STRENGTH OF MATERIALS

IV Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACEB07	Core	3	1	0	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

COURSE OBJECTIVES:

I The fundamentals of stress strain relationships and behavior of structural elements subjected to gradual, sudden and impact loading.

II The behavior of determinate beams in response to various applied loads and load combinations.

III The energy transmission through solid and hollow circular shafts and various applications of close coiled helical springs.

IV The concepts of hoop, radial and longitudinal stresses and design of thin cylindrical and spherical shells.

COURSE OUTCOMES:

After successful completion of the course, Students will be able to:

CO 1 **Explain** the concept of stress and strain in conjunction with elastic properties of materials for computing tensile or compressive strength of materials.

CO 2 **Explain** the behaviour of simple and composite bars subjected to various applied loads for computing stress distribution across the section.

CO 3 **Describe** the concepts of principal stresses and principal strains and the use of Mohr's circle of stresses for solving two-dimensional stress problems.

CO 4 **Understand** the concept of strain energy stored due to various external loads for computing the deflections of the member.

CO 5 **Develop** the relationship between bending moment, shear force and rate of loading for understanding response of the member under external loads.

CO 6 **Analyse** the determinate beams for computing shear force, bending moment, slope and deflection under various load combinations.

CO 7 **Apply** the theory of simple bending to beams for computing the strength and distribution of stress across the section.

CO 8 **Apply** the torsion equation to solid and hollow circular shafts for computing power transmission.

CO 9 **Analyse** thin walled cylindrical and spherical shells for computing circumferential and longitudinal stresses and strains developed by fluids stored under pressure.

CO10 **Devise** novel concepts, which will enhance the strength and stability of structures, for solving the real time problems.

MODULE-I	STRESSES AND STRAINS	Classes :12

Concept of stress and strain, St. Venant's principle, stress and strain diagram, 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. Strain Energy – Resilience, Gradual, sudden, impact and shock loadings, simple applications, two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of

stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.

MODULE-II	BENDING MOMENT AND SHEAR FORCE DIAGRAMS	Classes:12

Bending Moment (BM) and Shear Force (SF) diagrams. BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments. Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

MODULE-III	FLEXURAL STRESSES AND SHEAR STRESSES IN BEAMS	Classes :12

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 beam sections.
Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

MODULE-IV	TORSION	Classes:12

Derivation of torsion equation and its assumptions. Applications of the equation for hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.

MODULE-V	THIN CYLINDERS AND SPHERES	Classes:12

Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

Text Books:

1. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
2. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
3. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004.
4. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979.

Reference Books:

1. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf – TMH 2002.
2. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.

Web References:

1. http://www.nptelvideos.in/2012/11/strength-of-materials- prof.html
2. http://ocw.mit.edu/courses/civil-and-environmental-engineering/1-050-solid-mechanics-fall-2004/lecturenotes/
3. https://www.youtube.com/watch?v=coRgpxG2pyY&list=PLLbvVfERDon3oDfCYxkwRct1Q6YeOzi9g

E-Text Books:

1 http://www.freeengineeringbooks.com/Civil/Strength-of-Material-Books.php
2. http://royalmechanicalbuzz.blogspot.in/2015/04/strength-of-materials-book-by-r-k-bansal.html
3. https://books.google.co.in/books?id=I8gg0Q4OQ4C&printsec=frontcover&dq=STRENGTH+OF+MATERIALS&hl=en&sa=X&ved=0ahUKEwjpveCD44HgAhWBad4KHacUAgYQ6AEIMDAB#v=onepage& q=STRENGTH%20OF%20MATERIALS&f=false