II Year I Semester	**L**	**T**	**P**	**C**
Code: 17CE301	**4**	**1**	**0**	**3**

STRENGTH OF MATERIALS

Course Learning Objectives:

1. To impart preliminary concepts of Strength of Material and Principles of Elasticity and Plasticity Stress strain behaviour of materials and their governing laws. Introduce student the module of Elasticity and their relations
2. To give concepts of stresses developed in the cross section and bending equations calculation of section modulus of sections with different cross sections
3. To give concepts of Principal stresses and strains developed in cross section of the beams on the cross section and stresses on any inclined plane. To impart concepts of failures in the material considering different theories
4. To give concepts of torsion and governing torsion equation, and there by calculate the power transmitted by shafts and springs and design the cross section when subjected to loading using different theories of failures.
5. To classify columns and calculation of load carrying capacity and to assess stresses due to axial and lateral loads for different edge conditions
6. To classify cylinders based on their thickness and to derive equations for measurement of stresses across the cross section when subjected to external pressure.

Course Outcomes:

1. The student can able to understand the basic materials behaviour under the influence of different external loading conditions and the support conditions
2. The student will have knowledge of bending concepts and calculation of section modulus and for determination of stresses developed in the beams and deflections due to various loading conditions
3. The student will be able to assess stresses across section of the thin and thick cylinders to arrive at optimum sections to withstand the internal pressure using Lame's equation.
4. The student will be able to understand the basic concepts of Principal stresses developed in a member when it is subjected to stresses along different axes and design the sections.
5. The student can assess stresses in different engineering applications like shafts, springs, columns and struts subjected to different loading conditions.

SYLLABUS

UNIT I

Simple Stresses & Strains And Strain Energy:

Elasticity And Plasticity - Types Of Stresses And Strains - Hooke's Law, Stress Strain Diagram For Mild Steel Working Stress Factor Of Safety, Lateral Strain, Poisson's Ratio And Volumetric Strain - Elastic Moduli And Relation Ship Between Them - Bars Of Varying Section - Composite Bars- Temperature Stresses Strain Energy - Resilience - Gradual, Sudden, Impact And Shock Loadings- Simple Applications.

UNIT II

Flexural stresses & Shear Stresses:

Theory Of Simple Bending Assumptions, Derivation of Bending Equation M/I=F/Y=E/R, Neutral Axis, Determination Bending Stresses - Section Modulus of Rectangular and Circular Sections, I, T, Angle & Channel Sections Design of Simple Beams

Shear Stresses: Derivation Of Formula - Shear Stress Distribution Across Various Beam Sections Like Rectangular, Circular, Triangular, I,T Angle Sections, Built Up Beams

UNIT III

Principal Stresses & Strains &Theories Of Failures:

Introduction – Stress of an inclined section of a bar under Axial loading – Compound stresses – Normal & tangential Stresses on an inclined plane for Biaxial stresses- two perpendicular normal stresses accompanied by a state of simple shear.

Theories Of Failures: Introduction – Various Theories of failures like Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory.

UNIT IV

Torsion of Circular Shafts And Springs:

Theory of pure torsion – Derivation of Torsion equations: $T/J = q/r = N\phi/L$ – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

Springs: Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel – Carriage or leaf springs.

UNIT V

Columns and Struts:

Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns- assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof.Perry's formula.

Laterally loaded struts – subjected to uniformly distributed and concentrated loads – Maximum B.M. and stress due to transverse and lateral loading.

UNIT VI

Thin and Thick Cylinders:

Thin seamless cylindrical shells – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and Volumetric strains – changes in diameter and volume of thin cylinders – Thin spherical shells.

Thick Cylinders: Introduction Lame's theory for thick cylinders – Derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – Necessary difference of radii for shrinkage – Thick spherical shells.

TEXT BOOKS:

1. Strength of Materials by R.K.Rajput, S.Chand& Co, New Delhi
2. Strength of Materials by S. Ramamrutham
3. Mechanics of Materials- by R. C. Hibbler

REFERENCES:

1. Strength of Materials by R.K Bansal, Lakshmi Publications
2. Strength of Materials by R. Subramanian, Oxford Publications
3. Mechanics of Materials by B.C Punmia, Jain and Jain