STRENGTH OF MATERIALS

Course Code	18CV33	Credits	04
Course type	PC	CIE Marks	50 marks
Hours/week: L-T-P	3-2-0	SEE Marks	50 marks
Total Hours:	50	SEE Duration	3 Hours for 100 marks

Course Learning Objectives (CLO's)

1. Define stresses, strains and elastic constants and relationship between them.
2. Determine the shear force and bending moment in statically determinate beams.
3. Evaluate the bending stresses and shear stresses and plot the stress distribution diagrams.
4. Determine the slope and deflection for beams subjected to various loads.
5. Evaluate the buckling strength of columns and explain the concept of torsion.

Pre-requisites:
1. Engineering Mechanics

UNIT I   10 Hours

Simple Stresses and Strains

Introduction to stresses and strains, Hooke's law, Elastic constants, Relationship among Elastic constants, Stress – Strain relationship for structural steel, volumetric strain, composite sections, thermal stresses, Compound stresses- general two-dimensional stress system, principal planes and stresses, Mohr's circle

Case Study- Study on stress—strain behavior of various ductile and brittle materials. Different grades of steel available in market.

Self-Learning topics: NIL

UNIT II   10 Hours

Shear Force and Bending Moment in Beams

Shear Force and Bending Moment, Relationship between loading, shear force and bending moment, Plotting the SFD and BMD for cantilever, simply supported and overhanging beams subjected to point loads, UDL, UVL and applications to RC canopy and structures

Self-Learning topics: NIL

UNIT III   10 Hours

Stresses in Beams

Theory of bending, Derivation of equation for bending, Bending stresses in beams, Modulus of Rupture, Section Modulus, Flexural Rigidity, bending stress distribution across the depth of beam in RC and steel structural elements.

Shear stresses in beams, Shear Stress distribution diagrams for rectangular, 'I' and 'T' sections in RC and Steel structural elements

Case study- Demonstration of RC beam under flexure.

Deflection of Beams

Equation for elastic curve, Slope and Deflection for prismatic beams (Simply supported, Overhanging and Cantilever beams) subjected to point loads, UDL and external moment in RC and Steel structural elements including canopy, IS code requirements for structures- using Double Integration method and Macaulay's method

Self-Learning topics: NIL

Elastic Stability of Columns

Euler's theory for columns in RCC structures, Euler's buckling load for different end conditions, Effective length, Slenderness ratio, Rankine's formula.

Torsion of Circular Shafts

Assumptions, Derivation of torsion equation for circular shafts, Torsional Rigidity

Self-Learning topics: NIL

Text Books:

1. Timoshenko and Young, **"Elements of Strength of Materials"**, Affiliated East-West Press

2. Beer and Johnston, **"Mechanics of Materials"**, Tata McGraw Hill

3. Popov E. P., **"Mechanics of Solids"**, Prentice Hall of India

References:

1. Basavarajaiah B. S., Mahadevappa P. **"Strength of Materials in SI Units"**, University Press (India) Pvt. Ltd., 3rd Edition, 2010

2. James M. Gere, **"Mechanics of Materials"**, Thomson Learning

   E-resourses (https://nptel.ac.in/courses/105105108/
   https://www.youtube.com/watch?v=1pMZNpWjsk4
   https://www.youtube.com/watch?v=GkFgysZC4Vc&list=PL27C4A6AEA552F9E6)

Course Outcomes (COs):

At the end of the course, students will be able to:	Bloom's Level
1. Explain the types of stresses, strains and elastic constants and relation among them	L2
2. Analyse shear force, axial force and bending moment and draw SFD, AFD and BMD	L3 L4
3. Evaluate the bending and shear stresses and plot the stress distribution Diagrams	L3 L4
4. Analyse the beams subjected to various loads for Slope and Deflection	L4
5. Evaluate the buckling strength of columns and explain the concept of torsion	L3 L4

Program Outcomes (POs)

1. Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. **PO 01**

2. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations. **PO 05**

3. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. **PO 10**

Content Delivery/Assessments methods and Scheme of Evaluation

Course delivery methods
1. Lecture and Board
2. NPTEL/ Edusat
3. Power Point Presentation
4. Videos

Assessment methods
1. Assignments and Open Book Assignment
2. Quizzes
3. Internal Assessment Tests
4. Semester End Examination

CIE and SEE Pattern:
Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Average of two assignments	Quiz/Seminar/Course Project	Total Marks
Maximum marks: 50	15+15 = 30	10	10	50
Writing two IA tests is compulsory. Minimum marks required to qualify for SEE: 20 out of 50 marks				

Semester End Examination (SEE):
1. It will be conducted for 3 hours duration and 100 marks. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. Minimum passing marks required to be scored in SEE: 40 out of 100 marks
3. Question paper will have 10 questions carrying 20 marks each. Students have to answer FIVE full questions selecting atleast one full question from each unit.