MECHANICS OF SOLIDS

III Semester

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
A5AE05	PCC	3	1	-	4	30	70	100

COURSE OBJECTIVES:

The course should enable the students to:

1. Apply the concept of stress and strain to analyze and design structural members
2. Develop the shear force and bending moment diagrams for different beams subjected to various loads.
3. Determine the bending stress and develop the shear stress distribution across various beam sections.
4. Determine the principal stresses and deflection of beams.
5. Design the circular shafts and analyze the thin cylinders.

UNIT-I SIMPLE STRESSES AND STRAINS

SIMPLE STRESSES AND STRAINS: Elasticity and plasticity, Types of stresses and strains, Hooke's law stress, strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson's ratio and volumetric strain, Elastic module and the relationship between them, Bars of varying section, composite bars, Temperature stresses. Strain energy, Resilience - Gradual, Sudden, Impact loading.

UNIT-II SHEAR FORCE AND BENDING MOMENT

SHEAR FORCE AND BENDING MOMENT: Definition of beam, Types of beams, Concept of shear force and bending moment, Relation between Shear Force and Bending Moment. and rate of loading at a section of a beam. Shear Force and Bending Moment diagrams for cantilever, simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads, Point of contra flexure.

UNIT-III FLEXURAL STRESSES & SHEAR STRESSES

FLEXURAL STRESSES: Theory of simple bending, Assumptions, Derivation of bending equation: M/ I = f/y = E/RNeutral axis, Determination bending stresses, section modulus of rectangular and circular sections (Solid and Hollow), I, T, and Channel sections

SHEAR STRESSES: Derivation of formula, Shear stress distribution across various beams sections like rectangular ,circular, I.

UNIT-IV PRINCIPAL STRESSES AND STRAINS & DEFLECTION OF BEAMS

PRINCIPAL STRESSES AND STRAINS: Introduction - Stresses on an inclined section of a bar under axial loading - compound stresses - Normal and tangential stresses on an inclined plane for biaxial stresses - Two perpendicular normal stresses accompanied by a state of simple shear - Mohr's circle of stresses - Principle stresses and strains - Analytical and graphical solutions.
DEFLECTION OF BEAMS: Bending into a circular arc slope, deflection and radius of curvature, Differential equation forthe elastic line of a beam, Double integration and Macaulay's methods, Determination of slope and deflection for cantilever and simply supported beams subjected to point loads

UNIT-V	TORSION OF CIRCULAR SHAFTS & THIN CYLINDERS

TORSION OF CIRCULAR SHAFTS: Theory of pure torsion - derivation of Torsion equations: T/J = q/r = N/L - Assumptions made in the theory of pure torsion - Torsional moment of resistance - Polar section modulus - Power transmitted by shafts

THIN CYLINDERS: Thin seamless cylindrical shells, Derivation of formula for longitudinal and circumferential stresses hoop, longitudinal and volumetric strains, changes in dia, and volume of thin cylinders, Riveted boiler shells, Thin spherical shells.

Text Books:

1. Ramamrutham. S (2012), Strength of materials, 17th edition, Dhanpat Rai Publications, Engineering Mechanics/Timoshenko and D.H. Young, Mc Graw Hill Book Company New Delhi, India.
2. Dr.Bansal R.K*(2007),* Strength of materials, 10th edition,Laxmi Publications,Hyderabad

Reference Books:

1. Ryder G. H (2007), Strength of materials, 3rd edition, Macmillan, New Delhi, India.
2. Bhavikathi S. S (2008), Strength of materials, 3rd edition, Vikas Publishing House, New Delhi, India

COURSE OUTCOMES:

At the end of the course the student should be able to:

1. Understand basic concepts of stress, strain and their relations based on linear elasticity and material behaviors due to axial loading will be discussed.
2. Develop the shear force and bending moment diagrams for different beams subjected to various loads and find the maximum moment/shear and their locations.
3. Determine the bending stress and develop the shear stress distribution across various beam sections.
4. Determine the principal stresses and deflection of beams.
5. Design the circular shafts and analyze the thin cylinders.