ENGINEERING MECHANICS

(Common to all Branches)

Course Code: 13ME1102

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Course Educational Objectives:

To develop

- The skill of converting a physical problem into a suitable mathematical model
- Analytical skills of solving the mathematical model
- The skill of interpreting the results in terms of the given physical situation
- The skills of optimization

Course Outcomes:

The student will be able to

- Identify and list , for a given physical problem, all known's, intermediate unknowns, and final results
- Formulate suitable mathematical equations and the constraints.
- Resolve a given force into rectangular components, find the moment of a force about a given point and find the resultant of a set of forces
- Solve problems involving static and dynamic friction
- Locate the centroid and calculate the moments of inertia of a given plane area
- Find the resulting acceleration of a body subjected to a set of forces and moments
- Calculate the work done, energy, power and efficiency

UNIT-I (13 Lectures)

RESULTANTS OF FORCE SYSTEM:

Parallelogram law, forces and components, resultant of coplanar concurrent forces, components of forces in space, moment of force, principle of moments, coplanar applications, couples, resultant of any force system (coplanar concurrent cases only).

Equilibrium of force systems: Free body diagram, equations of equilibrium, equilibrium of planar systems, further discussion of planar equilibrium.

UNIT-II (09 Lectures)

FRICTION:

Theory of friction, angle of friction, laws of friction, static friction, kinetic friction, friction in bodies moving up or down on an inclined plane, wedge friction, screw friction and screw jack.

UNIT-III (14 Lectures)

CENTROIDS AND CENTERS OF GRAVITY:

Center of gravity of flat plate, centroids of areas and lines, importance of centroids of areas and lines, importance of centroids and moments of area, centroids determined by integration, centroids of composite figures, theorem of Pappus, center of gravity of bodies.

MOMENT OF INERTIA:

Definition of moment of inertia, polar moment of inertia, radius of gyration, parallel axis theorem, moments of inertia by integration, moments of inertia for composite areas.

UNIT-IV (12 Lectures)

MASS MOMENT OF INERTIA:

Introduction, radius of gyration, parallel axis theorem, mass moments of inertia by integration, moments of inertia of composite bodies.

KINEMATICS AND KINETICS OF A PARTICLE:

Motion of a particle, rectilinear motion, rectangular components of curvilinear motion, normal and tangential components of acceleration, radial and transverse components, cylindrical coordinates translation-analysis as a particle, further discussion of particle kinematics.

UNIT-V (10 Lectures)

KINEMATICS AND KINETICS OF A BODY UNDERGOING FIXED AXIS ROTATION:

Types of rigid-body motion, angular motion-fixed axis rotation, application of kinematic equations, kinetics of fixed axis rotation.

WORK-ENERGY METHOD:

Work-energy equation for translation, interpretation and computation of work, work-energy applied to particle motion, power, efficiency, applied to fixed-axis rotation, work-energy applied to connected systems, work-energy method.

TEXT BOOK:

Vijaya Kumar Reddy K and Suresh Kumar J(Adapters), "*Singer`s Engineering Mechanics : Statics and Dynamics*", Third edition (SI Units), BS Publications, Hyderabad, 2011

REFERENCES :

1. Timoshenko sp and Young DH, Rao and Pytel, "*Engineering Mechanics*", fourth edition, McGraw Hill international editions, 2013.
2. Hibbeler RC, " *Engineering Mechanics : Statics* ", low price edition, Pearson Education,2000.
3. Hibbeler RC, " *Engineering Mechanics : Dynamics* ", low price edition, Pearson Education,2000.
4. Tayal AK "*Engineering Mechanics: Statics and Dynamics*", Thirteenth edition, Umesh Publications, Delhi, 2005