

3SE82: ADVANCED STRENGTH OF MATERIALS
CREDITS – 4 (LTP: 3,0,1)

Course Objectives:

1. To impart knowledge of analysis for structural elements.
2. To explain various theories of failure.

Teaching and Assessment Scheme:

Teaching Scheme (Hours per Week)			Credits	Assessment Scheme				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE	CE	ESE	CE	150	
03	00	02	04	60	40	20		30

Course Contents:

Unit No.	Topics	Teaching Hours
1	Strain energy: Resilience, Proof resilience, modulus of resilience, Gradual, sudden and Impact loads, Energy of dilation and distortion, Castigliano's theorem, Maxwell's theorem of reciprocal deflection	9
2	Stresses in Springs: Leaf spring, deflection and bending stresses; open coiled helical springs; derivation of formula and application for deflection and rotation of free end under the action of axial load and/or axial couple; flat spiral springs – derivation of formula for strain energy, maximum stress and rotation	7
3	Theories of Failure: Maximum principal stress theory, maximum shear stress theory, Total strain energy theory, shear strain energy theory, graphical representation and derivation of equation for each and their applications.	7
4	Bending of curved elements: Calculation of stresses in crane or chain hooks, rings of circular section and trapezoidal section and chain links with straight sided	5
5	Shear flow in elements: Shear stress distribution in rectangular, circular, I,T and channel section and the compression with bending stresses, Shear flow in thin walled open sections, Determination of Shear centre, Derivation of equation of torsion, Assumptions, application of theory of torsion equation to solid & hollow circular shaft, torsional rigidity.	6
6	Thick Cylinders: Derivation of Lamé's equations, calculation of radial longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders, hub shrunk on solid shafts	5
7	Rotational stresses: Rotational stresses in discs and rims of uniform thickness; discs of uniform strength	6
Total		45

List of References:

1. S. P. Timoshenko and D. H. Young, "*Elements of Strength of Materials*" East West Press.
2. GH Ryder, "Strength of Materials", MacMillan and Co.
3. R.S. Lehri and A.S. Lehri, "*Strength of Materials*", S.K Kataria and Sons
4. Advanced Solid Mechanics by LS Srinath, McGraw-Hill.
5. Introduction to Mechanics of Solids by Crandell, Dahl and Lardner, McGraw Hill
6. Advanced Mechanics of Materials by Fred B. Seely and James O. Smith
7. Fundamentals of Solid Mechanics (A Treatise on Strength of Materials) by M. L. Gambhir, PHI Learning pvt. Ltd.
8. Strength of Materials by R. K. Rajput, S. Chand Publisher.
9. Mechanics of Materials by Dr.Kirpal Singh, Standard Publishers & Distributors.

Course Outcomes (COs):

1. Apply the strain energy concept to structural elements.
2. Apply theories of failure in structural elements.
3. Analyze curved elements.
4. Analyze different stresses in thin walled sections, thick shells and rotating elements.