

Branch Name:	Mechanical Engineering
Program Code:	ET101
Course Name:	Mechanics of Deformable Solids
Course Code:	2ET1010403T
Pre-requisite Course:	Mechanics of Solid

Course Objectives:

1. To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads
2. To calculate the elastic deformation occurring in various simple geometries for different types of loading

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								
					Theory (Marks)				Practical (Marks)				Total (Marks)
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
04	03	01	-	04	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Concept of Stress and Strain: Deformation of bars: Hooke's law, stress, strain, and elongation; Tensile, compressive and shear stresses in 2D solids; Elastic constants and their relations; Volumetric, linear and shear strains; Principal stresses and strain; Principal planes; Mohr's circle.	04	10
2	Mechanics of Beams: Transverse loading on beams, point and distributed loads; Shear force and bend moment diagrams; Types of beam supports – simply supported, over-hanging, cantilevers, fixed and guided beams; Static determinacy and indeterminacy; Theory of bending of beams, pure bending stress distribution and neutral plane, second moment of area; Different cross-sections of beams; Shear stress distribution.	14	25
3	Deflection of Beams: Deflection of a beam using the double integration method; Computation of slopes and deflection in beams; Myosotis method for computing deflections and slopes.	10	15
4	Column Buckling: Critical loads using Euler's theory; Different boundary conditions; Eccentric columns.	06	20
5	Torsion and Twist: Torsion stresses and deformation of circular and hollow shafts; Polar moment of area, stepped shafts; Deflection of shafts fixed at both ends; Stresses and deflection of helical springs.	06	20
6	Energy Theorem: Principle of virtual work; Minimum potential energy theorem; Castigliano's theorems; Maxwell reciprocity theorem.	04	10

List of Reference Books:

1. E. P. Popov, "Engineering Mechanics of Solids," Pearson, 2015.
2. Timoshenko and Gere, "Mechanics of Materials", CBS Publishers, 2011.
3. R. Subramanian, "Strength of Materials," Oxford University Press, 2007.
4. D.S. Bedi, "Strength of Materials", Khanna Book Publishing. 2022.
5. D.S. Bedi, "Engineering Mechanics", Khanna Book Publishing. 2021.
6. F. P. Beer, R. Johnson Jr and J. J. Dewole, "Mechanics of Materials," Tata McGraw Hill, Delhi 2005.
7. L.S Srinath, Advanced Mechanics of Solids, McGraw Hill, 2017.

List of Tutorials: The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial.

E-Resources:

1. <https://nptel.ac.in/courses/112/102/112102284/>
2. <https://nptel.ac.in/courses/105/105/105105108/>
3. <https://nptel.ac.in/courses/105/106/105106172/>

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Recognize various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components.	1 Remembering
CLO2	Apply fundamental principles of mechanics and practical problems of engineering.	3 Applying
CLO3	Evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.	4 Evaluating 1 Understanding
CLO4	To know mechanics of beam and their functions.	3 Applying
CLO5	Understand the different types of stresses and strains developed in the member subjected to axial, bending, shear torsion & thermal loads.	1 Understanding
CLO6	Analyze and design beams, shafts and hollow cylinders.	4 Analyze

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	H	M	L		L		L			L		M	L	
CLO2		H	M	M		M		L			M		H	
CLO3	M			M			M		L		L			L
CLO4		H			M			L	M	M			H	
CLO5			H			M		M				L	M	
CLO6	H		H		M		M			L				H

H: High, M: Medium, L: Low