## Engineering Mechanics

**B.Tech I Year I Sem**

| Course Code | Category | Hours/ Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | Engineering Sciences | L | T | P | 4 | CIA | SEE | TOTAL |
| | | 3 | 1 | 0 | | 40 | 60 | 100 |
| Contact Classes: 48 | Tutorial Classes: 16 | Practical Classes: Nil | | | | Total Classes:64 | | |

**Course Objectives:**
The objectives of this course is to
- Explain the resolution of a system of forces, compute their resultant and solve problems using equations of equilibrium.
- Perform analysis of bodies lying on rough surfaces.
- Locate the centroid of a body and compute the area moment of inertia and mass moment of inertia of standard and composite sections.
- Explain kinetics and kinematics of particles, projectiles, curvilinear motion, centroidal motion and plane motion of rigid bodies
- Explain the concepts of work-energy method.

**Course Outcomes:** Upon graduation he student will be able to

CO1: Determine resultant of forces acting on a body and analyze equilibrium of a body subjected to a system of forces.

CO2: Analyze the body subjected to friction and establish the centroid of a given section.

CO3: Evaluate the area and mass moment of inertia.

CO4: Comprehend the kinetics and kinematics of a body undergoing rectilinear, curvilinear, rotatory motion and rigid body motion.

CO5: Apply work energy equations for translation, fixed axis rotation and plane motion.

**UNIT - I**

**Introduction to Engineering Mechanics** - Force Systems: Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.

**UNIT - II**

**Friction:** Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, ladder friction.

Centroid and Centre of Gravity -Centroid of Lines, Areas and Volumes from first principle, centroid of composite sections; Centre of Gravity and its implications. – Theorem of Pappus.

**UNIT - III**

**Area moment of inertia**- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Product of Inertia, Parallel Axis Theorem, Perpendicular Axis Theorem.

Mass Moment of Inertia: Moment of Inertia of Masses - Transfer Formula for Mass Moments of Inertia – Mass moment of inertia of composite bodies.

**UNIT - IV**

Kinematics of Particles: Kinematics of particles – Rectilinear motion – Curvilinear motion – Projectiles.

Kinetics of Particles: Kinetics of particles – Newton's Second Law – Differential equations of rectilinear and curvilinear motion – Dynamic equilibrium – Inertia force – D. Alembert's Principle applied for rectilinear and curvilinear motion.

**UNIT - V**

Work - Energy Principle: Equation of translation, principle of conservation of energy, work – energy principle applied to particle motion and connected systems, fixed axis rotation. Impulse – Momentum.

Principle: Introduction, linear impulse momentum, principle of conservation of linear momentum, elastic impact and types of impact, loss of kinetic energy, co efficient of restitution.

**TEXT BOOKS:**

1. Shames and Rao (2006), Engineering Mechanics, Pearson Education
2. Reddy Vijay Kumar K. and J. Suresh Kumar (2010), Singer's Engineering Mechanics – Statics & Dynamics

**REFERENCE BOOKS:**

1. Timoshenko S.P and Young D.H., "Engineering Mechanics", McGraw Hill International Edition, 1983.
2. Andrew Pytel, Jaan Kiusalaas, "Engineering Mechanics", Cengage Learning, 2014.
3. Beer F.P& Johnston E.R Jr. Vector, "Mechanics for Engineers", TMH, 2004.
4. Hibbeler R. C & Ashok Gupta, "Engineering Mechanics", Pearson Education, 2010.
5. Tayal A.K., "Engineering Mechanics – Statics & Dynamics", Umesh Publications, 2011.
6. Basudeb Bhattacharyya, "Engineering Mechanics", Oxford University Press, 2008.
7. Meriam. J. L., "Engineering Mechanics", Volume-II Dynamics, John Wiley & Sons, 2008.
8. P.C Dumir et al. "Engineering Mechanics", University press.