ENGINEERING MECHANICS

III Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB03	Foundation	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

COURSE OBJECTIVES:

The course should enable the students to:

I. Ability to work comfortably with basic engineering mechanics concepts required for analyzing static 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 centre of gravity (mass)/centroid and moment of Inertia using integration methods and method of moments.

COURSE OUTCOMES (COs):

CO 1: Develop the ability to work comfortably with basic engineering mechanics concepts required for analysing rigid bodies and structures. Identify an appropriate structural system for studying a given problem and isolate it from its environment, model the problem using free body diagrams and accurate equilibrium equations.
CO 2: Understand laws of friction and advantages of friction. Can be able to use this knowledge for various engineering applications. Can be able to analyse simple pin-jointed frames under different load conditions.
CO 3: Can be able to locate the centroids and calculate the moments of inertia for various simple cross-sections such as I-section , T-section, Channel section etc., and composite sections. Mass moments of inertia can also be determined. Can apply the, principle of virtual work for the analysis of structures..
CO 4: Understand the principles (Laws of rigid body motion, Work-energy principle and Impulse-momentum principle etc.,), for analysing the problems related to the motion of rigid bodies with and without considering the forces which causes motion.
CO 5: Understands the concepts related to the free and forced vibrations and can be able to apply the same to real world problems. Also understands the simple harmonic motion of simple pendulum.

COURSE LEARNING OUTCOMES (CLOs):

1. A basic understanding of the laws and principle of mechanics..
2. The ability to solve simple force system problems in mechanics..
3. Determine the resultant and apply conditions of static equilibrium to a plane force system.
4. Can be able to apply the knowledge of forces and force systems in the analysis of more complex problems.
5. Understands the concepts of static and dynamic friction, advantages and disadvantages of friction

6. Solve the problems of simple systems with friction effect. Calculate the linear moving bodies in general plane motion and applications of friction
7. Analyze planar and spatial systems to determine the force in the members of truss and frames
8. Solve the problems on different types of beams.
9. Obtain the centroid, center of gravity and centre of mass for simple and composite objects
10. Understand the concept of moment of inertia and can calculate second moment of area for simple and composite sections
11. Can apply the knowledge of first and second moments of area in the analysis and design of complex structures.
12. Understand the concept of virtual work and an ability to solve practical problems using the principle of virtual work.
13. Understand the concepts of kinematics of the particles and rectilinear motion.
14. Explore knowledge & ability to solve various particle motion problems.
15. Derive the D' Alembert's principle and apply it to various field problems of kinetic motion
16. Determine the impact, impulse and impulsive forces occurring in the system and able to solve the problems.
17. Understands the concepts of vibration and explain the relation between simple harmonic motion and the equilibrium systems.
18. Derive the expressions for the concepts of simple, compound and torsional pendulums.
19. Applies the knowledge of vibrations in the analysis and design of various machine foundations..
20. Explore the use of modern engineering tools, software and equipment to prepare for competitive exams, higher studies etc.

Module-I	**INTRODUCTION TO ENGINEERING MECHANICS**	**Classes: 10**

Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – 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 and Spatial Systems; Static Indeterminacy.

Module-II	**FRICTION AND BASICS STRUCTURAL ANALYSIS**	**Classes: 09**

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack; Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams &types of beams; Frames &Machines.

Module-III	**CENTROID AND CENTRE OF GRAVITY AND VIRTUAL WORK AND ENERGY METHOD**	**Classes: 10**

Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; 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; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.
Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Module-IV	PARTICLE DYNAMICS AND INTRODUCTION TO KINETICS	Classes: 08
Particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique). Introduction to Kinetics of Rigid Bodies covering, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems.		
Module-V	**MECHANICAL VIBRATIONS**	**Classes: 08**
Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.		

Text Books:

1. Irving H. Shames (2006), "Engineering Mechanics", Prentice Hall, 4th Edition,2013
2. F. P. Beer and E. R. Johnston (2011), "Vector Mechanics for Engineers", Vol I - Statics, Vol II, – Dynamics, Tata McGraw Hill , 9th Edition,2013.
3. R. C. Hibbler (2006), "Engineering Mechanics: Principles of Statics and Dynamics", Pearson Press.

Reference Books:

1. S.Bhavikatti,"ATextBookofEngineeringMechanics",NewAgeInternational,1st Edition,2012
2. A.K.Tayal, "Engineering Mechanics", Uma Publications, 14th Edition, 2013.
3. R. K. Bansal "Engineering Mechanics", Laxmi Publication, 8thEdition, 2013.
4. Basudeb Bhattacharya, "Engineering Mechanics", Oxford University Press, 2nd Edition, 2014.
5. K.Vijay Reddy, J. Suresh Kumar, "Singer's Engineering Mechanics Statics and Dynamics", B Publishers, 1st Edition, 2013.

Web References:

1. https://en.wikipedia.org/wiki/Dynamics_(mechanics)
2. https://www.youtube.com/playlist?list=PLUl4u3cNGP62esZEwffjMAsEMW_YArxYC

E-Text Books:

1. http://www.freeengineeringbooks.com/Civil/Engineering-Mechanics-Books.php
2. http://www.textbooksonline.tn.nic.in/books/11/stdxi-voc-ema-em-2.pdf
3. http://www.faadooengineers.com/threads/17024-Engineering-mechanics-pdf-Free-Download