INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

ENGINEERING MECHANICS								
II Semester: AE / ME / CE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
AMED04	**Foundation**	3	0	0	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes:48**		
Prerequisite: Matrices and Calculus								

I. COURSE OVERVIEW:
Engineering Mechanics is a foundational course that introduces students to the principles of mechanics and their applications in analyzing and solving real-world engineering problems. This course focuses on imparting a comprehensive understanding of statics and dynamics, which are essential concepts for engineers across various disciplines. Through a combination of theoretical concepts, mathematical derivations, and practical applications, students will develop the skills necessary to analyze and predict the behavior of structures and systems under different conditions.

II. COURSES OBJECTIVES:
The students will try to learn

- **I.** The application of mathematics and science principles to represent the free body diagrams in the area of rigid body mechanics.
- **II.** The conditions of static and dynamic equilibrium of bodies subjected to a particular force system for solving the field problems.
- **III.** The effects of force and motion while carrying out the innovative design functions of engineering.

III. COURSE OUTCOMES:
After successful completion of the course, students should be able to:

CO1	Determine the unknown forces by free body diagrams to a given equilibrium force system through laws of mechanics.
CO2	Calculate the system of forces acting on wedge and screw jack by using the laws of static and dynamic frictions.
CO3	Use the concepts of centroid in stability problems for evaluation of area moment of inertia.
CO4	Identify the mass moment of inertia of symmetrical and non-symmetrical section using the concepts of centre of gravity.
CO5	Solve the position, velocity, acceleration and the characteristics of a body in dynamic equilibrium for various types of motion using appropriate mathematical tools.
CO6	Develop the governing equation from first principles by using work - energy and impulse - momentum in dynamic equilibrium condition.

IV. SYLLABUS:

MODULE – I: Introduction to Engineering Mechanics (10)
2DForce Systems: Basic concepts, particle equilibrium; rigid body equilibrium; system of forces, coplanar concurrent forces, 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.

MODULE – II: Friction, Centroid and Centre of gravity (8)
Friction: Types of friction, limiting friction, laws of friction, static and dynamic friction; motion of bodies, wedge friction, screw jack.

Centroid and Centre of Gravity: Centroid of lines, areas and volumes from first principle, centroid of composite

sections; centre of gravity and its implications, theorems of Pappus–Guldinus.

MODULE – III: Area moment of inertia and Mass moment of inertia (8)

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 moment of inertia, mass moment of inertia of composite bodies.

MODULE – IV: Kinematics of rigid bodies and Impulse – momentum method (10)

Review of particle dynamics, rectilinear motion; Plane curvilinear motion (rectangular path, and polar coordinates). Relative and constrained motion. Impulse-momentum (linear, angular); impact (direct and oblique).

MODULE – V: Kinetics of rigid bodies and Work – energy principle (12)

Kinetics of rigid bodies, basic terms, D' Alembert's principle and its applications in plane motion and connected bodies; instantaneous centre of rotation in plane motion and simple problems; work-kinetic energy, power, potential energy. work energy principle and its application in plane motion of connected bodies.

V. TEXT BOOKS:

1. K. Vijay Reddy, J. Suresh Kumar, *"Singer's Engineering Mechanics Statics and Dynamics",* B S Publishers, 1st edition, 2011.
2. S. Bhavikatti, *"A Text Book of Engineering Mechanics",* New Age International, 5th edition, 2020.

VI. REFERENCE BOOKS:

1. S. Timoshenko, D. H. Young & J. V. Rao, *"Engineering Mechanics",* 5th edition, TMH, 2017.
2. A. K. Tayal, *"Engineering Mechanics",* Uma Publications, 14th edition, 2013.
3. R. K. Bansal *"Engineering Mechanics*", Laxmi Publication, 8th edition, 2013.
4. Irving H. Shames, *"Engineering Mechanics",* Prentice Hall, 4th edition, 2021.
5. R. C. Hibbler, *"Engineering Mechanics: Principles of Statics and Dynamics",* Pearson Press, 5th edition, 2021.
6. Irving H. Shames (2006), *"Engineering Mechanics"*, Prentice Hall, 4th edition, 2013.

VII. ELECTRONICS RESOURCES:

1. https://nptel.ac.in/courses/112106286
2. https://akanksha.iare.ac.in/index?route=course/details&course_id=33
3. https://akanksha.iare.ac.in/index?route=course/details&course_id=31
4. https://akanksha.iare.ac.in/index?route=course/details&course_id=1293

VIII. MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open end experiments
5. Definitions and terminology
6. Assignments
7. Model question paper - I
8. Model question paper - II
9. Lecture notes
10. E-learning readiness videos (ELRV)
11. Power point presentation