# ENGINEERING MECHANICS

**II Semester: AE/ME/CE**

| Course Code | Category | Hours / Week | | | Credits | Maximum Marks | | |
|---|---|---|---|---|---|---|---|---|
| | | L | T | P | C | CIA | SEE | Total |
| AME002 | Foundation | 3 | 1 | - | 4 | 30 | 70 | 100 |
| Contact Classes: 45 | Tutorial Classes: 15 | Practical Classes: Nil | | | | Total Classes: 60 | | |

## OBJECTIVES:

**The course should enable the students to:**

I. Develop the ability to work comfortably with basic engineering mechanics concepts required for analyzing dynamic structures.
II. Identify an appropriate structural system to studying a given problem and isolate it from its environment, model the problem using good free-body diagrams and accurate equilibrium equations.
III. Identify and model various types of loading and support conditions that act on structural systems, apply pertinent mathematical, physical and engineering mechanical principles to the system to solve and analyze the problem.
IV. Understand the meaning of impulse and momentum, virtual work and solve the field problems.
V. Solve the problem of equilibrium by using the principle of work and energy and vibrations for preparing the students for higher level courses such as, Mechanics of Solids, Mechanics of Fluids etc.

## COURSE LEARNING OUTCOMES (CLOs):

1. Understand the concepts of kinematics of the particles and rectilinear motion.
2. Demonstrate knowledge of ability to identify & apply fundamentals to solve problems like motion curves, rigid body motion and fixed axis rotation.
3. Explore knowledge & ability to solve various particle motion problems.
4. Derive the D' Alembert's principle and apply it to various field problems of kinetic motion.
5. Discuss the nature of relation between force and mass under the influence of time.
6. Develop the relations for motion of body in lift and on inclined plane.
7. Determine the impact, impulse and impulsive forces occurring in the system.
8. Understand the inter relationship between impulse-momentum and virtual work and an ability to use such relationships to solve practical problems.
9. Knowledge of the lifting machines and simple framed structures equilibrium criteria, and the knowledge of the equilibrium condition systems.
10. Determine the effect of law of conservation of energy and its consideration in field problems.
11. Discuss the application of work energy method to particle motion.
12. Develop the work energy relations and apply to connected systems.
13. Understand the fixed axis rotation theory and solving the field problems by application of work energy method.
14. Introduction to concepts of vibration and explain the relation between simple harmonic motion and the equilibrium systems.
15. Derive the expressions for the concepts of simple, compound and torsional pendulums.
16. Explore the use of modern engineering tools, software and equipment to prepare for competitive exams, higher studies etc.

| UNIT-I | KINEMATICS OF PARTICLES- RECTILINEAR MOTION | Classes: 09 |
|---|---|---|
| Motion of a particle – Rectilinear motion – motion curves – Rectangular components of curvilinear motion Kinematics of Rigid Body - Types of rigid body motion - Angular motion - Fixed Axis Rotation. | | |
| **UNIT-II** | **KINETICS OF PARTICLE** | **Classes: 08** |
| Introduction-Definitions of Matter, body, particle, mass, weight, inertia, momentum. Newton's law of motion. Relation Between force & mass. Motion of a particle in rectangular coordinates. D'Alembert's Principle.Motion of Lift. Motion of body on an inclined plane. Motion of connected Bodies. | | |
| **UNIT-III** | **IMPULSE AND MOMENTUM, VIRTUAL WORK** | **Classes: 10** |
| Impulse And Momentum: Introduction- Impact, Momentum, Impulse & Impulsive forces, Units. Law of conservation of Momentum, Newton's law of collision of elastic bodies- coefficient of Restitution. Recoil of Gun. Impulse Momentum Equation.<br><br>**VIRTUAL WORK:** Introduction – Principle of virtual work – Applications – Beams, Lifting machines, Simple framed structures. | | |
| **UNIT-IV** | **WORK ENERGY METHOD** | **Classes: 09** |
| Law of conservation of Energy, Application of Work Energy Method to particle motion and connected system- Work energy applied to Connected Systems - Work energy applied to Fixed Axis Rotation | | |
| **UNIT-V** | **MECHANICAL VIBRATIONS** | **Classes: 09** |
| Definitions and Concepts – Simple Harmonic Motion – Free vibrations, simple and Compound Pendulums – Torsion Pendulum – Free vibrations without damping: General cases. | | |

**Text Books:**

1. R.C. Hibbler, "Engineering Mechanics", Prentice Hall, 12th Edition, 2009.
2. Engineering Mechanics - Statics and Dynamics by Ferdinand.L. Singer / Harper International Edition.
3. Engineering Mechanics/ S. Timoshenko and D.H. Young, Mc Graw Hill Book Company.

**REFERENCES:**

1. S. Bhavikatti, "A Text Book of Engineering Mechanics", New Age International, 1st Edition, 2012.
2. A.K Tayal ,"Engineering Mechanics", Uma Publications, 14th Edition, 2013.
3. R.K. Bansal "Engineering Mechanics", Laxmi Publications, 8th Edition, 2013.
4. Engg. Mechanics / KL Kumar / Tata McGraw Hill.
5. Engg. Mechanics / S.S. Bhavikati & K.G. Rajasekharappa.
6. Basudeb Bhattacharya, "Engineering Mechanics", Oxford University Press, 2nd Edition, 2014.
7. K. Vijay Reddy, J. Suresh Kumar, "Singer's Engineering Mechanics, Statics and Dynamics", B S Publishers, 1st Edition, 2013.

**Web References:**

1. http://link.springer.com/book
2. http://www.sciencedirect.com/science
3. http://www.e-booksdirectory.com

**E-Text Books:**

4.

1. https://www.pdfdrive.com/a-textbook-of-engineering-mechanics-by-r-s-khurmi-e36586540.html
2. https://www.pdfdrive.com/engineering-mechanics-statics-3rd-ed-e4229691.html
3. https://books.google.co.in/books/about/A_Textbook_of_Engineering_Mechanics.html?id=AOY9fiIkB9AC