

Branch Name:	Mechanical Engineering
Program Code:	ET402
Course Title:	2ET4020304
Course Code:	Strength of Material
Pre-requisite Course:	Engineering Mechanics

Course Objectives:

1. To understand the concept of Simple Stresses and Strains.
2. To understand the concept of moment of inertia.
3. To understand the concept of Theory of combined and bending stresses.
4. To understand the concept of Torsion in Shafts and springs.
5. To understand the concept of Mechanical property of material.

Teaching and Examination Scheme:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)				
Lecture (L)	Tutorial (T)	Practical (P)	Credit	Theory (Marks)		Practical (Marks)		Total (Marks)
				University Assessment	Continuous Assessment	University Assessment	Continuous Assessment	
4	0	2	5	60	40	20	30	150

Course Contents:

Unit No	Topic	Total Hours	Weightage (%)
1	Direct Stress & Strain • Different types of Structures and Loads • Direct Stress, linear Strain, Hook’s Law Calculate Numerical on Direct Stress & Linear Strain, Stress Strain curve of Mild Steel, Modulus of Elasticity, Yield, Breaking & Ultimate Stress and F.O.S • Lateral Strain and Poisson’s ratio • Temperature Stresses & Strain with & without yielding. • Shear Stress, Shear Strain & Shear Modulus • Differentiate Sudden, Gradual & Impact Load Strain Energy & Proof Resilience for Sudden, Gradual & Impact Load with numerical problems	15	25
2	Moment of Inertia • Moment of Inertia & its Importance • Parallel & Perpendicular Axis Theorem • Parallel & Perpendicular Axis Theorem • Formula of Moment of Inertia of solid & Hollow sections like Rectangle, Triangle, Circle • Moment of Inertia about C.G for I section, H section, Channel Section, Angle Section, T Section and Built-up Section.	10	18
3	Bending Stresses in Beam • Bending Theory Equation Bending stress, Sectional Modulus, Neutral Axis • Application of Bending theory to Statically determinate beams elements like shaft, axle, spindle, pulley arm having rectangular or circular section to find out stresses.	06	12
4	Deflection of Beams • Slope & Deflection • Formulae for Cantilever Beam subjected to Point Load at free end and with full UDL.	06	12

	- Formulae for S.S Beam subjected to Point Load at MIDSPAN and with full UDL. - Numerical problems on Slope and Deflection for 4.2 & 4.3		
5	Combined Direct & Bending Stresses - Eccentricity - Formula for combined Direct & Bending Stresses - Limit of Eccentricity - Core section for Rectangular & Circular (Hollow & Solid) - Numerical on Combined Stresses for Rectangle & Circular Section	06	12
6	Torsion & Springs - Torsion, Angle of Twist, Polar Moment of Inertia, Torsional Rigidity - Formula of Torsional Stress - Formula for Power Transmitted / Consumed for shaft, spindle and axle of solid and hollow sections subjected to Torsion Numerical based on 6.2 & 6.3. - Springs: Stiffness of a spring(s)- Individual, in series and in parallel, Uses of springs, Types of springs. - Calculation of main dimensions of Closed Coiled Helical spring.	08	15
7	Mechanical Properties of Materials - Various Mechanical Engineering Materials - Specifications of materials in accordance to BIS, ASME - Test Mechanical Properties like HARDNESS and IMPAC. - Factors affecting selection of materials.	05	06

Reference Books:

1. Strength of Materials (Mechanics of Solids), R.S.Khurmi, N. Khurmi, S Chand Publishing (2019) ISBN: 97-893-528-339-79.
2. Strength of Materials, Dr. R.K.Bansal, Laxmi Publications (P) Ltd. New Delhi (2005) ISBN: 97-881-700-814-70.
3. Strength of Materials, S. Ramamrutham & R.Narayanan, Dhanpat Rai Publishing Company (2011)
4. ISBN: 97-881-874-335-45.
5. Strength of Materials (Mechanics of Materials), R.S. Laheri, A.S. Laheri, S.K. Karatia & Sons, Delhi. (2010).
6. Strength of Materials, Dr. Sadhu Singh, Khanna Publishers, New Delhi. (2018).

List of Open-Source Software/learning website:

1. <https://nptel.ac.in/courses/105104160> (NPTEL Course :- Mechanics of Solids by IIT, Kanpur)
2. <https://www.youtube.com/watch?v=GkFgysZC4Vc&list=PL27C4A6AEA552F9E6> (NPTEL Video Lectures by IIT, Kharagpur)
3. www.vlab.co.in (Virtual Lab by Ministry of Education, Government of India)

Course Learning Outcomes (CLO):

1. Compute stress and strain values and find the changes in axial, lateral, and volumetric dimensions of bodies of uniform section and the composite section under the influence of normal forces.
2. Students can calculate the different stress developed in the beam under different loading.
3. Define resilience, proof-resilience, and modulus of resilience and obtain expressions for instantaneous stress developed in bodies subjected to different loads.
4. To evaluate the behavior of torsional members like shaft and axle.
5. Students can calculate the combined stress which applies to a different section.
6. Students can understand the different mechanical properties and standard material specifications as per BIS and ASME and understand the impact test.

Mapping of CLO with PO and PSO

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)			
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CLO1	H	M														
CLO2	M		M	L												
CLO3	H		L													
CLO4	M	M														
CLO5	M			L												
CLO6	M			L	L		L									

H: High, M: Medium, L: Low