23CE21T2 STRENGTH OF MATERIALS

Course Category	Professional Core	**Credits**	3
Course Type	Theory	**Lecture – Tutorial –Practical**	2-1-0
Prerequisite	Engineering Mechanics	**Sessional Evaluation**	30
		Semester End Exam. Evaluation	70
		Total Marks	100

Course Objectives	1. To understand the basic concepts of stress, strain and their relationship. 2. To understand shear force and bending moment diagrams of various beams for different loading conditions. 3. To understand the behavior of beams with different cross sections subjected to flexure, shear and torsion. 4. To know different methods for determining the deflection of various beams subjected to different loading conditions. 5. To understand the basic concepts of columns, thick and thin cylindrical shells.		
Course Outcomes	COs	Statements	Blooms Level
	CO1	Apply the principles of elasticity to measure stress and strain under various conditions.	L2
	CO2	Calculate and sketch shear force and bending moment diagrams of various beams for different loading conditions	L3
	CO3	Calculate stresses developed in the beams subjected to flexure, shear and torsion.	L2
	CO4	Analyse the beams for deflections subjected to various loading conditions.	L3
	CO5	Analyse columns for axial and eccentric loading, and thin and thick cylinders for external pressure.	L4
Course Content	**UNIT I** **Simple Stresses and Strains:** Elasticity and plasticity; Types of stresses and strains; Hooke's law; Factor of safety; Poisson's ratio; Relationship between Elastic constants; Bars of varying section; Stresses in composite bars.		

UNIT II

Shear Force and Bending Moment: Definition of beam; Types of beams; Concept of shear force and bending moment - Point of contra flexure, Relation between S.F., B.M and rate of loading at a section of a beam; S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads.

UNIT III

Flexural Stresses: Theory of simple bending - Assumptions, Derivation of bending equation, Neutral axis; Determination of bending stresses, Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections, Design of simple beams.

Shear Stresses: Derivation of formula, Shear stress distribution across various beam sections like rectangular, circular, I, T and Angle sections.

Torsion: circular shafts only

UNIT IV

Deflection of Beams: Double integration and Macaulay's methods - Determination of slope and deflection for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads; Mohr's theorems - Moment area method , application to simple cases of cantilever.

UNIT V

Columns: Introduction - Classification of columns, Axially loaded compression members; Euler's crippling load theory - Derivation of Euler's critical load formulae for various end conditions, Equivalent length, Slenderness ratio, Euler's critical stress, Limitations of Euler's theory; Rankine - Gordon formula – Eccentric loading and Secant formula; Prof. Perry's formula.

Thin and Thick cylindrical shells: Derivation of formula for longitudinal

	and circumferential stresses; Hoop, longitudinal and volumetric strains; Changes in diameter, and volume of thin cylinders; Lame's theory for thick cylinders - Derivation of Lame's formulae; Distribution of hoop and radial stresses across the thickness; Compound cylinders- Distribution of stresses.
Textbooks and Reference books	**Textbooks:** 1. R. K. Bansal, *"Strength of Materials"*, Lakshmi Publications, 16th edition, 2022. 2. B. S. Basavarajaiah and P. Mahadevappa, "*Strength of Materials*", Universities Press 3rd edition, 2010. 3. J.K. Gupta and S.K. Gupta, *"Strength of Materials"*, Cengage publications 2nd edition, 2024. **Reference Books**: 1. L.S Srinath, *"Advanced Mechanics of Solids"*, McGraw Hill Education, 3rd edition, 2017. 2. T.D. Gunneswara Rao and Mudimby Andal, "*Strength of Materials - Fundamentals and Applications"*, Cambridge University Press, 1st edition, 2018. 3. Beer and Johnston, *"Mechanics of Materials"*, McGraw Hill India Pvt. Ltd., 8th edition (SI Units), 2020. 4. Egor P.Popov, *"Mechanics of Solids",* Prentice Hall, 2nd edition, 2015. 5. R. K. Rajput, *"A Textbook of Strength of Materials"*, 7e (Mechanics of Solids) SIUnits S. Chand & Co, New Delhi 7th edition 2022. 6. Strength of Materials by S.S.Ratan Tata McGrill Publications 3rd edition, 2016.
E-resources	1. https://archive.nptel.ac.in/courses/105/105/105105108/ 2. https://gate.nptel.ac.in/video.php?branchID=5&cid=1

CO-PO Mapping: 3-High Mapping, 2-Moderate Mapping, 1-Low Mapping, - -Not Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	1	-	1	-	-	-	-	2	2	1	2	-
CO2	3	-	2	-	2	-	-	-	-	-	1	3	2	2	-
CO3	3	1	-	-	1	-	-	-	-	-	2	3	1	1	-
CO4	2	1	-	-	-	-	-	-	-	-	-	2	2	2	1
CO5	2	1	2	1	-	-	-	-	-	-	-	2	2	1	1