ADVANCED STRENGTH OF MATERIALS

Course Code	20ME4501A	Year	III	Semester	I
Course Category	Professional Elective-I	Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Strength of Materials
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes: Upon successful completion of the course, the student will be able to

CO	Statement	Skill	Blooms	Units
CO1	Understand the concepts of Strain energy and apply the energy methods on beams.	Understand	L2	1
CO2	Apply the concepts to find the deflections in fixed and continuous beams.	Apply	L3	2
CO3	Apply the principles to determine the stresses in thick cylinders, rotating elements and curved beams.	Apply	L3	3,4
CO4	Analyze 3D stresses at a point and yield criteria.	Analyze	L4	5

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3: High, 2: Medium, 1: Low)

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

Syllabus

UNIT	Course Content	Mapped COs
I	**Strain Energy:** Resilience, Proof Resilience, Strain energy stored in a body when the load is applied gradually, Load is applied suddenly, Load is applied with impact, Strain energy stored in a body due to shear stress. **Application of energy methods:** Principle of stationary potential energy, Castigliano's theorem on deflections, Castiglione's theorem on deflections for linear load deflection relations, deflections of statically determinate structures.	CO1
II	**Fixed beams:** Introduction, bending moment diagram for fixed beam, Slope and deflection of fixed beam carrying point load and uniformly distributed load, Fixed end moments of fixed beam due to sinking of a support. **Continuous beams:** Bending moment diagram for Continuous beam, Clapeyron's theorem of three moments to continuous beam with Simply supported ends, Clapeyron's theorem of three moments to continuous beam with fixed supported ends, Beams with constant moment of inertia.	CO2
III	**Thick cylinders:** Introduction, Stresses in thick Cylindrical shell (Lame's theory), Radial Deflection, Stresses in Compound Cylinders. **Centrifugal Stresses:** Introduction, Rotating Ring, Rotating Disc, Rotating Disc of uniform strength.	CO3
IV	**Curved beams:** Stresses in Beams of small and large initial curvature, The Winkler-Bach theory, Assumptions for stresses in the bending of curved bars,	CO3

	Stresses in Crane Hook and C-Clamp with Rectangular, circular and trapezoidal cross sections.	
V	**Analysis of stress:** Definition of stress at a point, stress notation, stress in arbitrary plane, stress transformation, principal stresses. **Yield Criteria:** General concepts, maximum Principal Stress Criterion, Maximum Principal Strain Criterion, Strain Energy Density Criterion, Maximum Shear Stress Criterion, Distortion Energy Density Criterion.	**CO4**

Learning Resource
Text books:
1. Stephen P. Timoshenko, James M. Gere "Mechanics of Materials", 2nd edition, C B S Publishers, 2011. 2. S.S. Rattan, "Strength of Materials", 2nd edition, Tata Mc-Graw Hill Private Limited, New Delhi, 2012.
Reference books:
1. James M. Gere, "Mechanics of Materials", 7th edition, Cengage learning India, 2010. 2. AdarshSwaroop, "Mechanics of Materials" 1st edition, New Age International Pvt. Ltd, 2012. 3. Popov, Mechanics of Solids, 2/e, New Pearson Education,2015. 4. B. Raghu Kumar, Strength of Materials, B S Publications, 2020.