

## STRENGTH OF MATERIALS – II

**Course Code: 13CE1112**

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<b>4</b>	<b>1</b>	<b>0</b>	<b>3</b>

### Course Educational Objectives:

- ❖ The student shall understand the behavior of materials under any structural system
- ❖ Student should be able to deal with the effect of various types of loading include bending, torsion, etc.,
- ❖ Student should be able to understand the stresses induced in thick and thin cylinders.

### Course Outcomes:

- ❖ Students will demonstrate the ability to analyse the principal stresses developed in a material.
- ❖ Students will be equipped with the importance of calculating deflections in various springs and their applications, theories of failures.

### UNIT-I

(16 Lectures)

#### PRINCIPAL STRESSES AND STRAINS:

Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr’s circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

#### 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-II****(10 Lectures)****DIRECT AND BENDING STRESSES:**

Stresses under the combined action of direct loading and B.M, core of a section – determination of stresses in the case of chimneys – conditions for stability – stresses due to direct loading and B.M. about both axis.

**UNIT-III****(14 Lectures)****TORSION OF CIRCULAR SHAFTS:**

Theory of pure torsion – Derivation of Torsional Rigidity equation – 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 closed and open coiled helical springs under axial pull and axial couple – springs in series and parallel – Carriage or leaf springs.

**UNIT-IV****(10 Lectures)****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.

**UNIT-V****(14 Lectures)****THIN 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 Lamé's theory for thick cylinders – Derivation of Lamé'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. R.K.Bansal, "*A Text book of Strength of Materials*", 4<sup>th</sup> Edition, Laxmi Publications (P) Ltd., New Delhi, 2008.
2. Sadhu Singh, "*Strength of Materials*", 2<sup>nd</sup> Edition, Khanna Publications, 2001.
3. S. Ramamrutham and R.Narayanan, "*Strength of Materials*", 11<sup>th</sup> Edition, Dhanpat Rai Publications, 2009.
4. Ferdinand Beer and Johnston, "*Mechanics of Solids*", 6<sup>th</sup> Edition, Tata Mc Graw Hill Publications, 2000.
5. Schaum's out line series, "*Strength of Materials*", 10<sup>th</sup> Edition, Mc Graw Hill International Editions, 2007.

**REFERENCES:**

1. R.K.Rajput, "*Strength of materials*", 4<sup>th</sup> Edition, S.Chand & Co, New Delhi, 2010.
2. A.R.Basu, "*Strength of Materials*", 2<sup>nd</sup> Edition, Dhanpat Rai & Co, Nai Sarah, New Delhi, 2008.
3. L.S.Srinath et al., "*Strength of Materials*", 1<sup>st</sup> Edition, Macmillan India Ltd., Delhi, 2001.
4. S.B. Junnarkar, "*Mechanics of Structures*", 10<sup>th</sup> Edition, Charotar Publishing House, Anand, Gujarat, 2000.

