

1/4 B.Tech. FIRST SEMESTER

AE1T3

ENGINEERING MECHANICS – I

Credits: 4

Lecture: 4 periods/week

Internal assessment: 30 marks

Tutorial: 1 periods/week

Semester end examination: 70 marks

Objectives:

1. Engineering mechanics examines the response of bodies or systems of bodies to external forces. Forces and force systems and their external effect on bodies, principally the condition of equilibrium.
2. The techniques of vector Mathematics are employed, and the rigor of physical analysis is emphasized.
3. In Statics Equilibrium of coplanar force systems; analysis of frames and trusses; no coplanar force systems; friction; centroids and moments of inertia will be studied for the bodies at rest.
4. Moment of inertia of plane areas and material bodies and rigid bodies are included.

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 moduli 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: Engineering Mechanics

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 by S. Timoshenko & D.H. Young, McGraw Hill International Edition. (For Concepts and symbolic Problems)
2. Engineering Mechanics Statics and dynamics by A.K.Tayal, Umesh Publication, Delhi, 2010, (For numerical Problems using S.I. System of Units)

References:

1. Vector Mechanics for Engineers Statics and Dynamics by Beer and Johnston, Tata McGraw Hill Publishing Company, New Delhi, 2003
2. Engg. Mechanics, S. S. Bhavikatti & J.G. Rajasekharappa, New Age International, 1994
3. Singer's Engineering Mechanics Statics and Dynamics by K. Vijaya Kumar Reddy and J Suresh Kumar (Third Edition SI Units-BS Publications), 2012