UNIVERSITY OF ENGINEERING & MANAGEMENT, JAIPUR

Course Description

Title of Course: Engineering Mechanics
Course Code: ME101
L-T Scheme: 3-0 **Course Credits: 3**

Introduction:

This course is an introduction to learning and applying the principles required to solve engineering mechanics problems. Concepts will be applied in this course from previous courses you have taken in basic math and physics. The course addresses the modeling and analysis of static equilibrium problems with an emphasis on real world engineering applications and problem solving.

Objectives:

• The purpose of this course is to impart the laws of mechanics
• To introduce the applications of equations of static equilibrium
• To introduce the concepts of centre of gravity and moment of inertia
• To introduce the methods of analysis of determinate trusses
• To impart knowledge of rectilinear, curvilinear motion, impact of objects, work and energy principles

Learning Outcomes:
Knowledge:

Upon successful completion of the course, you should be able to:

1. Use scalar and vector analytical techniques for analysing forces in statically determinate structures
2. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems
3. Apply basic knowledge of maths and physics to solve real-world problems

Application:

1. In this syllabus, students will learn the applications of the equations of static equilibrium to interacting bodies or parts of a structure. Students will learn about systems containing multi-force members, frames, and machines.
2. In the section students will learn about Truss structures, specifically method of joints, method of sections, and zero force members
3. In this syllabus students will learn about space trusses and will be introduced to shear force and bending moment diagrams.
4. In this syllabus, students will learn about cable support systems, specifically concentrated loads and suspension loads.
5. In this syllabus students will learn about coulomb friction and belt friction.

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Course Contents:

Unit 1:

Importance of Mechanics in engineering; Introduction to Statics; Concept of Particle and Rigid Body; Types of forces: collinear, concurrent, parallel, concentrated, distributed; Vector and scalar quantities; Force is a vector; Transmissibility of a force (sliding vector). Introduction to Vector Algebra; Parallelogram law; Addition and subtraction of vectors; Lami's theorem; Free vector; Bound vector; Representation of forces in terms of i,j,k; Cross product and Dot product and their applications. Two dimensional force system; Resolution of forces; Moment; Varignon's theorem; Couple; Resolution of a coplanar force by its equivalent force-couple system; Resultant of forces.

Unit 2:

Concept and Equilibrium of forces in two dimensions; Free body concept and diagram; Equations of equilibrium. Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.

Unit 3:

Distributed Force: Centroid and Centre of Gravity; Centroids of a triangle, circular sector, quadrilateral, composite areas consisting of above figures. Moments of inertia: MI of plane figure with respect to an axis in its plane, MI of plane figure with respect to an axis perpendicular to the plane of the figure; Parallel axis theorem; Mass moment of inertia of symmetrical bodies, e.g. cylinder, sphere, cone.

Unit 4:

Introduction to Dynamics: Kinematics and Kinetics; Newton's laws of motion; Law of gravitation & acceleration due to gravity; Rectilinear motion of particles; determination of position, velocity and acceleration under uniform and non-uniformly accelerated rectilinear motion; construction of x-t, v-t and a-t graphs. Plane curvilinear motion of particles: Rectangular components (Projectile motion); Normal and tangential components (circular motion).

Unit 5:

Kinetics of particles: Newton's second law; Equation of motion; D.Alembert's principle and free body diagram; Principle of work and energy ; Principle of conservation of energy; Power and efficiency.

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Text Books

1. Beer, F.P and Johnston, E.R, "Vector Mechanics for Engineers, Statics and Dynamics", McGraw hill International Book co.

References

1. Meriam, J.L. and Kraige, L.S., "Engineering Mechanics (Statics and Dynamics)", John Wiley & sons.
2. Meriam.,J.L. and Kraige, L.S., Irving H.shames, " Engineering Mechanics (Statics and Dynamics)", Prentice Hall of India Pvt. Ltd.
3. Rajasekaran, S and Sankarasubramanian, G., "Engineering Mechanics", Vikas Publishing House Pvt. Ltd, 1999