23CE3302: STRENGTH OF MATERIALS

(SYLLABUS)

Course Code	23CE3302	Year	II	Semester	I
Course Category	Professional Core	Branch	CIVIL	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Engineering Mechanics, Differentiation & Integration
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

After successful completion of the course, the student will be able to		Blooms Level
CO 1	To **understand** the basic materials behavior under the influence of different external loading conditions and the support conditions.	L2
CO 2	To **draw** the diagrams indicating the variation of the key performance features like axial forces, bending moment and shear forces in structural members.	L3
CO 3	To **acquire** knowledge of bending concepts and calculation of section modulus and for determination of stresses developed in the beams	L2
CO 4	To **analyze** the deflections due to various loading conditions.	L3
CO 5	To **assess** stresses across section of the thin, thick cylinders and columns to arrive at optimum sections to withstand the internal pressure using Lame's equation	L4

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	2	-	2	-	-	-	-	-	2	1	3	3	1
CO2	2	1	-	1	-	-	-	-	-	1	1	2	3	1
CO3	2	2	-	1	-	-	-	-	-	2	1	2	3	2
CO4	1	2	-	1	-	-	-	-	-	2	1	1	3	2
CO5	2	1	-	2	-	-	-	-	-	1	1	2	3	2

UNIT No.	Contents	Mapped COs
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.	CO1
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.	CO2
III	**Flexural and Shear Stresses:** **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	CO3

	Shear Stresses: Derivation of formula — Shear stress distribution across various beam sections like rectangular, circular, I, T Angle sections. **Torsion** – circular shafts only.	
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.	**CO4**
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. Lames theory for thick cylinders, Derivation of Lames formulae, distribution of hoop and radial stresses across the thickness, compound cylinders-distribution of stresses	**CO5**

Learning Resource(s)

Text Book(s)

1. Strength of Materials by R. K. Bansal, Lakshmi Publications, 16th Edition, 2022.
2. Strength of Materials by B. S. Basavarajaiah and P. Mahadevappa, Universities Press 3rd Edition, 2010
3. Strength of Materials by J.K. Gupta and S.K. Gupta, Cengage publications 2nd edition ,2024

Reference Book(s)

1. Advanced Mechanics of Solids, L.S Srinath, McGraw Hill Education, 2017, 3rd Edition
2. Strength of Materials - Fundamentals andApplications, T.D.Gunneswara Rao and Mudimby Andal, Cambridge University Press, 2018, 1st Edition
3. Mechanics of Materials, Beer and Johnston, McGraw Hill India Pvt. Ltd., 2020, 8th Edition (SI Units).
4. Mechanics of Solids — E P Popov, Prentice Hall, 2nd Edition, 2015.
5. A Textbook of Strength of Materials, by R. K. Rajput, 7e (Mechanics of Solids) SI Units S. Chand & Co, NewDelhi 7th edition 2022.
6. Strength of Materials by S.S.Ratan Tata McGrill Publications 3rd Edition , 2016.

e- Resources & other digital material

1 https://nptel.ac.in/courses/105105108
2 https://nptel.ac.in/courses/112107146
3 https://nptel.ac.in/courses/105105166
4 CED Moodle