use of subject-specific hardware/software/simulation/tools
Documentation	4	Quality and clarity of subject-related logs and reports
Viva/Presentation	4	Ability to explain subject's relevance and role in the project
Continuous Engagement	4	Evidence of consistent participation via logbooks and feedback

c) Total Assessment Structure

Component	Marks	Assessed By
Termwork – Project Execution	25 Marks	Project Guide
Termwork – Application of Subject Concepts	25 Marks	IDEA Lab Panel
Viva Voce (Final Evaluation)	50 Marks	External Examiner

R-2025- Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30
16212209	Basic Fluid Mechanics Lab	--	--	2	--	--	30	--	30	1

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT-1	IAT-2	IAT-1 + IAT-2				
16212209	Basic Fluid Mechanics Lab	--	--	--	--	25	25	50

Lab Objectives:

1 . Understand basic fluid properties and behaviors through experimental techniques.

2 . Apply theoretical principles such as Bernoulli's and Pascal's laws in laboratory conditions.

3 .Demonstrate fluid flow measurements using standard hydraulic devices and instruments.

4. Analyze energy losses in fluid systems under different flow and fitting conditions.

5 .Visualize fluid flow patterns and behavior in open channels and pipes.

6 .Introduce fundamental fluid machines (pumps, turbines) and flow-related structural behaviors.

Lab Outcomes:

After completion of the course, Students shall be able to

1 Measure and interpret viscosity, pressure, and flow using appropriate instruments.

2 Apply conservation laws to analyze pressure and velocity changes in fluid flow.

3 Quantify head loss and energy losses in pipelines and open-channel flows.

4 Visualize flow phenomena and interpret experimental results using theoretical principles.

5 Understand and analyze flow behavior through notches, orifices, and meters.

6 Describe and demonstrate performance characteristics of fluid machinery and floating structures.

List of Experiments.

Sr No	List of Experiments	Hrs

01	Determination of Viscosity of a Fluid Using Stokes' Law	2
02	Verification of Bernoulli's Theorem	2
03	Use of Manometers for Pressure Measurement	2
04	Flow Visualization using Dye Injection	2
05	Friction Loss Measurement in Pipe Flow	2
06	Minor Losses in Bends and Fittings	2
07	Demonstration of Flow through Open Channels	2
08	Observation of Hydraulic Jump in a Rectangular Channel	2
09	Flow Through Notches	2
10	Flow through Orifice	2
11	Flow through Venturi meter	2
12	Flow through Orifice meter	2
13	Stability of Floating Body (Metacentric height of ship Body)	2
14	Study of Wind tunnel	2
15	Demonstration of Centrifugal Pump and Hydraulic Turbine – Working Principle and Performance Observation	2

Sr No	**List of Assignments / Tutorials**
01	Questions Based on Module I and Crate PPT based on self-learning topics of module I
02	Questions Based on Module II and Crate PPT based on self-learning topics of module II

03	Questions Based on Module III and Crate PPT based on self-learning topics of module III
04	Questions Based on Module IV and Crate PPT based on self-learning topics of module IV
05	Questions Based on Module V and Crate PPT based on self-learning topics of module V
06	Questions Based on Module VI and Crate PPT based on self-learning topics of module VI

Text Books:

1. 1. Fluid Mechanics by Dr. A. K. Jain, Khanna Publishers.
2. 2. Fluid Mechanics and Fluid Machinery by R. K. Bansal, Laxmi Publications.
3. 3. A Textbook of Fluid Mechanics and Hydraulic Machines, Rajput, R. K, S. Chand Publishing

References:

4. Fluid Mechanics and Hydraulic Machines by McGraw Hill Education (India).
1. Fluid Mechanics by R. J. Garde, A.J Mirajgaonkar, SCITECH Publication.
2. Fluid Mechanics by K. Subramanya, McGraw Hill.
3. Fluid Mechanics by Frank White, McGraw Hill.

Online Resources:

Sr. No.	**Website Name**
1.	Virtual Lab

Assessment:

Term Work: Term Work shall consist of at least 10 to 12 practicals' based on the above list. Also, Term work Journal must include at least 2 assignments.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Practical& Oral Exam: An Oral & Practical exam will be held based on the above syllabus.

R-2025- F.E. Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours Per Week			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour/30)
16412210	Engineering Workshop II	--	--	2	--	--	30	15	45	1.5

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		IAT- 1	IAT-2	IAT-1 + IAT-2				
16412210	Engineering Workshop II	--	--	--	--	25	—-	25

Lab Objectives:

1. To understand and implement the fundamental safety rules, personal protective measures, and standard operating procedures essential for preventing accidents and ensuring a safe working environment in the engineering workshop.
2. To develop skills in using hand tools for fitting operations by performing basic metal cutting, filing, marking, and fitting exercises while following proper safety and operational procedures.
3. The objective is to enable students to understand different types of welding joints, select appropriate electrodes and equipment, and fabricate simple welded components while following standard safety procedures and workshop practices.
4. To introduce students to basic IOT and embedded systems by programming a NODE MCU ESP8266 micro controller to blink an LED..
5. To introduce students to fundamental robotics concepts through the assembly and programming of a basic line following robot.
6. To understand flight dynamics, sensor integration, remote control systems, and applications of drones in real-world.
7. Identify different types of 3D printers (FDM, SLA, SLS) and their components

Lab Outcomes: At the end of the course, the student will be able to

1. Able to Understand and follow standard safety rules and operating procedures for tools and machinery.
2. Able to identify and correctly use common fitting tools such as files, hacksaws, bench vices, punches, scribers, and hammers.
3. Able to Identify various types of welding processes such as gas welding, arc welding, and spot welding, along with their applications.
4. Able to collect data from sensors and control actuators using boards like Arduino, NodeMCU, or Raspberry Pi.
5. Able to Write and implement code to control robotic motion using microcontrollers like Arduino, Raspberry Pi, or other platforms.
6. Able to operate a drone using a remote controller and execute programmed missions using waypoint navigation
7. Able to Perform printer setup, filament loading, calibration, and execute the printing process successfully

Detailed Syllabus

Sr No	Name of Module	Detailed content	Hours	Lo
	Safety and precautions	Lab rules and lab safety, knowledge of proper use of safety kit.	**2**	**LO1**
1	**Fabrication**	Introduction to Fitting Section. ● Introduction to fitting tools, sheets ● Fitting job Introduction to welding section ● Introduction to types of welding machine , safety as well as types of welding etc. ● Lap Joint Job.	**6** **4**	**LO2** **LO3**
		Self learning https://youtu.be/deHaqv7WX5I?feature=shared(welding) https://youtu.be/NwWpuRfZDjI?feature=shared https://youtu.be/y-OKi8oSNQ4?feature=shared	**3**	
2	**Introduction to IOT and Embedded system**	Programming a NodeMCU ESP8266 microcontroller to blink an LED. ● Introduction to NODE MCU and IOT. ● Circuit setup and IDE configuration. ● Setting up Arduino IDE for ESP8266. Experimenting Variation and Discussion	**4**	**LO4**
		Self Learning Connect the DHT sensor to the NodeMCU. Write and upload a program using Arduino IDE to read temperature data. Write and upload a program using Arduino IDE to read temperature data. Send the data to Thing Speak (or any IoT dashboard). Visualize the readings on a real-time graph.	**3**	
3	**Introduction to Robotics**	Programming a basic line following robots ● Introduction to robotics and components	**4**	**LO5**

		• Assembling a line following robots • Programming the robot. Testing and evaluation		
		Self learning Build and Control a Basic Line-Following Robot (Modify the code to adjust speed based on curves.)	**3**	
4	**Introduction to drone technology**	Introduction to drone • Components familiarizations • Drone assembly • Calibration and coding upload • Flight testing and troubleshooting	**4**	**LO6**
		Self Learning Studying basic principle of drone Studying drone programming Basic drown fundamentals	**3**	
5	**Introduction to 3D Printing**	To design and print your first object • Introduction and basics. • 3d modelling • Slicing and preparing the print	**6**	**LO7**
		Self Learning Explore process parameter of 3d printer Explore 2d and 3d drafting and modelling	**3**	

Reference Books

1. Workshop Technology (Vol. 1)by S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy
2. Welding Technology by O.P. Khanna
3. IoT: Building Arduino-Based Projects by Peter Waher.

4. Robotics: Modelling, Planning and Control by Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo.
5. 3D Printing: A Practical Guide for Librarians by Sara Russell Gonzalez, Denise Beaubien Bennett.
6. Make: DIY Drones for the Evil Genius by Ian Cinnamon.

Online Resources

Sr No	Reference
1	https://onlinecourses.nptel.ac.in/noc21_cs17 -Introduction to internet of things, by Prof. Sudip Misra , IIT Kharagpur
2	https://onlinecourses.nptel.ac.in/noc21_cs08 -Embedded Systems Design, By Prof. Anupam Basu, IIT Kharagpur
3	https://onlinecourses.nptel.ac.in/noc25_ae30/preview -Drone Systems and Control, By Prof. Suresh Sundaram, Dr. Rudrashis Majumder
4	https://onlinecourses.swayam2.ac.in/ntr25_ed66/preview - 3D Printing and Design for Educators, By Dr. Sharad K. Pradhan

Suggested list of Experiments:

Sr No	List of Experiments	Hrs.
01	Fitting Job	6
02	Lap joint Job.	4
03	Blinking LED with Node MCU.	4
04	Built and test basic Line following robot	4
05	Design and Print your first object.	6
06	To assemble and understand working of mini drone.	4

Assessment for Term Work (25 marks)

- **Term Work Marks:** 25 Marks (Total marks)
- **Job and Manual**:- 20 Marks
- **Regularity and active involvement:-** 5 Marks

R-2025- Mechanical Engineering

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned					Total Credits (C)
		L	T	P	L	T	P	SL	Notional Learning Hour	(Notional Learning Hour/30
98441211	Indian Knowledge System	2	-	-	30		-	30	60	2

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT 1	IAT 2	IAT1 +IAT 2					
98441211	Indian Knowledge System	20	20	40	60	2.5	--	--	100

Rationale:

The Indian Knowledge System (IKS) is vital for preserving India's rich cultural heritage, fostering holistic and sustainable practices, and integrating ancient wisdom with modern science to address contemporary challenges and enrich global knowledge.

Course Objectives:

1. To explore and understand the evolution of Indian scientific thought
2. To evaluate the historical and modern educational systems in our country.
3. To analyse sustainable practices in in ancient India.
4. To know the richness of Indian Arts and Culture
5. To understand the contributions of Indian Scientists and Nobel Laureates
6. To understand the principles of good governance.

Course Outcomes:

1. Recognize the sources and concepts of the Indian knowledge system
2. Learn about our history of Indian ancient knowledge and its significance in the current scenario.
3. Demonstrate sustainable development in various fields like Science, Technology, agriculture, industry, architecture performing arts, etc.
4. Understand and appreciate the rich heritage that resides in literature
5. Learn about the ancient Bhartiya education system in comparison with the modern era
6. Showcase the multi-dimensional nature of IKS and its importance in modern

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	1.Students should have the foundational knowledge and skills necessary for a comprehensive understanding of IKS 2. Students should be familiar with the Indian Culture, Language, and History of Science and Technology in India.		

I	**Introduction to The Indian Knowledge System (I.K.S.)**	Basic knowledge and scope of IKS, IKS in ancient India and modern india,, Preservation of culture, tradition and Dharma through education. Sources of Education, Aim of Education, Curriculum, methods of learning, Reviving, Knowledge (Ancient Scientific Discoveries) **Self-Learning Topics: Macaulay's Education Policy and Max Mullar Ideology in destroying Indian Tradition**	5 5	CO2
II	**Development of Scientific Thoughts in Ancient India**	Development in Science, Technology, Astronomy, Mathematics, and Life Sciences – Life Science, Physiology, Ayurveda, etc. Discoveries during Ancient times **Self-Learning Topics: Technological Innovations in Ancient India, Architecture and Engineering**	5 5	CO1
III	**Development of Arts & Culture in India**	Development of Arts & Culture in India, Introduction to Ancient Architecture (Arts, Forts, Paintings, Sculpture, Temple architecture, etc.), Development in performing arts & culture: Music, Art of singing, Art of dancing, Natyakala, Cultural traditions and Folk arts **Self-Learning Topics: Origin and Evolution of Indian Classical Music and Dance, Natyashastra by Bharata Muni, Handicrafts and Decorative Arts**	5 5	CO4
IV	**Good Governance in Ancient India**	Introduction to Indian religions,Moral and Ethical Governance,Vishva Kalyan through Vasudhaiva Kutumbkam,Principles of Good Governance about Ramayana, Mahabharat, Artha Sastra and Kauṭilyan State,Scientific Explanation of Vedic or traditional system of	5	CO6

		society for Good Governance **Self-LearningTopics:Governance Models and Kingdoms, Court System and Judges, Crime, Punishment & Fairness**	5	
V	**Contribution of Indian Scientist & Nobel Laureates**	Baudhayan, Aryabhatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna, Susruta, Kanada & Charak Rabindranath Tagore, C.V. Raman, Har Gobind Khorana, Mother Teresa, Subrahmanyan Chandrasekhar, Amartya Sen, V.S. Naipaul, Venkatraman Ramakrishnan, Kailash Satyarthi and Abhijit Banerjee **Self-Learning Topics: Indian Contributions to Global Science**	5 5	CO5
VI	**Sustainable Practices in Ancient India**	Agriculture, waste management, water conservation, forest conservation, architecture, urban planning, biodiversity preservation, etc Yoga, Pranayama, and meditation for health and well-being. **Self-Learning Topics: Vaastu Shastra Principles, Minimalism and Non-materialism**	5 5	CO3
		Total	**60**	

Text Books:

1. A.K Bag, History of technology in India (Set 3 vol), Indian Nation Science Academy, 1997.
2. An Introduction to Indian Knowledge Systems: Concepts and Applications, B Mahadevan, V R Bhat, and Nagendra Pavana R N; 2022 (Prentice Hall of India).
3. Ancient Indian Knowledge: Implications To Education System, Boski Singh; 2019
4. India's Glorious Scientific Tradition by Suresh Soni; 2010 (Ocean Books Pvt. Ltd.)
5. Indian Art: Forms, Concerns, and Development in Historical Perspective (History of Science, Philosophy and Culture in Indian Civilization), General Editor: D.P. Chattopadhyaya, Ed. By. B.N. Goswamy; 1999 Munshiram Manoharlal Publishers Pvt. Ltd.
6. Indian Knowledge Systems: Vol I and II, Kapil Kapoor and A K Singh; 2005 (D.K. Print World Ltd).
7. Pandey, K.K. Kriya Sarira Comprehensive Human Physiology, Chaukhambha Sanskrit series, Varanasi, 2018
8. Shukla Vidyadhar & Tripathi Ravidatt, Aayurved ka Itihas evam Parichay, Chaukhambha Sanskrit Sansthaan, New Delhi, 2017
9. Textbook on The Knowledge System of Bharata by Bhag Chand Chauhan; 2023 (Garuda Prakashan) 6. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati; 2006
10. Traditional Knowledge System in India, Amit Jha
11. J. K. Bajaj and M. D. Srinivas, Timeless India Resurgent India, Centre for Policy Studies, Chennai, 2001.

Online References:

Sr. No.	Website Name
1.	https://swayam.gov.in/explorer?searchText=iks
2.	https://iksindia.org/book-list.php
3.	https://iksindia.org/index.php

Assessment:

Internal Assessment:

Assessment consists of **one** class test of 20 marks, the first class test is to be conducted when approx. 50% syllabus is completed and **second** assessment will be of 20 marks based on field visit/case study report/PPT presentation. Duration of written test shall be one hour.

The End Semester Theory Examination shall consist of a total of 60 marks.

- **Question paper format**
- Question Paper will comprise of a total of six questions each carrying 15 marks Q.1 will be compulsory and should cover maximum contents of the syllabus
- Remaining questions will be mixed in nature (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)
- A total of four questions need to be answered

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Course Code	Course Name	Teaching Scheme (Contact Hours Per Week)			Teaching Scheme (Contact Hours Per Semester)					
		L	T	P	L	T	P	SL	Notional Learning Hour	Total Credits (C) (Notional Learning Hour / 30)
16461212	NSS & Civil Defence	-	-	4*	-	-	60	-	60	2

*: Students need to complete 60 hours throughout the semester as it is not possible to get 4 hours /week due to the dynamic schedule of the Government agencies.

Course Code	Course Name	Theory					Term work	Pract / Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		IAT-1	IAT-2	IAT-1 + IAT-2					
16461212	NSS & Civil Defence	--	--	--	--	--	25	--	25

Rationale:

The National Service Scheme (NSS) is a central sector scheme of the Government of India aimed at developing the personality of students through community service. The NSS syllabus is designed with a strong rationale that aligns with the educational, social, and developmental goals of the nation. The NSS syllabus promotes the all-round development of students by instilling values such as discipline, leadership, empathy, and teamwork. It encourages experiential learning beyond the classroom, complementing academic education.

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Course Objectives:

1. To Introduce National Service Scheme to learners and explain how it is used in current social studies.
2. To make the students aware of the need of having a foundation in social science and NSS.
3. To develop the personality of NSS volunteers through community service. It can enhance the personal growth and social skills of students.
4. To introduce students to social concepts and issues in society, as well as to get involved in resolving social issues.
5. To equip NSS volunteers with basic skills in civil defence, first aid, fire safety, and crowd management, enabling them to act as first responders during emergencies.
6. To build awareness, preparedness, and responsiveness among NSS volunteers to effectively assist in disaster situations.

Course Outcomes:

1. **Describe** the fundamentals and history of the National Service Scheme (NSS), with specific reference to its role in social work and nation-building.
2. **Demonstrate** understanding of NSS-related procedures, including organizational structure, volunteer enrollment, and activity planning.
3. **Participate** in community-based social service activities such as voter awareness drives, campus cleanup, tree plantation, and cyber safety campaigns.
4. **Develop** leadership, team-building, and project management skills through planning and executing NSS activities.
5. **Explain** the basic concepts of civil defence and disaster response mechanisms.
6. **Apply** practical skills in fire safety, first aid, and emergency management during simulated and real-life situations.

DETAILED SYLLABUS:

Sr. No.	Name of Module	Detailed Content	Hours	CO Mapping
I	**Leadership & Personality development**	Meaning, definition, qualities, and characteristics of a Leader. Meaning of personality, Dimensions of personality. Personality and Leadership nexus. Universal Human Values and Ethics for youths, Sustainable Development Goals	06	CO1

II	**Activity Based Programmes**	(Colleges can plan various social activities for learners and make a detailed report) Activities can be conducted throughout the academic year .Evaluation will be based on record keeping of the attendance of the learner.	10	CO2
III	**Awareness based Programmes**	Awareness Programmes such as Rally, Seminar, Workshops, poster making, theme based rangoli making , essay writing, slogan writing, quizzes , Celebration of National and International days, Personality Development Programmes, Group Activities, etc.,	10	CO3
IV	**Area Based Projects**	Visit to Adopted villages, Swatchatha \Programme, Visit and Conserving Ancient monuments and heritage site, Socio Economic Survey of village/slum, Nature Camp, Environmental Education, Women Empowerment Programme, Health and hygiene programmes and Blood donation, Legal awareness Programme, Literacy Programme, Cyber theft awareness Water Conservation Programme and RWH, One Day Special Camp in a village (preferably in adopted village/Adopted areas/Slums/MR Schools etc.).	14	CO4
V	**Introduction to Civil Defence and Disaster Management**	Definition and objectives of civil defence, Structure and functions of the Civil Defence Organization, Types of disasters: natural and man-made, Phases of disaster management: prevention, preparedness, response, recovery, NDMA (National Disaster Management Authority) and its role, Role of youth in disaster management	10	CO5
VI	**Basics of Fire Safety and First Aid**	Types of fires and fire extinguishers, Basic fire-fighting techniques, First aid for common injuries: bleeding, fractures, burns, CPR, Emergency numbers and response protocol, Evacuation techniques	10	CO6
		Total	60	

Text Books:

1. National Service Scheme Manual 2006, Government of India
2. Salunkhe P.B. Ed, Chhatrapati Shahu the Pillar of Social Democracy
3. National Service Scheme Manual, Govt. of India
4. Training Programme on National Programme Scheme TISS
5. Orientation Courses for N.S.S. Programme Officers, TISS

Online References:

Sr. No.	Website Name
1.	https://nssmu.in
2.	https://nss.gymkhana.iitb.ac.in/home

Assessment:

Term work (TW) for 25 marks:

- Term Work (TW) will comprise a **report submitted by the students, detailing the 60 hours** of social service completed during the semester as per the assigned projects and activities.

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Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
16471213	**Audit Course (non-graded)**	3	-	-	3	-	-	-

Audit Course: Developing a Research Ecosystem @ SLRTCE

This audit course is specifically designed for students keen on exploring the multifaceted world of research within an engineering context. It offers a unique opportunity to gain a comprehensive understanding of the essential components that drive a vibrant research ecosystem, without the pressure of examinations or academic credit. Students auditing this course are expected to actively participate in class discussions and complete assigned work, thereby enriching their educational experience beyond the confines of their core curriculum.

Course Objectives:

The primary objective of this audit course is to equip students with foundational knowledge and practical insights into key areas crucial for cultivating a strong research culture in engineering colleges. By the end of this course, students will:

- Understand the significance of Intellectual Property Rights (IPR) in academic research.
- Differentiate between various forms of IPR, including Copyright and Patents, and their implications.
- Gain an introductory understanding of the patenting process.
- Learn the fundamental principles of effective research paper writing.
- Develop skills in structuring and writing compelling research proposals.
- Appreciate the ethical considerations and best practices in academic research.

Course Structure:

This course will be delivered in Semester 2 through three weekly lectures, each focusing on a specific aspect of the research ecosystem. The interactive nature of the lectures will encourage active participation, critical thinking, and collaborative learning.To ensure relevance and specialized learning, each department is empowered to customize the course content based on their unique discipline.