

BONAM VENKATA CHALAMAYYA INSTITUTE OF TECHNOLOGY & SCIENCE (AUTONOMOUS) DEPARTMENT OF CIVIL ENGINEERING

| Regulation | BR23 | | | | |
|---------------|-----------------------|---|---|---|---|
| II B.TECH | C C 22CE2T02 | L | T | P | C |
| I SEMESTER | Course Code: 23CE3T02 | 3 | 0 | 0 | 3 |
| Course Title: | STRENGTH OF MATERIALS | | | | |

Course Learning Objectives:

- 1. To impart Fundamental concepts of Strength of Material and Principles of Elasticity and Plasticity Stress
- 2. To impart concepts of shear force and bending moment on various types of beams and loading conditions
- 3. To impart concepts of stresses developed in the cross section and bending equations calculation of section modulus of sections with different cross sections.
- 4. To the concepts above will be utilized in measuring deflections in beams under various loading and support conditions.
- 5. To classify cylinders and columns based on their thickness and to derive equations for measurement of stresses across the cross section when subjected to external pressure

Course Outcomes:

At the end of completion of the course, the student will be able

| СО | Statement | 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 |

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 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

| Dr M C S MADAN | Dr G Yesuratnam | Dr A Murali | Dr B Raghuram | Mr P Rajesh Sr | Mr Chakradhar Prasad |
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Shear Stresses: Derivation of formula — Shear stress distribution across various beam sections like rectangular, circular, I, T 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:

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.

TEXTBOOKS:

- 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

REFERENCES:

- 1. Advanced Mechanics of Solids, L.S Srinath, McGraw Hill Education, 2017, 3rd Edition
- 2. Strength of Materials Fundamentals and Applications, 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).

Web Resources:

https://youtu.be/GkFgysZC4Vc?si=hsMdNYzIZvAZ3XZq https://youtu.be/EOGFWIg3mV8?si=ZBWXSg7gJqvkzHU6 https://youtu.be/geqRGNIZGq8?si=PVbnr_egLZkjIrp1 https://youtu.be/DnKG0J_tBso?si=iqq3YaYCa2t_W_WR https://youtu.be/tXPks3VXUPY?si=7S51oWHqxjezg0Av https://youtu.be/j3MuFDxRsMo?si=rCC6ACsiCS1Mm4X7

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