ENGINEERING MECHANICS

III Semester: ME

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AMEB03	Foundation	3	1	3	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. Students should develop the ability to work comfortably with basic engineering mechanics concepts required for analyzing static structures. Correlate principles and applications of lasers and fiber optics.

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. Understand the meaning of centre of gravity (mass)/centroid and moment of Inertia using integration methods and method of moments.

IV. To solve the problem of equilibrium by using the principle of work and energy, impulse momentum and vibrations for preparing the students for higher level courses such as Mechanics of Solids, Mechanics of Fluids, Mechanical Design and Structural Analysis etc.

COURSE OUTCOMES(COs):

CO 1: Understand the concepts of laws of mechanics, force systems and friction forces.
CO 2: Analyze the spatial systems, forces in frames and the concepts of centroids and centre of gravity.
CO 3: Understand the concepts of kinetics and kinematics to solve the problems related to motion of the body.
CO 4: Understand the concept of impulse forces, work energy relations for connected systems.
CO 5: Explore the knowledge on vibrations and simple harmonic motion.

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. Solve the problems of simple systems with the friction, calculate the linear moving bodies in general plane motion and applications of friction.
5. Analyze planer and spatial systems to determine the force in the members of truss and frames.
6. Solve the problems on different types of beams.
7. Obtain the centroid, center of gravity, first moment and second moment of area.
8. Understand the concept of virtual work and an ability to solve practical problems.
9. Understand the concepts of kinematics of the particles and rectilinear motion.
10. Explore knowledge & ability to solve various particle motion problems.
11. Derive the D' Alembert's principle and apply it to various field problems of kinetic motion.
12. Determine the impact, impulse and impulsive forces occurring in the system and able to solve the problems.
13. Develop the work energy relations and apply to connected systems.
14. Understand the fixed axis rotation theory and solving the field problems by application of work energy method.
15. Introduction to concepts of vibration and explain the relation between simple harmonic motion and the equilibrium systems.
16. Derive the expressions for the concepts of simple, compound and torsional pendulums.
17. Explore the use of modern engineering tools, software and equipment to real world problems.

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.

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

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