ME 1020: Engineering Mechanics

Spring 2025 – 3 Credit Hours

1. Instructor

Name: Chandra Prakash, Ph.D.
Assistant Professor
Office - 505, Academic Block C
Department of Mechanical and Aerospace Engineering
Web: impact-lab.in
Email: cprakashj@mae.iith.ac.in;
Telephone: (040) 2301 6683

2. Classes

Location LHC4

Monday 10:00 am – 10:55 am
Wednesday 09:00 am – 09:55 am
Thursday 11:00 am – 11:55 am

Course Webpage: www.impact-lab.in/em2025
Password: 25ME1020
Office Hours:
Thursday, 2:30 pm – 3:30 pm, C-505

3. Couse Duration

02/01/2025 – 30/04/2025 (16 weeks)

4. Course Description

This course is to introduce engineering students to the following concepts of mechanics:

- *Particle, deformable, rigid bodies, statics, dynamics; fundamental laws of mechanics, parallelogram law and triangular law; vector operations; Resultant of coplanar and concurrent forces; Components of forces in space; Equilibrium of a particle and a rigid body.*
- *Trusses, Frames and Machines, analysis of forces in trusses using the method of joints and the method of sections; Special conditions in truss members: zero-force members; Condition of statically determinate system; Force analysis in frames and machines.*
- *Internal forces-normal or axial force, shear force, bending moment, torsional moment; Sign convention for different internal forces; Application of the method of sections to determine internal forces; Relationship between applied load, shear force, and bending moment; Method of superposition to obtain shear force diagram and bending moment diagram.*
- *Friction: Introduction to the concept of dry friction, Equilibrium of rigid bodies subjected to dry friction; Examples demonstrating the application of frictions on wedges, screws, belts, and bearings; Concept of rolling resistance.*
- *Center of gravity and centroid; Moment of inertia; Theorems of Pappus and Guldinus; Moment of inertia for simple geometries; Parallel-axis theorem; Perpendicular-axis theorem; Polar moment of area; Radius of gyration; Application to Composite areas; Mass moment of inertia.*
- *Kinematics of particles, the rectilinear motion of particles, the curvilinear motion of particles, Kinematics of rigid bodies, Kinetics of particles, a system of particles, the plane motion of rigid bodies, energy, and momentum methods, the kinetics of rigid bodies in three dimensions, and introduction to mechanical vibrations.*

5. Textbook

- Meriam J.L and Kraige L.G., Engineering Mechanics, Volume I - statics, Volume II - dynamics, John Wiley & Sons, New York.
- Beer F.P. and Johnston E.R., Vector Mechanics for Engineers - Volume I - Statics, Volume II - Dynamics, McGraw Hill, New York.
- Shames L.H., Engineering Mechanics, Prentice Hall, New Delhi
- R. C. Hibbler, Engineering Mechanics, Vols. I and II, Pearson Press.

6. Percentage Distribution

- Quiz-I 20%
- Quiz-II 20%
- Quiz-III 20%
- Final Exam 40%

7. Attendance Policy

No penalty for above 80% attendance. -2% for 60-80%; - 4% for 40 - 60%; -5% for below 40%.

8. Exams

- Students are permitted to bring a calculator.
- Students are permitted to use a crib sheet of A4 size for exams.
- Students are permitted to use both sides of the crib sheet without restrictions to the format or information on the sheet.
- Under extraordinary circumstances, make-up exams will be considered. Students must contact the instructor for prior approval.

9. Homework Assignments

There are no homework assignments for the course.

10. Course Schedule

WK		Date	Class #	HW due	Chapters
0	M	02/01/2025	1		Course Introduction
1	M	06/01/2025	2		Position and Force Vectors
	W	08/01/2025	3		Particle Equilibrium
	Th	09/01/2025	4		Equivalent Force and Moments
2	M	13/01/2025	5		Rigid Body Equilibrium

	W	15/01/2025	6		Rigid Body Equilibrium
	Th	16/01/2025	7		Truss System
3	M	20/01/2025	8		Truss and Frame
	W	22/01/2025	9		Frames
	Th	23/01/2025	10		**Quiz-I**
4	M	27/01/2025	11		Centroid and Center of Mass
	W	29/01/2025	12		Center of Mass and Gravity
	Th	30/01/2025	13		Distributed Forces; Beams and Cables
5	M	03/02/2025	14		Internal Forces and Moments
	W	05/02/2025	15		Moments of Inertia
	Th	06/02/2025	16		Friction and its Applications
6	M	10/02/2025	17		Rectilinear and Curvilinear Motion
	W	12/02/2025	18		Particle Motion in reference frames; Relative Motion
	Th	13/02/2025	19		Force and Acceleration Methods
7	M	17/02/2025	20		Work and Energy Methods
	W	19/02/2025	21		Impulse and Momentum Methods
	Th	20/02/2025	22		Extension to a system of particles
8	M	24/02/2025	23		**Quiz-II**
	W	26/02/2025	24		Translation Motion
	Th	27/02/2025	25		Rotation about a fixed axis
9	M	03/03/2025	26		Absolute and Relative Motion
	W	05/03/2025	27		Velocity and Acceleration Analysis
	Th	06/03/2025	28		Rotating Frames
10	M	10/03/2025			No Class (semester break)

	W	12/03/2025			No Class (semester break)
	Th	13/03/2025			No Class (semester break)
11	M	17/03/2025	29		Force and Acceleration Analysis
	W	19/03/2025	30		Work and Energy Analysis
	Th	20/03/2025	31		Work and Energy Analysis
12	M	24/03/2025	32		Momentum and Impulse Analysis
	W	26/03/2025	33		System of Rigid Bodies
	Th	27/03/2025	34		System of Rigid Bodies
13	M	31/03/2025			No Class (Id-ul-Fitr)
	W	02/04/2025	35		**Quiz-III**
	Th	03/04/2025	36		Translation; Fixed axis rotation
14	M	07/04/2025	37		Parallel-plane motion
	W	09/04/2025	38		Rotation about a Fixed point; General Motion
	Th	10/04/2025			No Class (Mahavir Jayanti)
15	M	14/04/2025	39		Relative motion using translating and rotating axis
	W	16/04/2025	40		Angular momentum of rigid bodies in 3D
	Th	17/04/2025	41		Impulse Momentum Principles
16	M	21/04/2025	42		Kinetics energy of Rigid Bodies in 3D
	W	23/04/2025	43		Newton Euler equations for 3D motion
	Th	24/04/2025	44		Mechanical Vibration
17	M	28/04/2025	45		Gyroscopes
	W	30/04/2025	46		Course Review