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	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

I. COURSE OVERVIEW:

Fluid mechanics is branch of applied mechanics that is concerned with the behavior of fluids either in motion (fluid dynamics) or at rest (fluid statics). This course introduces to a broad range of fundamental concepts, methods of fluid mechanics, mathematical description of fluid flows and the solution of some important flow problems. The course emphasizes importance of dimensionless numbers in various engineering fluid flow problems for designing a prototype and model. It discusses the basic concept of bluff body aerodynamics, boundary layer and physical aspects of boundary layer thickness. Compare and contrast various fluid machinery based on flow properties and its applications.

II. OBJECTIVES:

The course should enable the students to:

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 design of thin cylindrical and spherical shells by considering hoop, radial and longitudinal stresses.

III. COURSE OBJECTIVE:

After successful completion of the course, students should be able to:

CO 1	**Summaries** the concepts of stress, strain and strain energy in conjunction with elastic properties of materials for understanding the behaviour of simple and composite bars subjected to uniaxial and biaxial stresses.	Understand
CO 2	**Interpret** the relationship between bending moment, shear force and rate of loading with the help of Shear force and bending moment diagrams for better understanding response of the member under external loads.	Understand
CO 3	**Apply** the theory of simple bending to beams for computing the flexural strength and distribution of bending and shear stress across the section.	Apply
CO 4	**Apply** the torsion equation to springs, solid and hollow circular shafts for computing tensional stiffness of springs and power transmitted by shafts.	Apply
CO 5	**Apply** fluid pressure concepts for computing circumferential and longitudinal stresses and strains on thin walled cylindrical and spherical shells, produced by fluids stored under pressure.	Apply
CO 6	**Take part in** developing novel concepts, which will enhance the strength and stability of structures for solving the real time problems.	Analyze

IV. SYLLABUS:

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 : 08
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 OF BEAMS**	**Classes: 08**
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: 08**
Derivation of torsion equation and its assumptions. Applications of the equation of the 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: 09**
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/lecture-notes/
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