2/4 B.Tech. THIRD SEMESTER

CE3T3 **MECHANICS OF SOLIDS – I** **Credits: 3**

Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period /week **Semester end examination: 70 marks**

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Pre-requisites: Engineering mechanics

Learning objectives:

- To understand the behaviour of materials and structural bodies under the action of loads.
- To gain knowledge on the relation between the external loads, internal strength parameters and displacements, this is the basis to study the non-idealized real structures.

Course outcomes:

At the end of course, the student will be able to:

1. Assess the internal behaviour properties of materials such as simple stresses, strains, strain energy, principal stresses & strains.
2. Determine shear force, bending moment and deflection of statically determinate beams and frames.
3. Derive the flexure equation, and evaluate the flexural stresses, section modulus for various sections.
4. Draw shear stress distribution for rectangular, circular, triangular, I, T and angle sections.
5. Apply the torsion equation, calculate power transmitted by the shaft and determine the deflections of closed coiled helical springs.

UNIT – I

SIMPLE STRESSES AND STRAINS:

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 the relationship between them – Bars of varying section – composite bars – Temperature stresses.

UNIT – II

SHEAR FORCE AND BENDING MOMENT:

Definition of beam – Types of beams – Types of Supports - Concept of shear force and bending moment- Relation between S.F., B.M and rate of loading at a section of a beam, Point of contra flexure.
S.F and B.M diagrams for cantilever simply supported and overhanging beams subjected to point loads, UDL, UVL and combination of these loads. S.F and B.M diagrams for simple frames and beams with internal hinges.

UNIT – III

FLEXURAL STRESSES:
Normal stress, Theory of simple bending – Assumptions – Derivation of bending equation, Neutral axis – Determination of bending stresses – section modulus of rectangular and circular sections, I, T, angle, triangular and Channel sections.

COMBINED DIRECT AND BENDING STRESSES:

Combined direct and bending stresses, eccentric loading, kernel of a section – rectangular, circular sections.

UNIT – IV

SHEAR STRESSES:
Derivation of formula – Shear stress distribution across various beam sections viz. rectangular, circular, triangular, I, T sections.

STRAIN ENERGY:
Strain energy due to axial loading, bending, shear and torsion

UNIT – V

TORSION OF CIRCULAR SHAFTS:
Theory of pure torsion – Derivation of Torsion equation – Assumptions – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts

SPRINGS:
Introduction – Types of springs – deflection of close coiled helical springs under axial load– springs in series and parallel.

Learning resources

TEXT BOOKS:

1. Mechanics of Materials – E.P. Popov - PHI Publications
2. Strength of Materials – Timoshenko
3. Mechanics of Materials – F.P. Beer and E R Johnson and JD Dewolf – Mc. Graw- hill Publications
4. Introduction to text book of Strength of materials by R.K.Bansal – Laxmi publications Pvt.Ltd. New Delhi.
5. Introduction to text book of Strength of Material by U.C. Jindal, Galgotia publications.

REFERENCES:

1. Strength of Materials by S. Ramamrutham and R.Narayan – Dhanpat Rai publications
2. Strength of materials by R.K.Rajput, S.Chand & Co, New Delhi.
3. Strength of Materials by A.R.Basu, Dhanpat Rai & Co, Nai Sarah, New Delhi.
4. Strength of Materials by Bhavi Katti.

e-learning resources:

http://nptel.ac.in/courses.php

http://jntuk-coeerd.in/