1/4 B.Tech. FIRST SEMESTER

ME1T4 **ENGINEERING MECHANICS-I** **Credits: 4**

Lecture: 4 periods/week **Internal assessment: 30 marks**
Tutorial: 1 periods/week **Semester end examination: 70 marks**

Objectives:

1. The student will acquire the fundamental concepts of deformable bodies.
2. The student will describe force-deformation, and stress-strain relationships for isotropic materials.
3. The student will be able to analyze axially loaded members, beams, plane trusses, thin and thick cylinder for induced stresses, strains and deformations under static loads

Learning outcomes:

At the end of course the student will be able to:

1. Apply the formal theory of mechanics of solids to calculate forces, deflections, moments, stresses, and strains in a wide variety of structural members subjected to tension, compression, and torsion, both individually and in combination, including axially loaded bars, circular shafts in torsion and thin-walled pressure vessels.
2. Use the method of superposition as applied to problems involving statically determinate and indeterminate axially loaded members.
3. Utilize basic properties of materials such as elastic modulii and Poisson's ratio appropriately to solve problems related to isotropic elasticity.
4. Draw the shear force and bending moment diagrams of simple members subject to combination of loads.
5. Solve problems relating to pure bending of beams and other simple structures.

Pre-Requisites: Mathematics, Engineering Physics

UNIT – I

CONCURRENT FORCES IN A PLANE:

Principles of statics, Force, Addition of two forces: Parallelogram Law – Composition and resolution of forces – Constraint, Action and Reaction. Types of supports and support reactions. Free body diagram. Equilibrium of concurrent forces in a plane – Method of projections – Moment of a force, Theorem of Varignon, Method of moments.

UNIT –II

PARALLEL FORCES IN A PLANE:

Introduction, Types of parallel forces, Resultant. Couple, Resolution of force into force and a couple. General case of parallel forces in a plane.

UNIT – III

FORCES IN SPACE:

Components of a force in Space – Position Vector– Moment of Force

UNIT – IV

CENTROIDS:

Introduction, Determination of centroids of simple figures by integration method, Centroids of composite plane figures, Pappus theorem.

UNIT – V

AREA MOMENTS OF INERTIA :

Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

UNIT – VI

ANALYSIS OF TRUSSES BY METHOD OF JOINTS:

Types of Trusses – Assumptions for forces in members of a perfect truss, Force table, Cantilever Trusses, Structures with one end hinged and the other freely supported on rollers carrying horizontal or inclined loads.

UNIT – VII

FRICTION:

Introduction, Classification of friction, Laws of dry friction. Co-efficient of friction, Angle of friction, Angle of repose, Cone of friction, Frictional forces on wheel, Wedge friction.

UNIT – VIII

PRINCIPLE OF VIRTUAL WORK:

Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.

Learning resources

Text books :

1. Engineering Mechanics, (2nd Edition) by S.Timoshenko & D.H.Young, McGraw Hill publications.
2. Engineering Mechanics Statics and dynamics, by A.K.Tayal, Umesh Publication, Delhi, 2009.

Reference books :

1. Vector Mechanics for Engineers Statics and Dynamics, (9^{th} edition) by Beer and Johnston, Tata McGraw Hill Publishing Company, New Delhi.
2. Engineering Mechanics, by S.S. Bhavikatti & J.G. Rajasekharappa, New Age International Publishers, New Delhi, 2008.
3. Engineering Mechanics, (3^{ed} edition) by Statics and Dynamics K.Vijaya Kumar Reddy and J Suresh Kumar, BS Publications.