

AE-321: Advanced strength of material

L	T	P	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/-	20/25	40/50	-

Objectives: this course introduces the students with theory of elasticity, torsion of non-circular sections, deformation and design of members for fatigue and creep.

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		Contact Hours
Unit-1	Theory of Elasticity: Plane stress and plane strain problem, strain-displacement relation, stress - strain relations, equilibrium equations, body force, compatibility equations, airy stress function, analysis of simple two dimensional problems in Cartesian coordinates	8
Unit-2	Plates: Bending of circular plates carrying uniformly distributed load over entire surface or with concentrated load at centre, simply supported rectangular plate carrying uniformly distributed (excluding derivation of formulae).	6
Unit-3	Torsion of non-circular section shafts: St. Venant's methods, torsion of shafts of elliptical and rectangular sections, membrane analogy, torsion of shafts of thin tubular section. Laterally loaded columns: Analysis of long columns carrying lateral loads in addition to axial compression eccentrically loaded columns. Beams on Elastic Foundations: Modules of foundation, equation of elastic curve, solution for beams of infinite and semi-infinite length.	6
Unit-4	Deformation beyond elastic limit: Behaviour of material beyond elastic limit, perfectly plastic material, torsion of shafts and analysis of thick cylinders with radial pressure when loaded beyond elastic limit, residual stresses.	8
Unit-5	Curved beams : Theory of curved beams, stresses in curved beams, expression for radius of neutral axis for different cross-sections, C-clamps	6
Unit-6	Miscellaneous Topics: Contact stress in ball and roller bearings, bending of curved tubes, stress analysis of flywheel. Design of members for fatigue and creep: Fatigue behaviour, factors affecting fatigue, mechanics of fatigue failure, fatigue under combined stresses, fatigue life and cumulative fatigue, design formulae for fatigue calculations. Mechanics of creep, relationships regarding creep rate different stresses and temperature, bending of beams at high temperature, stress relaxation in steam turbine bolting, creep under combined stresses, creep analysis of rotating discs	8
Total		42

Reference Books:

1	E.J. Hearn,"Mechanics of Materials: v. 2: An Introduction to the Mechanics of Elastic and Plastic Deformation of Solids and Structural Components",PublisherELSEVIER, New Delhi, 2008(ISBN-8131214567)
2	Timoshenko,"Strength of Materials: vol. 2 ",Publisher-CBS Publishers & Distributors, 2002(ISBN-8123910770)
3	L S Srinath, Advanced Mechanics of Solids, 3rd Edition, McGraw-Hill, 2009.
4	S P Timoshenko and J N Goodier, Theory of Elasticity, 3rd Edition, Tata McGraw-Hill Edition, 2010

Course Outcomes

CO1	To Understand basics of elasticity and its related problems.
CO2	To study bending of plates with different loadings.
CO3	To study torsion of non-circular section shafts, Analysis of long columns carrying lateral loads and Beams on Elastic Foundations
CO4	To study perfectly plastic material, torsion of shafts and analysis of thick cylinders
CO5	To study Mechanics of wire drawing , tube drawing and forging process
CO6	To study of creep, fatigue, stress analysis of flywheel.

CO-PO/PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2