Course-Plan

ME102	**Engineering Mechanics**	**L-T-P-Cr-CH:3-1-0-4-4**	**Core/ME** **Prerequisite: Nil**

School: Engineering

Department: Mechanical Engineering

Course Code: ME 102

Course Name: Engineering Mechanics

Instructor: Dr. Satadru Kashyap,
Assistant Professor,
Department of Mechanical Engineering.
Email: satadru@tezu.ernet.in, website: https://satadrukashyap.wordpress.com/

Abstract: This course is to introduce the basic principles of engineering mechanics with emphasis on their analysis and application to practical engineering problems. As a result, students will develop a clear understanding of the basic principles that govern the dynamics of particles and rigid bodies; as well as an ability to use that understanding in the solution of engineering problems. The students will be able to solve problems dealing with various force systems, trusses, beams and frames and understand the distributed force systems. Problems pertinent to friction related problems, centre of gravity and moment of inertia along with problems related to dynamics (kinetics and kinematics) will also be discussed at length.

Objective:

- Applying their knowledge of 12^{th} level Mathematics and Physics to solve practical engineering problems dealing with mechanics.
- Identify the basic principles that govern the dynamics of particles and rigid bodies.
- Develop ideas on various conditions on loading and support conditions that act on a structural system.
- Extend their knowledge to take on higher level courses in Solid Mechanics, Theory of Machines and Structural Analysis.

Prerequisites of the course: None.

Expected Course Outcomes (COs): Upon the completion of the course, the students will be able to:

CO1: Solve fundamental problems related to rigid body mechanics.

CO2: Gain prerequisite knowledge to take on higher level courses in solid mechanics, structural analysis and mechanical design.

CO3: Identify and model various types of loading and support conditions that act on structural systems.

CO4: Apply the knowledge of mechanics for solving related application-oriented problems.

Course outline and suggested reading:

- Force systems: Coplanar concurrent and non concurrent forces, Moment of a force about a point and about an axis; couple moment; reduction of a force system to a force and a couple.
- Equilibrium: Free body diagram; equations of equilibrium; problems in two and three dimensions; plane frames and trusses (method of joints, method of sections).

- Friction: Laws of Coulomb friction, problems involving large and small contact surfaces; square threaded screws; belt friction.
- Properties of areas: Centre of mass, centre of gravity, moment of inertia of an area, product of inertia of an area, mass moment of inertia, and product of inertia of a mass.
- Principle of Virtual Work, Principle of minimum potential energy
- Kinematics and Kinetics of particles: Particle dynamics in rectangular coordinates cylindrical coordinates and in terms of path variables; central force motion.
- Energy and Momentum Methods for Particle: Conservative force field, principle of work and energy, principle of impulse and momentum, impact.
- Rigid Body Dynamics: Translation and rotation of rigid body, motion relative to rotating axes, Coriolis acceleration, equations of motion for a rigid body

Lesson Plan

Topic	No. of classes (L+T)	Topic	No. of classes (L+T)
Force systems	6+1	Kinematics and Kinetics of particles	6+1
Equilibrium	8+2	Rigid body dynamics	7+2
Friction	6+1		
Properties of areas	6+1		
Virtual Work	4+1	Total = 52 Classes	

Evaluation plan: Evaluation would be based upon the following:

Component	Marks	Time
Test I	25	45 min
Major I	40	1 hr 15 min
Test III	25	Assignment type
Major II	60	2 hrs
Total	**150**	

Pedagogy: Theory classes will help students in understanding the concepts and origin of all rigid body mechanics related theorems and corollaries while tutorial classes would discuss how these concepts are used in the solution of practical and field related problems. Assignments and exams will be formulated to test the fundamental concepts and ability to solve problems in mechanics.

Textbooks:

1. J.L Meriam and L.G. Kraige, Engineering Mechanics: Statics, 6th Edition, Wiley
2. J.L Meriam and L.G. Kraige, Engineering Mechanics: Dynamics, 6th Edition, Wiley
3. F. P. Beer and F. R. Johnston, Mechanics for Engineering, 10th Edition, McGraw Hill
4. I. H. Shames, Engineering Mechanics, 4th Edition, Prentice Hall India.

Reference:

1. R.C. Hibbler, Engineering Mechanics, 12th Edition, Pearson

Course outcome: At the completion of the course, students will be able to:

- Determine the resultant force and moment for a given force system.
- Construct free body diagrams and to calculate the reactions necessary to ensure static equilibrium.
- Analyze planar and spatial systems to determine the forces in members of trusses, frames and problems related to friction.
- Compute the motion parameters for a body subjected to a given force system.
- Determine the centroid and second moment of area.
- Describe the motion of a particle in terms of its position, velocity and acceleration in different frames of reference and to analyze the forces causing the motion of a particle.