19CE3401 - MECHANICS OF SOLIDS

Course Category:	Program Core		Credits:	3
Course Type:	Theory		Lecture-Tutorial-Practical:	3-0-0
Prerequisites:	19CE3301- Engineering Mechanics		Continuous Evaluation:	30
			Semester End Evaluation:	70
			Total Marks:	100

Course Outcomes

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

CO1	**Describe** the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships	K2
CO2	**Determine** shear force, bending moment of statically determinate beams and frames and draw SFD and BMD.	K3
CO3	**Analyze** various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress	K4
CO4	**Evaluate** the flexural stresses, section modulus for various sections and draw shear stress distribution for rectangular, circular, triangular, I, T and angle sections.	K5
CO5	**Apply** the torsion equation, calculate power transmitted by the shaft and determine the deflections of closed coiled helical springs.	K3

Contribution of Course Outcomes towards achievement of Program Outcomes														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3						1					3	2
CO2	2	3						1					3	2
CO3	2	3						1					3	2
CO4	2	3						1					3	2
CO5	2	3						1					3	2
Avg.	2	3						1					3	2

1- Low	2-Medium	3-High

Course Content

UNIT-1	**SIMPLE STRESSES AND ELASTIC CONSTANTS** Concept of stress and strain, St. Venant's principle, stress and strain diagram, 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 moduli and the relationship between them; Bars of varying section, composite bars, temperature stresses. Relationship between elastic constants. Strain Energy –Resilience, Gradual, sudden, impact and shock loadings, simple applications.	CO1
UNIT-2	**BENDING MOMENT AND SHEAR FORCE DIAGRAMS** Relationship between moment, shear and load. Bending Moment (BM) and Shear Force (SF) diagrams. BM and SF diagrams for cantilevers, simply supported with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments	CO2
UNIT-3	**COMPLEX STRESSES** Stresses on inclined plane on block subjected to normal stress and shear stress along two planes at right angles, principal plane and principal stresses, Mohr's circle for finding principal stresses, Directions of principal planes, Volumetric strain.	CO3
UNIT-4	**STRESSES IN BEAMS** Derivation of bending equation, Neutral axis, determination of bending stresses, section modulus of rectangular and circular sections (Solid and Hollow), I, T,	CO4

	Angle and Channel sections, Design of simple beam sections. Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.	
UNIT-5	**TORSIONAL STRESSES IN SHAFTS** Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.	**CO5**

Learning Resources

Text Books	1. V.N Vazirani and M.M Ratwani, Analysis Of Structures Vol-I, Khanna Publishers, 2003. 2. S.Timoshenko, Strength Of Materials: Elementary Theory and Problems-Vol.I, 2004. 3. R.Subrahmanian, Strength of Materials, 3/e, Oxford University Press, 2016.
Reference Books	1. S.S. Rattan, Strength of Materials, 2/e, Tata McGraw Hill Education, 2011. 2. Gere and Timoshenko, Mechanics of Materials, 4/e, CBS Publishers, 2006. 3. Stephen Timoshenko, Strength of Materials, 3/e, CBS Publisher, 2002. 4. R.K. Rajput, Strength of Materials, S. Chand Publications, 2007
e-Resources& other digital material	1. http://nptel.ac.in/courses.php 2. http://jntuk-coeerd.in/