ENGINEERING MECHANICS

III Semester: ME

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 student will try to learn:

I. The application of mechanics laws to static and dynamic equilibrium conditions in a body for solving the field problems.
II. The importance of free body diagram for a given system and put in the knowledge of mathematics and science into the vast area of rigid body mechanics.
III. The effects of force and motion while carrying out the innovative design functions of engineering.

COURSE OUTCOMES:

CO 1: **Determine** the reactions and resultants for the system of forces in engineering applications with principles of mechanics.
CO 2: **Analyze** the unknown forces with the help of free body diagrams to a given force system.
CO 3: **Identify** the equilibrium equations for a planar and spatial force systems from the rest or motion condition of the body
CO 4: **Apply** the static and dynamic friction laws for the equilibrium state of a wedge and ladder applications.
CO 5: **Apply** the friction laws to a standard and differential screw jack for conditions of self-locking and overhauling.
CO 6: **Demonstrate** the concepts of equilibrium for truss, beam, frames and machine applications.
CO 7: **Identify** the centroid, centre of gravity and moment of inertia for the simple plane sections from the first principles.
CO 8: **Explore** the theorems of moment and the mass moment of inertia of circular plate, cylinder, cone and sphere.
CO 9: **Apply** the concepts of virtual work and work-energy method for single and connected configured systems.
CO 10: **Determine** normal and tangential accelerations for a particle in rectilinear and curvilinear motion through kinematic equations.
CO 11: **Derive** the dynamic equilibrium of a body in motion by introducing inertia force through D' Alembert's principle.
CO 12: **Compute** the time period and frequencies of simple, compound and torsional pendulums using the basics of free and forced vibrations.

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, 8th Edition, 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