

<p align="center">B. E. CIVIL ENGINEERING Choice Based Credit System (CBCS) and Outcome Based Education (OBE) SEMESTER - III</p>			
STRENGTH OF MATERIALS			
Course Code	18CV32	CIE Marks	40
Teaching Hours/Week (L:T:P)	(3:2:0)	SEE Marks	60
Credits	04	Exam Hours	03
<p>Course Learning Objectives: This course will enable students</p> <ol style="list-style-type: none"> 1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements. 2. To know the development of internal forces and resistance mechanism for one dimensional and two-dimensional structural elements. 3. To analyse and understand different internal forces and stresses induced due to representative loads on structural elements. 4. To determine slope and deflections of beams. 5. To evaluate the behaviour of torsion members, columns and struts. 			
Module-1			
<p>Simple Stresses and Strain: Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self-weight. Saint Venant's principle, Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.</p>			
Module-2			
<p>Compound Stresses: Introduction, state of stress at a point, General two dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses. Theory of failures: Max. Shear stress theory and Max. principal stress theory.</p> <p>Thin and Thick Cylinders: Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lamé's equation, radial and hoop stress distribution.</p>			
Module-3			
<p>Shear Force and Bending Moment in Beams: Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.</p>			
Module-4			
<p>Bending and Shear Stresses in Beams: Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections. Shear centre (only concept).</p> <p>Torsion in Circular Shaft: Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft.</p>			
Module-5			
<p>Deflection of Beams: Definition of slope, Deflection and curvature, Sign conventions, Derivation of moment-curvature equation. Double integration method and Macaulay's method: Slope and deflection for standard loading cases and for determinate prismatic beams subjected to point loads, UDL, UVL and couple.</p> <p>Columns and Struts: Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns.</p>			

Course outcomes: After studying this course, students will be able;

1. To evaluate the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To evaluate the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
3. To analyse different internal forces and stresses induced due to representative loads on structural elements.
4. To evaluate slope and deflections of beams.
5. To evaluate the behaviour of torsion members, columns and struts.

Question paper pattern:


- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks:

1. B.S. Basavarajaiah, P. Mahadevappa "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition, 2010
2. Ferdinand P. Beer, E. Russell Johnston and Jr. John T. De Wolf "Mechanics of Materials", Tata McGraw-Hill, Third Edition, SI Units

Reference Books:

1. D.H. Young, S.P. Timoshenko "Elements of Strength of Materials" East West Press Pvt. Ltd., 5th Edition (Reprint 2014).
2. R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010.
3. S.S. Rattan "Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint 2013).
4. Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.


H.O.D.
Dept. of Civil Engineering
Alva's Institute of Engg. & Technology
Mijar, Moodbidri - 574 225