COURSESTRUCTURE AND DETAILED SYLLABUS

MECHANICAL ENGINEERING

FOR

B. TECH FOUR YEAR

DEGREE PROGRAMME

APPLICABLE FOR THE BATCHES ADMITTED FROM 2025-2026

AR 25

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMUS INSTITUTION)

Approved by AICTE,recognised Under (2f)&(12b) of UGC

Permanently affiliated to JNTUGV, Vizianagaram

K.Kotturu, Tekkali, Srikakulam-532201, ANDHRAPRADESH.

WWW.adityatekkali.edu.in

VISION OF THE INSTITUTE

To evolve into a premier engineering institute in the country by continuously enhancing the range of our competencies, expanding the gamut of our activities and extending the frontiers of our operations.

MISSION OF THE INSTITUTE

Synergizing knowledge, technology and human resource, we impart the best quality education in Technology and Management. In the process, we make education more objective so that the efficiency for employability increases on a continued basis.

DEPARTMENT OF MECHANICAL ENGINEERING

Aditya Institute of Technology and Management established the Department of Mechanical Engineering (ME) in 2004 with an initial intake of 60 students and got approval for additional intake of another 60 seats in 2011-12. A Post Graduate Program (M. Tech) in Thermal Engineering was introduced in 2011-12 with an intake of 18 seats. The Department of ME feels proud to announce that this Institution has got accredited by NAAC. The college has got TEQIP funds in phase-II under sub-component 1.1. These two important additions surely enhance the prestige of the institution and in turn help students to improve their academic standards. Both the B. Tech and M. Tech programs were duly approved by the AICTE and Govt. of A.P. and permanently affiliated to JNTUGV, Vizianagaram. The Department has its UG Mechanical Engineering Program accredited thrice by NBA in 2013, 2017 and 2021. Further the UG B.Tech. intake has been enhanced to 180 in the year 2019. The Department has JNTUGV authorized research center with five research scholars pursuing their Ph.D. The Department is further equipped with skill oriented labs including Siemens-PLM authorized training centre and Applied Robot Control lab in association with European Centre for Mechatronics & Manufacturing, Germany. The State of art laboratories such as 3DX lab from Dassault Systemes, Automobile and Refrigeration-Air conditioning labs in association with AP State Skilled Development Center stand as assets to Department of Mechanical Engineering by which the skill-sets of students are being enhanced.

VISION OF THE DEPARTMENT

To emerge as one of the most preferred departments in the Southern region to produce professionally competent mechanical engineers.

MISSION OF THE DEPARTMENT

1. Provide students with a set of necessary knowledge, skills and attitude.
2. Develop the professional potential of students through comprehensive teaching and learning processes.
3. Inculcate life-long learning among the students to serve the profession and meet intellectual, ethical and career challenges.
4. Establish vital, state-of-the-art research facilities to provide its students and faculty with opportunities to create, interpret, apply and disseminate knowledge.

PROGRAM EDUCATIONAL OBJECTIVES

PEO 1: Attain successful careers in Mechanical or allied Engineering disciplines.
PEO 2: Create new methods and processes to solve contemporary mechanical engineering problems.
PEO 3: Exhibit ethical and leadership qualities in their chosen professional careers.

PROGRAM OUTCOMES

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1 : Analyze and design mechanical components as per given specifications using Engineering and Design Analysis software tools.

PSO 2 : Evaluate thermal systems including IC engines, Refrigeration & Air - Conditioning, and Power generating systems.

PSO 3 : Apply traditional and modern to manufacture and assemble mechanical components with quality assurance.

ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI
AR25 – COURSE STRUCTURE (1st B.Tech.)
(Proposed for Mechanical)

Year/Sem.	Category	Code	Theory/Lab	L	T	P	C
I B. Tech. (1st Sem)	MC	25MCS101	Induction Program	3 weeks			0
	BH	25BHT102	Linear Algebra & Calculus	2	1	0	3
	BH	25BHT104	Engineering Physics	3	0	0	3
	ES	25EST102	Basic Electrical and Electronics Engineering	3	0	0	3
	ES	25EST106	Computer Programming	3	0	0	3
	ES	25EST103	Engineering Graphics	1	0	4	3
	BH	25BHL102	Engineering Physics Lab	0	0	3	1.5
	ES	25ESL102	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5
	ES	25ESL105	Computer Programming Lab	0	0	3	1.5
	MC	25MCS102	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5
Total				**12**	**1**	**14**	**20**

Year/Sem.	Category	Code	Theory/Lab	L	T	P	C
I B. Tech. (2nd Sem)	BH	25BHT101	Communicative English	3	0	0	3
	BH	25BHT103	Differential Equations and Vector Calculus	2	1	0	3
	BH	25BHT105	Engineering Chemistry	3	0	0	3
	ES	25EST104	Engineering Mechanics	3	0	0	3
	PC	25MET101	Thermodynamics	3	0	0	3
	ES	25ESL104	Engineering Workshop	0	0	3	1.5
	BH	25BHL101	Communicative English Lab	0	0	3	1.5
	BH	25BHL103	Engineering Chemistry Lab	0	0	3	1.5
	MC	25MCS103	Health and Wellness, Yoga and Sports	0	0	1	0.5
	BH	25BHS104	Design Thinking and Sustainable Development	1	0	2	2
Total				**15**	**1**	**12**	**22**
Mandatory Socially Relevant Internship using Design Thinking and Sustainable Development of 02 weeks duration							

AR25 - B. Tech. -ME   **I Year I Semester**

INDUCTION PROGRAMME
(Common to all branches of engineering)

Subject Code: 25MCS101

L	T	P	C
3 weeks			0

S.No.	Course Name	Category	L-T-P-C
1	Physical Activities -- Sports, Yoga and Meditation,Plantation	MC	0-0-6-0
2	Career Counseling	MC	2-0-2-0
3	Orientation to all branches -- career options, tools,etc.	MC	3-0-0-0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematicalskills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

LINEAR ALGEBRA & CALCULUS
(Common to all branches of engineering)

Subject Code: 25BHT102

L	T	P	C
2	1	0	3

COURSE OBJECTIVES:
- Understand and apply fundamental concepts of matrices, including rank, inverse, and solutions of linear systems using direct and iterative methods
- Explore linear and orthogonal transformations, eigen values, eigen vectors, and apply the Cayley-Hamilton theorem and canonical forms
- Gain proficiency in calculus through the application of Mean Value Theorems and function approximations using Taylor's and Maclaurin's series
- Analyze and apply techniques in multi variable calculus including partial differentiation, Jacobian and optimization using Lagrange multipliers
- Apply double and triple integration techniques for calculating areas, volumes and other applications in engineering contexts

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1:	Solve systems of linear equations and analyze matrices using rank, inverse, and elimination methods
CO2:	Analyze and simplify matrices using eigenvalues, eigenvectors and the Cayley-Hamilton theorem
CO3:	Apply mean value theorems and function expansions to approximate and interpret real-valued functions
CO4:	Use multi-variable calculus to find partial derivatives and solve optimization problems
CO5:	Compute and apply double and triple integrals to evaluate areas and volumes in engineering contexts.

UNIT - I
Matrices: Rank of a matrix by echelon form and normal form; inverse of non-singular matrices using Gauss-Jordan method.
System of linear equations: Solving homogeneous and non-homogeneous systems using Gauss elimination method and Gauss-Seidel iteration method

UNIT - II
Linear Transformation and Orthogonal Transformation:
Eigen values and eigen vectors and their properties (without proof); Diagonalization of a matrix; Cayley - Hamilton Theorem (without proof); Finding the inverse and powers of a matrix using the Cayley - Hamilton Theorem.
Quadratic forms: Nature of quadratic forms; reduction of quadratic forms to canonical form using orthogonal transformation.

UNIT - III
Calculus:
Mean Value Theorems: Rolle's Theorem, Lagrange's Mean Value Theorem and Cauchy's Mean Value Theorem with geometrical interpretations. Taylor's and Maclaurin's Theorems with remainders (without proof); problems and applications based on the above theorems.

UNIT - IV
Partial Differentiation and Applications (Multivariable Calculus):
Partial derivatives, total derivatives, chain rule, change of variables; Taylor's and Maclaurin's series expansion for functions of two variables; Jacobians; maxima and minima of functions of two variables; method of Lagrange multipliers.

UNIT - V
Multiple Integrals (Multivariable Calculus):
Double integrals – change of variables (Cartesian and Polar coordinates); change of order of integration. Triple integrals – cylindrical and spherical coordinates. Applications of double integrals (Area) and triple integrals (Volumes).

Text Books
1. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, JohnWiley & Sons, 2018
3. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2018

Reference Books
1. T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganatham & M.V.S.S.N.Prasad, Engineering Mathematics-I, S.Chand Publisher, 2020.
2. R.K. Jainand S.R.K. Iyengar, Advanced Engineering Mathematics, 5/Ed, Alpha Science International Ltd.,2021 (9th reprint).
3. Michael Greenberg, Advanced Engineering Mathematics, 9thedition, Pearson edn

ENGINEERING PHYSICS
(Common to all branches of engineering)

Subject Code: 25BHT104

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:
- To introduce the basic concepts of physical optics phenomena, such as interference and diffraction
- Understanding of the concepts of quantum mechanics and semiconductor physics, as well as dielectric and magnetic materials, that lead to potential applications in emerging micro-devices.

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1: Understand the phenomenon of interference and diffraction of light, enabling precise analysis of optical instruments

CO2: Acquire foundational insight into the quantum nature of the particles and electronic properties of the semiconductors.

CO3: Develop insight into the dielectric and magnetic propertiesof materials

CO4: Analyze the crystal structures by X-ray diffraction techniques.

CO5: Apply the basic knowledge of lasers and fiber optics to analyze their construction

UNIT - I Wave Optics:
Interference: Introduction - Principle of superposition and its Analytical treatment - Interference of light - Interference in thin films (Reflection Geometry) - Colors in thin films- Newton's Rings- Determination of wavelength and refractive index.
Diffraction: Introduction –difference between interference and diffraction – difference between Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & Diffraction Grating (N-slit) – Maximum number of orders possible – determination of wavelength of laser.

UNIT - II
Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrödinger's time-independent wave equations– Particle in a one-dimensional infinite potential well.
Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors and Extrinsic semiconductors - Drift and diffusion currents – Einstein's equation

- Hall effect and its applications.

UNIT - III

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius-Mossotti equation.

Magnetic Materials: Introduction - Magnetic dipole moment – Magnetization-Magnetic susceptibility and permeability - Classification of magnetic materials: Dia, Para, Ferro, Anti-Ferro & Ferri magnetic materials - Domain concept for Ferromagnetism (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT - IV

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC.

X-ray diffraction: Miller indices – separation between successive (hkl) planes - Bragg's law - X-ray Diffractometer – crystal structure determination by Laue method and Powder method.

UNIT - V

Lasers: Introduction - Characteristics of Lasers - Principles of Laser: Absorption, Spontaneous emission, stimulated emission, principle of lasing action, population inversion, pumping, Types of Lasers: Helium-Neon Laser [Four Level System] –semiconductor laser - Applications of Lasers.

Optical Fiber: Introduction - Construction of Optical Fiber - Principle of Optical Fiber: Total Internal Reflection - Numerical Aperture and Acceptance Angle - Classification of optical fibers based on refractive index profile - Applications of Optical Fibers in Communication.

Text Books
1. "A Text book of Engineering Physics" - M. N. Avadhanulu, P.G.K shirsagar & TVS Arun Murthy, S.Chand Publications, 11th Edition 2019.
2. "Engineering Physics" - D. K. Bhattacharya and Poonam Tandon, Oxford press (2015).
3. "Engineering Physics" - P. K. Palanisamy SciTech publications.

Reference Books
1. "Fundamentals of Physics" - Halliday, Resnick and Walker, John Wiley &Sons.
2. "Engineering Physics" - M.R. Srinivasan, New Age international publishers (2009).
3. "Engineering Physics" - Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018.
4. "Engineering Physics" - Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press.
5. "Semiconductor physics and devices: Basic principle" - A. Donald, Neamen, Mc GrawHill.
6. "Engineering Physics" - B.K. Pandey and S. Chaturvedi, Cengage Learning
7. "Solid state physics" – A. J. Dekker, Pan Macmillan publishers
8. "Introduction to Solid State Physics" - Charles Kittel ,Wiley

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to CSE/IT/CSM/CSD/CSC/ME/CE)

Subject Code: 25EST102

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:
- To introduce the basic knowledge of electric circuits
- To analyze AC circuits
- To provide knowledge on DC Machines
- To understand the working, characteristics of PN Junction diode, Zener diode
- To explain the working of Rectifiers, Characteristics of transistor in Common base Configuration.

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1:   Able to summarize different electrical circuits

CO2:   Able to Summarize the behavior of AC circuits

CO3:   Able to examine the operation of DC Machines

CO4:   Able to Describe the working of PN Junction diode, Zener diode

CO5:   Able to describe the working of Rectifiers and behavior of transistor (BJT) in Common base Configuration

UNIT - I
Introduction to Electric Circuits: Basic definitions, Electrical circuit elements (R, L and C), Voltage and current sources Independent and dependent sources, Ohm's Law, Series & Parallel circuits, Voltage and current division Rules, Source transformation, Kirchhoff's Laws, Faraday's laws of electromagnetic induction and simple problems.

UNIT - II
AC Circuits: Basic definitions, Representation of sinusoidal waveforms, peak and RMS values, phasor representation, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series only), real power, reactive power, apparent power, power factor, simple problems.

UNIT - III DC Machines
 DC Generator: Generator- Principle of Operation, Construction, EMF equation, Classification,
 DC Motor: Motor- principle of operation, Torque equation, Classification, Speed Control

Methods, Operation of three point starter

UNIT - IV
Diode Characteristics: Formation of PN junction diode, V-I Characteristics of Diode, Diode as a switch, Zener Diode Characteristics, Zener Diode as Voltage Regulator.
Rectifiers: Hale wave Rectifier, Full Wave rectifier (Mid-point center tapped connection diode only)

UNIT - V
Transistor Characteristics: Bipolar Junction Transistors (BJT) - input & output Characteristics of transistor in CB configuration, Relationship between α, β and γ.

Text Books
1. D.P. Kothari and I.J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. Integrated Electronics – Jacob Millman, Chritos C. Halkies, Tata Mc-Graw Hill 2009.

Reference Books
1. Electronic Devices and Circuits–R.L. Boylestad and Louis Nashelsky, Pearson/Prentice Hall, 9th Edition, 2006.
2. Principles of Electrical and Electronics Engineering by V.K. Mehta, S. Chand & Co.

COMPUTER PROGRAMMING
(Common to all branches of engineering)

Subject Code: 25EST106

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:
- To provide a strong foundation in problem solving and programming is using the C language.
- This course introduces number systems, core programming concepts, control structures, arrays, functions, pointers, structures, and file handling.
- Emphasis is on writing efficient, modular, and error-free programs suitable for real-world applications.

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1:	Explore number systems and develop basic C programs using algorithms, flowcharts, and simple I/O operations.
CO2:	Apply decision-making, looping, and branching statements to solve conditional and repetitive problems.
CO3:	Use arrays and strings for data storage and manipulation
CO4:	Design modular programs using functions and apply pointer concepts for dynamic and memory optimized programs.
CO5:	Devise programs to manage and store complex data using structures and files.

UNIT - I
Introduction to Number System: Number Systems - Binary, Decimal, Octal, and Hexadecimal Systems, and Conversions

Introduction to Programming: Introduction to components of the Computer system, Algorithm, Flow chart, Program development steps, C Tokens, Data Types, Operator precedence and associativity, Expression Evaluation, Structure of C program, simple programs using formatted and unformatted I/O statements, preprocessor directives.

UNIT - II
Decision statements: if, if-else, nested if, if-else-if ladder, and switch case.
Iterative statements: while, do-while, for, nested loops.
Branching statements: Break and continue.

UNIT - III
Arrays and Strings

Arrays: Definition, Types of Arrays, declaration, initialization, Operations on arrays.
Strings: Fundamentals, declaration, initialization, accessing string, String manipulation.

UNIT - IV
Functions and Pointers

Functions: Definition and use, Declaration, Types of Functions, Parameter passing (Call by value and call by reference), Passing Arrays, Recursion, Recursion vs Iteration, function Vs Macro, Storage classes.
Pointers: Definition, Declaration, Initialization, Pointer arithmetic, functions and pointers, Pointer to pointer, arrays and pointers, Pointers as Function Arguments, DMA

UNIT - V
Structures, Unions and File Handling

Structures: Definition, Declaration, Accessing the structure elements, Array of structures, Arrays within structures, pointer to structure, passing structure to function, nested structures, self-referential structures, bit fields.
File Handling: Purpose, Types of files, file opening modes, closing a file, file I/O, Error Handling, Random Access to Files, Command line arguments, .

Text Books
1. B. W. Kernighan and D. M. Ritchie, The C Programming Language, 2nd ed., Englewood Cliffs, NJ, USA: Prentice-Hall, 1988.
2. Y. Kanetkar, Let Us C, 20th ed., New Delhi, India: BPB Publications, 2024.
3. N. Kamthane, Programming in C, 3rd ed., New Delhi, India: Pearson Education, 2015.

Reference Books
1. E. Balagurusamy, Programming in ANSI C, 9th ed., New Delhi, India: McGraw-Hill Education, 2024.
2. B. S. Gottfried, Programming with C, 2nd ed., New York, NY, USA: McGraw-Hill Education, 2006.

Web Links:
- https://www.programiz.com/c-programming
- https://www.geeksforgeeks.org/c/c-programming-language/
- https://www.tutorialspoint.com/cprogramming/index.htm

ENGINEERING GRAPHICS
(Common to ME and CE)

Subject Code: 25EST103

L	T	P	C
1	0	4	3

COURSE OBJECTIVES:
- To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing
- To impart knowledge on the projection of points, lines, planes, and solids
- To develop the imaginative skills of the students required to understand the development of surfaces
- To improve the visualization skills for better understanding of conversion of orthographic to isometric views and vice-versa

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1: Draw engineering curves (Conics, Cycloids, and Involutes)
CO2: Draw projection of points, straight lines and planes using first angle projection
CO3: Draw projection of solids in various positions
CO4: Draw the development of lateral surface for different solids.
CO5: Convert orthographic views into isometric projections and vice-versa.

UNIT - I
Introduction: Drawing Instruments and their uses, Types of Lines and Dimensioning, Line bisecting, Angle bisecting, Line divided into equal number of parts, Construction of Regular Polygons (general method).
Construction of ellipse, parabola, and hyperbola (general method)
Construction of ellipse (Oblong method and Concentric circles method)
Construction of Cycloid and Involutes

UNIT - II
Introduction to Orthographic Projections (First Angle Projection only).
Projections of Points: A point situated in I, II, III, & IV quadrants.
Projections of Straight Lines: Line parallel to one or both the planes, Line contained by one or both the planes, Line perpendicular to one of the planes, Line inclined to one plane and parallel to other.

Projections of Planes: Types of planes, plane parallel to one of the planes, and plane inclined to one reference plane.

UNIT - III
Projections of Solids (Polyhedra): Types of solids, Projections of solids in simple positions, Projections of solids axis inclined to the VP and parallel to the HP. Projections of solids axis inclined to the HP and parallel to the VP.

Projections of Solids (Solids of revolution): Projections of solids axis inclined to the VP and parallel to the HP. Projections of solids axis inclined to the HP and parallel to the VP.

UNIT - IV
Development of Surfaces:

Parallel line method of development, Developments of lateral surfaces of right Solids i.e., Cube, Prisms, Cylinders.

Radial line method of development, Development of lateral surfaces of right Solids i.e., Pyramids, Cones.

UNIT - V
Orthographic Projections: Conversion of pictorial view (Isometric views) into orthographic views.

Isometric Projections: Isometric axes, lines & planes. Isometric scale, Isometric drawing, Isometric drawing of plane figures, prisms and pyramids. Conversion of orthographic views into Isometric views.

Text Books
1. Engineering Drawing, N. D. Bhatt, V. M. Panchal, Charotar Pub
2. Engineering Drawing, K. L .Narayana, P.Kanniah, Scitech Pub.

Reference Books
1. Engineering Drawing and Graphics, 2nd ed., K. Venugopal, New Age International Pub.
2. Fundamentals of Engineering Drawing, 11th ed., Luzadder, J. Warren, D.M. Jon, Prentice Hall India Pub

ENGINEERING PHYSICS LAB
(Common to all branches of engineering)

Subject Code: 25BHL102

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:
- Applying the basic concepts of optical phenomena like interference and diffraction for verifying dimensions of thin objects, recognising the importance of the energy gap in the study of electrical properties of semiconductors, and investigating the parameters and applications of lasers and optical fibers through experiments.

COURSE OUTCOMES:

Upon the completion of this course, the students will be able to

CO1: Verify the microscopic dimensions of the objects by applying principles of interference and diffraction

CO2: Acquire a practical understanding of semiconductor physics by analyzing electronic properties of the semiconductors

CO3: Analyze the induced magnetic field in a current-carrying circular coil

CO4: Corroborate the mechanical properties of the materials

CO5: Evaluate the characteristics of the lasers and fiber optics

LIST OF EXPERIMENTS

1. Determination of the radius of curvature of a given Plano-convex lens by Newton's rings.

2. Determination of the thickness of a thin object using wedge shaped film.

3. Determination of wavelengths of different spectral lines in the mercury spectrum using a diffraction grating in normal incidence configuration.

4. Determination of the width of a slit using the diffraction phenomenon.

5. Determination of the temperature coefficient of a thermistor.

6. Determination of the energy band gap of a given semiconductor

7. To study the V-I characteristics of a PN junction diode in forward and reverse biasing conditions.

8. Magnetic field along the axis of a current-carrying circular coil by Stewart Gee's Method.

9. Determination of acceleration due to gravity and radius of Gyration by using a compound

pendulum.

10. Determination of the rigidity modulus of the material of the given wire using the torsional pendulum

11. Determination of the wavelength of Laser light using a diffraction grating.

12. Determination of numerical aperture and bending loss of an optical fiber

13. Determination of Hall voltage and Hall coefficient of a given semiconductor using the Hall effect.

14. Sonometer: Verification of laws of stretched string.

15. Determination of the Frequency of the electrically maintained tuning fork by Melde's experiment.

16. Determination of crystal structure and lattice parameter of a given crystal using powder diffraction data.

17. Determination of Young's modulus of the given beam by non-uniform bending.

18. Determination of dielectric constant using the resonance method.

Note: Any **TEN** of the listed experiments are to be conducted. Out of which any **TWO** experiments may be conducted in virtual mode.

References

1. ATextbookofPracticalPhysics-S.Balasubramanian,M.N.Srinivasan,S.ChandPublishers, 2017.

Web Resources

- www.vlab.co.in
- https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html,prototype

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB
(Common to CSE/IT/CSM/CSD/CSC/ME/CE)

Subject Code: 25ESL102

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:
- To introduce the basic laws related to electrical and electronics Circuits.
- To provide knowledge on Speed control Methods on DC motors.
- To analyze V-I characteristics of P-N diode and Zener diode.
- To provide knowledge on transistor Common base Configuration.
- To provide knowledge on Half and Full Wave Rectifiers.

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1: Demonstrate various basic electrical circuits.

CO2: Demonstrate speed control methods of DC motors.

CO3: Analyze the V-I characteristics of P-N diode and zener diode.

CO4: Analyze the transistor common base configuration characteristics.

CO5: Demonstrate the performance of on Half and Full wave rectifiers.

LIST OF EXPERIMENTS

1. Verification of Ohm's law.
2. Verification of Kirchhoff's current law
3. Verification of Kirchhoff's voltage law.
4. Verification of total resistance of the series and parallel connected circuits.
5. Verification on Measurement of power factor of series RL circuit.
6. Verification on Speed control Methods of DC motor.
7. Verification of PN Junction diode forward and reverse bias characteristics.
8. Verification of Zener diode characteristics.
9. Verification of Transistor CB characteristics (Input and Output).
10. Verification of Half wave rectifier (With and without Capacitor).

ADDITIONAL EXPERIMENTS

11. Verification of Full wave rectifier (With and without Capacitor).
12. Verification of operation and working of three point starter.

COMPUTER PROGRAMMING LAB
(Common to all branches of engineering)

Subject Code: 25ESL105

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:
- To equip students with hands-on programming skills using the C language by solving a variety of real-life and algorithmic problems
- The course emphasizes the use of control structures, arrays, functions, pointers, structures, and file handling through practical implementation
- It aims to develop logical thinking and modular coding practices aligned with foundational computing principles

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1: Apply basic C programming constructs such as variables, data types, operators, and input/output operations to solve simple problems

CO2: Develop programs using control structures to implement decision making and iterative tasks

CO3: Demonstrate the usage of arrays to solve problems related to lists of elements

CO4: Implement modular and memory optimized programs using functions and pointers

CO5: Design programs using structures and file handling techniques to manipulate stored data

LIST OF EXPERIMENTS

1. Write the C programs to perform the following
   a) Simple and compound interest calculation
   b) Find the maximum of 3 values using the conditional operator.
   c) Interchanging values of two variables.

2. Write the C programs to perform the following
   a) Demonstrate the precedence and associativity among operators using single expression
   b) Demonstrate the type casting operations
   c) Demonstrate different format specifies on different data types

3. Write C programs for the following using decision making statements
   a) Find roots of quadratic equation.
   b) Find the max and min of three numbers using if-else.
   c) Determine type of character (vowel, consonant, digit, special character).

4. Write the C programs to perform the following
   a) Read a number and display in reverse.
   b) Check for Armstrong number property
   c) Convert a binary number (entered as an integer) into its decimal equivalent.

5. Write a menu-driven C program using switch-case and loops to display:
   a) Prime numbers in a given range
   b) Fibonacci series
   c) Different patterns like Pascal triangle

6. Implement the following using arrays
   a) Largest and smallest from a list of elements.
   b) Program for Linear Search.
   c) Program for arranging elements.

7. Implement the following using arrays
   a) To count the total number of duplicate elements in an array.
   b) Matrix addition
   c) Matrix multiplication

8. Write a program in C using functions
   a) Implementation of strong number property.
   b) Implementation of call by value and call by reference
   c) Demonstrate the string operations with and without library functions (length, reverse, copy, concatenation, compare)

9. Write the C programs to perform the following
   a) GCD using recursion and non-recursion.
   b) Demonstrate working of macros vs functions.

10. Write the C programs to perform the following
    a) Find the sum and average of the list of elements using DMA Functions
    b) Demonstrate pointer arithmetic.

11. Write the C programs to perform the following
    a) Passing structure as a parameter to a function
    b) Nested structures.

12. Write the C programs to perform the following
    a) Count the number of lines, words, and characters in a file using command line arguments.
    b) Merging the contents of two files into a new file.

Text Books
1. B. W. Kernighan and D. M. Ritchie, The C Programming Language, 2nd ed., Englewood Cliffs, NJ, USA: Prentice-Hall, 1988.
2. Y. Kanetkar, Let Us C, 20th ed., New Delhi, India: BPB Publications, 2024.
3. N. Kamthane, Programming in C, 3rd ed., New Delhi, India: Pearson Education, 2015.

Reference Books
1. E. Balagurusamy, Programming in ANSI C, 9th ed., New Delhi, India: McGraw-Hill Education, 2024
2. B. S. Gottfried, Programming with C, 2nd ed., New York, NY, USA: McGraw-Hill Education, 2006.

Web Links
- https://www.programiz.com/c-programming
- https://www.geeksforgeeks.org/c/c-programming-language/
- https://www.tutorialspoint.com/cprogramming/index.htm

NSS/NCC/Scouts & Guides/Community Service
(Common to all branches of engineering)

Subject Code: 25MCS102

L	T	P	C
0	0	1	0.5

COURSE OBJECTIVES:
- The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1: Understand the importance of discipline, character and service motto

CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques

CO3: Explore human relationships by analyzing social problems

CO4: Determine to extend their help for the fellow beings and downtrodden people

CO5: Develop leadership skills and civic responsibilities.

UNIT - I
Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

i) Conducting – ice breaking sessions-expectations from the course - knowing personal talents and skills

ii) Conducting orientations programs for the students – future plans - activities - releasing road map etc.

iii) Displaying success stories-motivational biopics - award winning movies on societal issues etc.

iv) Conducting talent show in singing patriotic songs - paintings - any other contribution.

UNIT - II
Nature & Care Activities:

i) Best out of waste competition.

ii) Poster and signs making competition to spread environmental awareness.

iii) Recycling and environmental pollution article writing competition.

iv) Organising Zero-waste day.

v) Digital Environmental awareness activity via various social media platforms.

vi) Virtual demonstration of different eco-friendly approaches for sustainable living.

vii) Write a summary on any book related to environmental issues.

UNIT - III

Community Service Activities:

i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities- experts-etc.

ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,

iii) Conducting consumer Awareness. Explaining various legal provisions etc.

iv) Women Empowerment Programmes - Sexual Abuse, Adolescent Health and Population Education.

v) Any other programmes in collaboration with local charities, NGOs etc.

Reference Books

1. Nirmalya Kumar Sinha & Surajit Majumder, A Text Book of National Service Scheme Vol;.I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., ―Introduction to Environmental Engineering‖, McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. ―Introduction to Environmental Engineering and Science‖, Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi

COMMUNICATIVE ENGLISH
(Common to all branches of engineering)

Subject Code: 25BHT101

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:
- To enable students to build vocabulary appropriate to their levels and to make students understand printed texts of different genres
- To enhance basic writing skills of the students in different forms of written communication
- To assist students implicitly synthesize the rules of grammar for the production of accurate sentences
- To aid students to acquire appropriate and adequate letter writing skills
- To get students enhance their essay writing skills and develop reading skills

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1: Students will be able to comprehend printed texts of different genres easily and they will be able to make appropriate word choice for writing

CO2: Students will be able to write short texts efficiently

CO3: Students will be able to construct grammatically correct sentences

CO4: Students will be able to communicate through letters effectively

CO5: Students will be able to write essays and comprehend unfamiliar passages.

UNIT - I
A Power of a Plate of Rice by Ifeoma Okoye Skimming and Scanning — Capital letters and Punctuation — Spellings — Parts of speech — Root words — Prefixes and Suffixes — Synonyms and Antonyms.

UNIT - II
Night of the Scorpion by Nissim Ezekiel Sequencing — Paragraph writing — Cohesive devices — Articles — Prepositions Homonyms, Homographs, homophones

UNIT - III
Biography of Steve Jobs Drawing inferences — Paraphrasing, Summarizing, Note-making — Verbs and Tenses, Subject-verb agreement — Compound words — Collocations

UNIT - IV

The Toys of Peace by Saki Data interpretation — Official letters and Résumé — Direct and Indirect speech — Academic reporting verbs — Active and passive voice — Words often confused — Jargon

UNIT - V

The Power of Intrapersonal Communication (An Essay) Reading comprehension — Essay writing — Correcting errors — Technical Jargon

Text Books
1. Pathfinder: Communicative English for UndergraduateStudents, 1st Edition, Orient Black Swan, 2023 (Units 1, 2 & 3)
2. Empowering English by Cengage Publications, 2023 (Units 4 & 5)

Reference Books
1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web Resources:
GRAMMAR
1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html
4. https://www.learngrammar.net/
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

VOCABULARY
1. https://www.youtube.com/c/DailyVideoVocabulary/videos
2. https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(Common to all branches of engineering)

Subject Code: 25BHT103

L	T	P	C
2	1	0	3

COURSE OBJECTIVES:
- Develop understanding of first-order and first-degree differential equations and their real-world applications.
- Introduce methods to solve higher-order linear differential equations with constant coefficients and apply them to engineering systems.
- Equip students with techniques for forming and solving partial differential equations relevant to physical processes
- Provide knowledge of vector differentiation operators—gradient, divergence and curl—and their physical interpretations
- Enable students to evaluate vector integrals and apply the fundamental vector theorems (Green's, Stoke's and Divergence) in practical scenarios

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1: Apply first-order differential equations to model and solve problems in growth and electric circuits

CO2: Solve higher-order linear differential equations

CO3: Use Lagrange's method to solve partial differential equations arising from physical and engineering problems

CO4: Calculate and interpret the gradient, divergence and curl of vector fields and verify standard identities

CO5: Evaluate line and surface integrals and apply vector calculus theorems to real-world applications

UNIT - I
Differential Equations of First Order and First Degree:
Exact differential equations and equations reducible to exact form; linear differential equations; Bernoulli's equations.
Applications: Newton's Law of Cooling, Law of Natural Growth and Decay and Electrical Circuits.

UNIT - II

Linear Differential Equations of Higher Order (with Constant Coefficients):

Definitions of homogeneous and non-homogeneous equations; complementary function; general and particular integrals; method of variation of parameters.
Application: L–C–R Circuit.

UNIT - III

Partial Differential Equations:

Introduction and formation of partial differential equations by eliminating arbitrary constants a arbitrary functions; solutions of first-order linear equations using Lagrange's method.

UNIT - IV

Vector Differentiation:

Scalar and vector point functions; vector operator Del; Del applied to scalar point functions Gradient; Del applied to vector point functions – Divergence and Curl; vector identities.

UNIT - V

Vector Integration:

Line integral -Work done, surface integral- Flux. Integral theorems- Green's Theorem, Stoke Theorem and Divergence Theorem (without proof).

Text Books
1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers,2017.
3. B.V. Ramana, Higher Engineering Mathematics, McGraw Hill Education, 2017.

Reference Books
1. Dennis G.Zill and Warren S.Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2018.
2. Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn.
3. T. K. V. Iyengar, B. Krishna Gandhi, S. Ranganatham & M.V.S.S.N.Prasad, Engineering Mathematics-I, S.Chand Publisher, 2020.
4. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 5/e, Alpha Science International Ltd., 2021 (9th reprint).

ENGINEERING CHEMISTRY
(Common to CE and ME)

Subject Code: 25BHT105

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:
- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard waters, softening methods of hard water
- To train the students on the principles and applications of electrochemistry, polymers, surface chemistry, and cement

COURSE OUTCOMES:

Upon the completion of this course, the students will be able to

CO1: Demonstrate the importance of water for society and industrial needs

CO2: Summarize the concepts of Instrumental methods and distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

CO3: Demonstrate the corrosion prevention methods and factors affecting corrosion

CO4: Demonstrate the preparation, properties, and applications of polymer materials and fuels.

CO5: Demonstrate the importance of modern engineering materials like cement, refractories, composites, and lubricants.

UNIT - I
Water Technology
Soft and hard water, Estimation of hardness of water by EDTA Method, Numerical Problems on Temporary and Permanent Hardness - Disadvantages of Hard Water, Boiler troubles –Priming, foaming, scale and sludge, Caustic embrittlement, Industrial water treatment –Ion-exchange processes, Desalination of brackish water- Reverse osmosis (RO) and electrodialysis. Wastewater treatment-Block diagram (primary, secondary, tertiary).

UNIT - II
Instrumental Methods and Applications
Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law-Statements. UV-Visible Spectroscopy, Instrumentation, electronic transition, Definition of Chromophore – Definition of Auxochrome – Absorption and Intensity Shifts, IR spectroscopy- Instrumentation fundamental modes and Fingerprint Region. NMR – Principle - Equivalent and Non-Equivalent Protons - Chemical Shift- Splitting – Coupling Constant.

UNIT - III
Electrochemistry and Applications
Electrodes –electrochemical cell, Nernst equation, cell potential calculations (emf formula). Primary cells – Zinc-air battery, Secondary cells –lithiumion batteries - working principle of the batteries including cell reactions; Fuel cells-Basic Concepts, the principle and working of hydrogen-oxygen Fuel cell.

Corrosion: Introduction to corrosion, Dry corrosion - Pilling Bedworth rule, Electrochemical theory of corrosion, Factors affecting the corrosion, cathodic (sacrificial anodic protection and impressed current cathodic protection) and Metallic (Anodic and Cathodic) Coatings-working principle**.**

UNIT - IV
Polymers and Fuel Chemistry
Introduction to polymers, functionality of monomers, chain growth, step growth polymerization. Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of poly styrene. PVC, Nylon 6,6 and Bakelite. Biodegradable polymers – Introduction- Polyl Lactic Acid (PLA)-Applications.

Fuels – Types of fuels, calorific value of fuels (HCV, LCV and Theoretical calculations of calorific value), numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum-Fractional distillation.

UNIT - V
Modern Engineering Materials
Composites: Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications

Refractories: Introduction-Definition, Classification, Properties, and applications.

Lubricants: Introduction-Definition, Functions of lubricants, Mechanism, Properties of lubricating oils – Viscosity, Flash point, Fire point, Cloud and Pour Points, Acid Number or neutralization number.

Building materials: Portland Cement- Constituents- Setting and Hardening of cement

Text Books
1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010

Reference Books

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman, 1992
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

ENGINEERING MECHANICS
(Common to ME and CE)

Subject Code: 25EST104

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:
- To enable students to apply fundamental laws and basic concepts of rigid body mechanics to solve problems of bodies under rest or in motion.
- To enable the students to apply conditions of static equilibrium to analyse physical systems.
- To compute the geometric sectional properties of various areas.
- To make students to learn the effect of friction on different planes

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1:   Compute the resultant of system of forces acting on bodies in two dimensional plane

CO2:   Solve, statically-determinate problems in the field of engineering

CO3:   Analyze perfect plane trusses and solve problems involving rigid bodies under the influence of frictional forces

CO4:   Determine the centroid of regular geometrical sections and apply transfer theorems to determine moment of inertia of various sections

CO5:   Predict motion parameters of bodies under rectilinear, fixed axis rotation and general plane motion and solve the problems involving dynamics of rigid bodies

UNIT - I
Basics of Statics: Fundamental Principles, Classification of force system, principle of transmissibility of a force, composition of forces, resolution of a force, Free body diagrams, moment, Principle of moments, couple, Resultant of coplanar concurrent force system, Resultant of coplanar non-concurrent force system, Numerical examples.

UNIT - II
Equilibrium of coplanar force system: Equilibrium of coplanar concurrent force system, Lami's theorem, Equilibrium of coplanar parallel force system, types of beams, types of loadings, types of supports, support reactions of statically determinate beams subjected to various types of loads, Equilibrium of coplanar non-concurrent force system, Numerical examples.

UNIT - III
Analysis of Trusses: Introduction, Classification of trusses, analysis of plane perfect trusses by the method of joints and method of sections, Numerical examples.

Friction: Introduction, laws of Coulomb friction, equilibrium of blocks on horizontal plane, equilibrium of blocks on inclined plane, ladder friction, wedge friction, Numerical examples.

UNIT - IV
Centroid of Plane areas: Introduction, Locating the centroid of rectangle, triangle, circle, semicircle, quadrant and sector of a circle using method of integration, centroid of composite areas and simple built up sections, Numerical examples.

Moment of inertia of plane areas: Introduction, Rectangular moment of inertia, polar moment of inertia, product of inertia, radius of gyration, parallel axes theorem, perpendicular axis theorem, moment of inertia of rectangular, triangular and circular areas from the method of integration, moment of inertia of composite areas and simple built up sections, Numerical examples.

UNIT - V
Kinematics: Displacements, Velocity and Acceleration – Rectilinear motion

Kinematics of rigid bodies: Fixed axis rotation, Numerical examples, Concept of analysis of plane motion

Kinetics of rigid bodies: Introduction, Work energy and D 'Alembert's principle of dynamic equilibrium and its application in rectilinear, fixed axis rotation and connected bodies including pulleys, Numerical examples.

Text Books
1. Engineering Mechanics, S.Timoshenko, D.H.Young, J.V.Rao, S.Pati., McGraw Hill Education 2017. 5th Edition.
2. Engineering Mechanics, P.C.Dumir- S.Sengupta and Srinivas V veeravalli University press. 2020. First Edition.
3. Engineering Mechanics, S.S Bhavikatti. New age international publications 2018. 4th Edition.

Reference Books
1. Engineering Mechanics, Statics and Dynamics, Rogers and M A. Nelson., McGraw Hill Education. 2017. First Edition
2. Engineering Mechanics, Statics and Dynamics, I.H.Shames., PHI, 2002. 4thEdition
3. Engineering Mechanics, Volume-I: Statics, Volume-II: Dynamics, J. L. Meriam and L.G. Kraige., John Wiley, 2008. 6th Edition

4. Engineering Mechanics Statics And Dynamics,A. K. Tayal, Umesh Publications, 2019, 14th Edition

5. Introduction to Statics and Dynamics, Basudev Battachatia, Oxford University Press,2014. Second Edition

6. Engineering Mechanics: Statics and Dynamics, Hibbeler R.C., Pearson Education, Inc., New Delhi, 2022, 14th Edition

THERMODYNAMICS

Subject Code: 25MET101

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:
- To provide foundational understanding of thermodynamic principles, including the behaviour of systems and control volume, thermodynamic properties, processes, and equilibrium, as well as the formulation and application of the zeroth and first laws of thermodynamics.
- To develop the ability to analyse energy interactions and transformations using the first and second laws of thermodynamics for both closed and open systems, including steady flow processes, heat engines, refrigerators, and heat pumps.
- To enable students to evaluate advanced thermodynamic concepts, such as entropy, availability, and gas mixtures, and apply them in practical applications like energy analysis of reacting systems and determining maximum work potential from energy sources.

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1: Describe fundamental thermodynamic concepts, properties, processes, and work interactions in closed systems

CO2: Apply the first law of thermodynamics to analyze energy and mass balances in closed and open systems.

CO3: Interpret and evaluate the second law of thermodynamics and its application to thermodynamic cycles and devices.

CO4: Analyze entropy changes and assess the availability and maximum work potential in reversible and irreversible processes

CO5: Perform thermodynamic analysis of ideal gas mixtures and combustion processes in reacting systems.

UNIT - I
Introduction to Thermodynamics: Macroscopic & Microscopic view point thermodynamic system and control volume, Thermodynamic properties, Processes and Cycles, Thermodynamic equilibrium, Quasi-Static process, Concept of Continuum, Zeroth law of TD

Thermodynamic Work: Work Transfer, PdV Work - Various Quasi-Static Processes, Path Function and Point Function.

UNIT - II

First Law of Thermodynamics: First law for a closed system undergoing a cycle and change of state, Energy - A property of the system, Specific heat at constant volume, Enthalpy, Specific heat at constant pressure, PMM1, Limitations of the first law.

First Law Applied to Flow Systems: Steady flow process, Mass balance and Energy balance in a simple steady flow process, Examples of steady flow processes..

UNIT - III

Second Law of Thermodynamics: Qualitative difference between heat and work - Cyclic heat engine, Kelvin-Planck statement of second law (PMM2), Clausius' statement of second Law, Refrigerator and Heat pump, equivalence of Kelvin-Planck and Clausius statements, Reversibility and Irreversibility, Carnot cycle, Carnot's theorem

UNIT - IV

Entropy: Clausius' theorem, The property of entropy, The inequality of Clausius, Entropy change in an irreversible process, entropy principle.

Available energy and availability: Available energy, Available energy referred to cycle, Decrease in available energy when heat transfer through a finite temperature difference, Available energy from a finite energy source, Maximum work in reversible process, Availability, Availability in a steady flow process, Availability in a Non-flow Process.

UNIT - V

Gas Mixtures: General considerations and mixtures of Ideal gases, the combustion process, Enthalpy of formation, Energy analysis of reacting systems.

Text Books
1. Engineering Thermodynamics, P.K. Nag, Tata McGraw-Hill Publications.
2. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons
3. Thermodynamics: An Engineering Approach, Michael A. Boles and Yungus A. Cengel, Tata McGraw-Hill Publications.

Reference Books
1. Thermal Engineering, P.L. Ballaney, Khanna Publications,
2. Thermal Engineering, M.L.Mathur, F.S.Mehta, Jain Brothers Publications,
3. Introduction to Thermodynamics, J.B.Jones, G.A.Hawkins, John Wiley Publications,
4. Fundamentals of Thermodynamics, Gordon John Van Wylen, Richard Edwin Sonntag, John Wiley Publications

ENGINEERING WORKSHOP
(Common to ME, CE, ECE, and EEE)

Subject Code: 25ESL104

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:
- The Engineering Workshop Practice for engineers is a training lab course spread over entire semester. The modules include training on different trades like Fitting, Carpentry, Black smithy etc., which makes the students to learn how various joints are made using wood and other materials.

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1: Make half-lap, mortise & tenon, corner dovetail or bridle wooden joints

CO2: Develop sheet metal into objects like square tray, taper side tray, conical funnel or elbow pipe

CO3: Fabricate metal plates into a straight, square, dovetail or V-fit joints

CO4: Forge MS rod to round or round to square cross-section, or into L- or S- bend.

CO5: Construct wiring system for staircase or a godown, parallel and series or tube light wiring.

List of experiments

I. Wood Working: Familiarity with different types of wood and tools used in wood Working.

Tasks to be performed:
i. Half - Lap joint   **ii.** Corner Dovetail joint   **iii.** Mortise and Tenon joint   **iv.** Bridle joint

II. Sheet Metal Working: Familiarity with different types sheet metal and tools used in sheet metal work, development of sheet metal jobs from sheet metal & knowledge of basic concepts of soldering.

Tasks to be performed:
i. Square Tray   **ii.** Taper side Tray   **iii.** Conical Funnel   **iv.** Elbow Pipe.

III. Fitting: Familiarity with different types of metals & tools used in fitting.

Tasks to be performed:
i. "V" – fitting   **ii.** Square fitting   **iii.** Dovetail fitting   **iv.** Semi Circular

fitting

IV. Forging: Familiarity with different types of metals to be forged and the tools used in forging. Knowledge of different types of furnaces like coal fired, electrical furnaces etc.

Tasks to be performed:
i. Round M.S rod to Square bar   **ii.** L- bend from given M.S. Rod.
iii. S- bend from given M.S. Rod.   **iv.** Heat treatment tests like annealing, normalizing etc.

V. House wiring

Tasks to be performed:
i. Series & Parallel wiring connection   **ii.** Staircase wiring connection
iii. Godown Lighting   **iv.** Tube light connection

Text Books
1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

References

1. Elements of Workshop Technology, Vol.I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers,Mumbai.2007,14thedition

2. Workshop Practice by H. S.Bawa,Tata-McGrawHill,2004.

3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P. A.; Atul Prakashan, 2021-22.

COMMUNICATIVE ENGLISH LAB
(Common to all branches of engineering)

Subject Code: 25BHL101

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:
- To enable students to cultivate proper speech habits
- To enhance the ability of students to make extempore speeches
- To help students master techniques of being successful in debates and group discussions
- To assist students to acquire effective and adequate presentation skills
- To prepare students to face interviews in an assertive manner

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to

CO1: Students will be able to pronounce words accurately

CO2: Students will be able to speak spontaneously

CO3: Students will be able to participate in debates and group discussions and contribute proactively

CO4: Students will be able to present data on select topics using pre-existing slides

CO5: Students will be able to face interviews confidently.

UNIT - I
Phonetics — Neutral English Accent

UNIT - II
JAM session — Role play

UNIT - III
Debate — Group Discussion

UNIT - IV
Poster Presentation — PPT Presentations

UNIT - V
Cover letter — *Résumé* — Interview Skills

Suggested Software:
- Walden InfoTech
- Young India Films

Reference Books
1. Meenakshi Raman, Sangeeta-Sharma. Technical Communication. Oxford Press. 2018.
2. Samson T : Innovate with English, Foundations
3. Grant Taylor: English Conversation Practice, Tata McGraw-Hill Education India, 2016.
4. Jayashree, M Let's Hear them Speak: Developing Listening-Speaking skills in English. Sage Publications.
5. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
6. T. Balasubramanyam, A Textbook of English Phonetics for Indian Students, (3rd Ed.) Trinity Press.

Web Resources:
Spoken English:

1) www.esl-lab.com
2) www.englishmedialab.com
3) www.englishinteractive.net
4) https://www.britishcouncil.in/english/online
5) http://www.letstalkpodcast.com/
6) https://www.youtube.com/c/mmmEnglish_Emma/featured
7) https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8) https://www.youtube.com/c/engvidAdam/featured
9) https://www.youtube.com/c/EnglishClass101/featured
10) https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11) https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw
12) https://www.linguahouse.com/en-GB
13) https://www.ted.com/watch/ted-ed

Voice & Accent:

1) https://www.youtube.com/user/letstalkaccent/videos
2) https://www.youtube.com/c/EngLanguageClub/featured
3) https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4) https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

ENGINEERING CHEMISTRY LABORATORY
(Common to CE and ME)

Subject Code: 25BHL103

L	T	P	C
0	0	3	1.5

COURSE OBJECTIVES:
- To verify the fundamental concepts with experiments

COURSE OUTCOMES:

Upon the completion of this course, the students will be able to

CO1: Determine the cell constant, conductance, potential of solutions.

CO2: Measure molecular/system properties such as surface tension and viscosity and prepare advanced polymer Bakelite materials

CO3: Determine the molecular/system properties such as kinematic viscosity, Flash and fire point and acid number etc.

CO4: Estimate the Iron (by colurimeter) and Calcium in cement and determine the pH of solutions.

CO5: Measure molecular/system properties such as chloride content, hardness of water, dissolved oxygen.

List of Experiments:

1. Determination of Hardness of a groundwater sample.

2. Estimation of Dissolved Oxygen by Winkler's method

3. Determination of Strength of an acid in Pb-Acid battery.(P^HMETRY)

4. Preparation of a polymer (Bakelite)

5. Determination of percentage of Iron sample by colorimetry

6. Estimation of Calcium in port land Cement

7. Preparation of nano-materials by precipitation method.

8. Adsorption of acetic acid by charcoal

9. Determination of percentage Moisture content in a coal sample

10. Determination of Viscosity of lubricating oil by Redwood Viscometer 1

11. Determination of Viscosity of lubricating oil by Redwood Viscometer 2

12. Determination of Calorific value of gases by Junker's gas Calorimeter

13. Conductometric titration of strong acid vs. strong base.

14. Potentiometry - determination of redox potentials and emfs.

15. Determination of surface tension and viscosity.

16. Determination of acid number of lubricating oil.

17. Determination of flash and fire point of lubricating oil.

Reference:

- "Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C. Denney, J.D. Barnes and B. Sivasankar

HEALTH AND WELLNESS, YOGA AND SPORTS
(Common to all branches of engineering)

Subject Code: 25MCS103

L	T	P	C
0	0	1	0.5

COURSE OBJECTIVES:
- The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life.
- It mainly enhances the essential traits required for the development of the personality.

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to
CO1: Understand the importance of yoga and sports for Physical fitness and sound health.
CO2: Demonstrate an understanding of health-related fitness components
CO3: Compare and contrast various activities that help enhance their health.
CO4: Assess current personal fitness levels.
CO5: Develop Positive Personality

UNIT - I
Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity
Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:
i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT - II
Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:
Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar.

UNIT - III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc.
Practicing general and specific warm up, aerobics

ii) Practicing cardio-respiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

DESIGN THINKING AND SUSTAINABLE DEVELOPMENT
(Common to all branches of engineering)

Subject Code: 25BHS104

L	T	P	C
1	0	2	2

COURSE OBJECTIVES:
- Understand the principles of creativity, innovation, and entrepreneurship in an engineering context.
- Apply the process of design thinking to real-life problems
- Recognize and evaluate the importance of sustainable development and responsible engineering.
- Explore user pain points and identify real-world problems through empathy and market analysis.
- Apply ideation techniques to validate feasible and viable solutions for the identified problems.

COURSE OUTCOMES:
Upon the completion of this course, the students will be able to
CO1: Describe innovation ecosystems, and entrepreneurial processes
CO2: Analyze the global sustainable development goals (SDGs) and connect them to engineering practices
CO3: Understand and explore design thinking methodology to identify and solve real-world problems
CO4: Develop understanding to identify and validate user problem statement
CO5: Develop approach towards generation and feasibility assessment of ideas

UNIT - I
Introduction to Innovation and Entrepreneurship: Innovation and its types – Incremental, Disruptive, Frugal, Social, Real-world examples of innovation – Indian and global, Introduction to entrepreneurial mindset, Journey of a startup – Idea to Market, Role of engineers in entrepreneurship
Activity: Conducting case studies on selected startups (e.g., Airbnb, Uber, etc.) and performing an in-depth sectoral analysis

UNIT - II
Sustainable Development Goals: Introduction to UN Sustainable Development Goals (SDGs), Link between engineering, sustainability, and society, Circular economy, Green technologies, Lifecycle thinking, Frugal innovation, Resource optimization
Activity: Conduct an analysis of a minimum of five Sustainable Development Goals (SDGs), including a comprehensive review of their objectives, targets, and key performance indicators

UNIT - III
Design Thinking – A Human-Centred Approach: Introduction to Design Thinking, Practical case studies of Design Thinking, The 5 stages of Design Thinking – Empathize, Define, Ideate, Prototype, Test

UNIT – IV
Problem Statement Identification and Validation: Empathize towards understanding user pain points, Tools and approaches for empathizing with users, Define – Confirm the problem the user is facing, Market analysis – Market size, Competitor analysis
Activity:
- For the identified problem, build empathy maps and create detailed user personas based on insights gathered from surveys and interviews.
- Determine the total market size, perform an in-depth market analysis, and analyze competitors to identify opportunities and gaps.
- Define the Problem statement and write HMW Statements.

UNIT - V
Ideation to solve user problems: Tools and approaches to identify ideas for solving identified problems, Feasibility and viability of ideas for prototype development
Activity: Apply brainstorming techniques to generate solutions for the identified problem and organize them visually through mind mapping.

Text Books
1. Eric Ries. (2011). The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business.
2. Anuja Agarwal. (2023). Design Thinking: A Framework for Applying Design Thinking in Problem Solving. Cengage Learning India
3. Akhilesh A. Waoo. (2024). Sustainable Development Goals. Forever Shinings Publication

References
1. Rob Fitzpatrick. (2013). The Mom Test: How to Talk to Customers and Learn If Your Business is a Good Idea When Everyone is Lying to You.
2. Tim Brown. (2009). Change by Design: How Design Thinking Creates New Alternatives for Business and Society
3. Bill Aulet. (2013). Disciplined Entrepreneurship: 24 Steps to a Successful Startup. Wiley
4. Peter Thiel with Blake Masters. (2014). Zero to One: Notes on Startups, or How to Build the Future. Crown Business.
5. Don Norman. (2013). The Design of Everyday Things: Revised and Expanded Edition. Basic Books.
6. Lewrick, Michael, Patrick Link & Larry Leifer. (2018). The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems. Wiley