ME 11001 **Engineering Mechanics** **L T P C**

B. Tech (Mechanical Engg.) First/Second Semester (Core) **3 1 0 4**

Unit-1 STATICS

Statics of rigid bodies: Classification of force systems- principle of transmissibility of a force Composition and resolution- Resultant of a coplanar force systems and conditions of equilibrium, free body diagrams.

Moment of a force, couple, properties of couple- Varignon's theorem, Concurrent and parallel forces, conditions of equilibrium.

Beams: Types of loading, Support reactions of simply supported and overhanging beams under different types of loading.

Friction: Laws of dry friction - Angle of friction - Cone of friction - Ladder friction, Wedge friction, Belt friction, Simple Screw Jack.

Properties of surfaces: Centroid of simple and composite areas- Theorems of Pappus and Guldinus.

Moment of inertia of areas, Parallel and perpendicular axes theorems- Radius of Gyration, moment of inertia of simple and composite areas.

Plane Truss: Statically determinate trusses; Analysis of a truss and frames - Method of joints, Method of section, Method of Members.

Virtual Work: Degree of freedom, Virtual displacement and virtual work; Principle of virtual work.

Unit-2 DYNAMICS

Kinematics of Particles: Differential equations of kinematics; Cartesian coordinate system; Normal and tangent co-ordinate system, projectile motion.

Kinetics of Particles: Kinetics of rectilinear and curvilinear motion, D'Alemberts Principle, Principle of impulse and momentum, Work, energy and power, Direct and oblique collision.

Rotation of Rigid Bodies: Moment of inertia of material bodies, Kinematics and Kinetics of rotation equation of motion, Principle of work and energy; Principle of impulse and momentum.

Plane motion of Rigid Bodies: Translation of a rigid body in a plane; Kinematics of plane motion; Instantaneous center of rotation; Kinetics of plane motion – equation of motion, principle of work and energy; Principle of impulse and momentum.

Text Books:

1. S. Timoshenko, D. H. Young, J.V. Rao, S. Pati. ***Engineering Mechanics,*** McGraw Hill Education; 5/e.
2. J. L. Meriam & L.G. Kraige. ***Engineering Mechanics -Statics,*** John Wiley & Sons, Inc; 3/e.
3. J. L. Meriam & L.G. Kraige. ***Engineering Mechanics -Dynamics,*** John Wiley & Sons, Inc; 3/e.
4. F. P. Beer, Jr., E. R. Johnston, E. R. Eisenberg, P. J. Cornwell, D. Mazurek. ***Vector Mechanics for Engineers- Statics & Dynamics,*** McGraw-Hill Higher Education; 9/e.

Reference Books:

1. R.C. Hibbeler. ***Engineering Mechanics - Statics & Dynamics,*** Pearson Education, 4/e.
2. Rogers and M A. Nelson. ***Engineering Mechanics Statics and Dynamics,*** McGraw Hill Education; 1/e.
3. K. L. Kumar, V. Kumar. ***Engineering Mechanics,*** McGraw Hill Education; 4/e.

Course Outcomes (COs):

Upon the completion of this course, the students are expected to:

1. identify and analyze the problems by applying the fundamental principles of engineering mechanics and proceed to design and development of the mechanical systems.

ME 12002 **Workshop Practice** **L T P C**

B. Tech (Mechanical Engg.) First/Second Semester (Core) **0 0 3 2**

Unit-1 General safety precautions in workshop and introduction.

Unit-2 Carpentry Shop: Safety precaution, Kinds of wood and timber, Application of timber as per their classification, Carpentry hand tools and machines, Different types of carpentry joint, Demonstration of wood working machine like, band saw, circular saw, thickness planner, wood working lathe, surface planners, etc.

Unit-3 Welding Shop: Safety precaution in welding shop, Introduction to gas and arc welding, Soldering and brazing etc. Welding equipment and welding material.

Unit-4 Fitting Shop: Safety precaution, Introduction to fitting shop tools, equipment, Operation and their uses, Marking and measuring practice.

Unit-5 Machine Shop: Safety precautions, Demonstration and working principles of some of the general machines, like lathe, shaper, milling, drilling , grinding, slotting etc., General idea of cutting tools of the machines.

Text Books:

1. S K Hajra Choudhury, A K Hajra Choudhury, N. Roy. ***Workshop Technology Vol I & II,*** Media Promoters & Publishers Pvt. Ltd; 9/e.

Reference Books:

1. H S Bawa. ***Workshop Practice,*** McGraw Hill Education; 2nd edition, 2/e.

Course Outcomes (COs):

Upon the completion of this course, the students are expected to:

1. know the importance of general safety precautions on different shop floors.
2. identify the basics of tools and equipments used in fitting, carpentry, sheet metal, machine, welding and smithy.
3. do fabrication of wooden joints and understand joining of metals.
4. make metal joints and sheet metal work.
5. understand the basics of removal of material from work piece surface to attain specific shape.
6. familiarize with the production of simple models in fitting, carpentry, sheet metal, machine, welding and smithy trades.

NEP 2020 ME Professional Course 1

		L	T	P	C
PC-XXX	**Fundamentals of Mechanical Engineering**				
	B.Tech. (ME), First Semester (Professional Core)	**3**	**0**	**0**	**3**

UNIT-I **Introduction to Mechanical Engineering**

Basic areas and concepts of Mechanical Engineering, Role of mechanical engineers in industries and society

UNIT-II **Thermal Science & Its Applications**

Thermodynamic systems and processes; Temperature and Zeroth law of thermodynamics; Thermodynamic concept of energy; Modes of work and heat transfer; Statements of zeroth, first, second and third law of thermodynamics and their applications; Fluid properties

UNIT-III **Design Elements in Mechanical Engineering**

Mechanical Properties, Stress and strain, elastic constants, thermal stresses, beams; mechanisms and linkages, degree of freedom, cam, gear, gyroscope; Introduction to machine elements: riveted and welded joints, shafts and coupling, rolling and sliding contact bearings, pressure vessel.

UNIT-IV **Materials & Manufacturing**

Engineering materials, classification of materials, engineering applications of materials, material properties, selection of materials.

Introduction to manufacturing, the need for manufacturing, the basics of various manufacturing processes: casting, welding, forming, machining, etc., selection of manufacturing processes, and application to industries.

UNIT-V **Recent Trends in Mechanical Engineering**

Basics of additive manufacturing, micro and nano fabrication, Mechatronics, microelectromechanical systems (MEMS), robotics and automation, CAD-CAM, CIM, and smart manufacturing.

Course Outcome:

The students will be able to

1. define the role of mechanical engineers towards industry and society.
2. explain various topics in thermal engineering.
3. interpret design ideas in mechanical engineering.
4. identify various manufacturing processes and correlate it with different engineering materials.
5. infer about various recent developments in mechanical engineering.

Text Books/Ref. Books:

1. Shigley, Joseph, Charles Mischke, and Richard Budynas. Mechanical Engineering Design. Boston, MA: McGraw-Hill, 2003. ISBN: 9780072921939.
2. Norton, Robert L. Design of Machinery: An Introduction to the Synthesis and Analysis of Mechanisms and Machines. Boston, MA: McGraw-Hill, 2007. ISBN: 9780073290980.
3. Oberg, Erik, Franklin D. Jones, Holbrook L. Horton, and Henry H. Ryffel. Machinery's Handbook. 28th ed. New York, NY: Industrial Press, 2008. ISBN: 9780831128005.
4. Shackelford James, Introduction to Material Science for Engineers, Pearson, 8th Edition, 2014, ISBN: 9780133826654
5. Hajra Choudhury S. K. , Hajra Choudhury A. K. Roy N. Elements of Workshop Technology: Vol.1 & 2, Media Promoters, 2008, ISBN: 978-8185099149
6. Kalpakjian Serope, Schimid Steven R, Manufacturing Engineering and Technology, Pearson Education, 7th Edition, 2018, ISBN: 9789332587908
7. Ghosh Amitava, Mallik Ahsok Kumar, Manufacturing Science, Affiliated East West Press, New Delhi, 2nd Edition, 1985, ISBN: 9788176710633
8. Erian A. Baskharone, Thermal Science: Essentials of Thermodynamics, Fluid Mechanics, and Heat Transfer, 1st Edition, 2012, McGraw-Hill Companies, ISBN: 9780071772341
9. C. Boegnakke and R. E. Sonntag. Fundamentals of Thermodynamics: 10th Edition, 2022, Wiley ISBN 978-93-5464-221-0

S. K. Som, G. Biswas and S. Chakraborty. Introduction to Fluid Mechanics and Machines. 3rd Edition, 2012, McGraw Hill Higher Education, ISBN 978-0-07-132919-4.

NEP 2020 ME Professional Course 2

		L	T	P	C
ME 11004	**Engineering Thermodynamics**				
		3	**0**	**0**	**3**

B.Tech. (ME), Second Semester
(Professional Core)

UNIT-1 Properties of pure substance; Idea of a generalized chart and the law of corresponding states; behavior of ideal and real gases.

UNIT-1I First Law of Thermodynamics: First law referred to cyclic and non-cyclic processes, concept of internal energy of a system, conservation of energy for simple compressible closed systems; Definitions of enthalpy and specific heats; Conservation of energy for a control volume (or open system), steady & transient processes.

UNIT-1II Second Law of Thermodynamics: Directional constraints on natural processes; Statements of Second law of Thermodynamics and their equivalence, Concept of reversibility; Carnot principle; Absolute thermodynamic temperature scale; Clausius inequality, entropy, change in entropy in various thermodynamic processes, Tds relations, entropy balance for closed and open systems, Entropy principle, entropy generation, and Concept of Third law of Thermodynamics.

UNIT-1V Exergy: Concept of reversible work & irreversibility; Exergy change of a system: closed & open systems, exergy transfer by heat, work and mass, exergy destruction, exergy balance in closed & open systems, Exergetic (second law) efficiency

UNIT-V Thermodynamic Property Relations: Maxwell relations; Clausius-Clapeyron equation; Difference in heat capacities; Ratio of heat capacities; Joule-Thompson coefficient.

Course Outcome:

Upon the completion of this course, the students are expected to:

1. calculate properties of pure substances and analyze behaviour of ideal and real gases.

2. apply first law of thermodynamics to various closed and open systems.

3. apply second law of thermodynamics to closed and open systems to calculate specified parameters such as work, heat transfer, or entropy.

4. calculate exergy destruction for various processes carried out on various thermal devices.

5. develop fundamental relations between commonly encountered thermodynamic properties and express the properties that cannot be measured directly in terms of easily measurable properties.

6. identify and formulate elementary level engineering problems related to thermodynamics and energy transformation in a conceptual form as well as in terms of mathematical/physical models.

Text Books/Ref. Books:

1. Cengel and Boles. Thermodynamics: An Engineering Approach, 7/e. Tata McGraw Hill.

2. Moran, Shappiro, Boettner and Bailey. Principles of Engineering Thermodynamics, 8e. Wiley.

3. P.K. Nag. Engineering Thermodynamics, 5/e. McGraw Hill.

4. Boegnakke and Sonntag. *Fundamentals of Thermodynamics: 10e*. Wiley.

5. Rogers and Mayhew. *Engineering Thermodynamics, 4e*. Pearson Education.