COURSE CONTENT

ADVANCED STRENGTH OF MATERIALS								
IV Semester: CE								
Course Code	**Category**	**Hours/ Week**			**Credits**	**Maximum Marks**		
2540117	**Core**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes:Nil**				**Total Classes: 45**		
Prerequisites: Strength of Materials								

Course Overview :

The Advanced Strength of Materials course covers analysis and design of structural members under complex loading. Topics include principal stresses, theories of failure, torsion of shafts, springs, combined direct and bending stresses, columns, unsymmetrical bending, and shear center. Emphasis is on analytical and graphical methods, practical design applications, and understanding stress distribution for safe and efficient structures.

Course Objectives: The objective of this Course is

- To understand the nature of stresses developed in simple geometries shafts, springs, columns & cylindrical and spherical shells for various types of simple loads.
- To calculate the stability and elastic deformation occurring in various simple geometries for different types of loading.
- To understand the unsymmetrical bending and shear center importance for equilibrium conditions in a structural member of having different axis of symmetry.

Course Outcome: On completion of the course, the student will be able to:

- Describe the concepts and principles, understand the theory of elasticity, and perform calculations, relative to the strength of structures and mechanical components in particular to torsion and direct compression.
- To evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.
- Analyze strength and stability of structural members subjected to Direct, and Direct and Bending stresses.
- Understand and evaluate the shear center and unsymmetrical bending.

UNIT–I

Principal Stresses: Introduction–Stresses on an oblique plane 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–Principal stresses–Mohr's circle of stresses– ellipse of Stress-Analytical and graphical solutions.

Theories of Failure: Introduction–Various theories of Failure-Maximum Principal Stress theory, Maximum Principal Strain Theory, Maximum shear stress Theory-Strain Energy and Shear Strain Energy Theory (VonMises Theory).

UNIT–II

Torsion of Circular Shafts: Theory of pure torsion– Derivation of Torsion Equation-Assumptions made in the theory of pure torsion – Polar section modulus – Power transmitted by shafts – Combined bending and torsion–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.

UNIT- III

Direct and Bending Stresses: Stresses under the combined action of direct loading and bending moment, core of a section–determination of stresses in the case of retaining walls, chimneys and dams– conditions for stability- Overturning and sliding–stresses due to direct loading and bending moment about both axes.

UNIT- IV

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–Long columns subjected to eccentric loading – Secant formula–Empirical formulae — Rankine– Gordon formula- Straight line formula– Prof.Perry'sformula.

UNIT–V

Unsymmetrical Bending:

Introduction – Centroidal principal axes of section –Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes – Resolution of bending moment into two rectangular axes through the centroid–Location of neutral axis.

Shear Centre: Introduction - Shear center for symmetrical and unsymmetrical (channel, I, T and L) sections.

TEXT BOOKS:

1. Mechanics of Materials by Dr.B.C. Punmia, Dr. Ashok Kumar Jain and Dr. Arun Kumar Jain
2. Strength of Materials by R. Subramanian, Oxford University Press.

REFERENCE BOOKS:

1. Mechanics of Materials by R.C. Hibbeler, Pearson Education
2. Engineering Mechanics of Solids by Popov E.P. Prentice-Hall Ltd
3. Strength of Materials by T.D. GunneswaraRao and M. Andal, Cambridge Publishers
4. Strength of Materials by R.K. Bansal, Lakshmi Publications House Pvt.Ltd.
5. Fundamentals of Solid Mechanics by M.L. Gambhir, PHI Learning Pvt. Ltd