SHIV NADAR UNIVERSITY

I. Course Title: Strength of Materials

II. Course Code: CED201

III. Course Credits (L:T:P): 4 (3:0:1)

IV. Total Contact Hours/Batch/Week (L:T:P): 3:0:1

V. Course Type: Major Core & UWE

VI. Prerequisite: Engineering Mechanics & Engineering Mathematics

VII. Course Coordinator/Instructor: Dr. Jagabandhu Dixit

VIII. School/Department: Civil Engineering

IX. Disciplines to which the course may be of interest: School of Engineering

X. **Course Objectives**:

- Students will be introduced to deformation, strain, stress and stress states, elasticity and plasticity.
- Students will understand and apply the theory of solid mechanics - the equilibrium, kinematic, and constitutive equations - to calculate forces, deflections, moments, stresses, and strains in a wide variety of structural members subjected to tension, compression, torsion and bending.
- Students will understand the concepts of stress at a point, strain at a point, and the stress-strain relationships for linear, elastic, homogeneous, isotropic materials.
- Students will be able to determine principal stresses and angles, maximum shearing stresses and angles, and the stresses acting on any arbitrary plane within a structural element.

XI. **Course Content**:

Stresses and Strains: Free body diagram, Mechanical properties, Different states of stress, Mohr's circle of stresses. Deformable bodies, Strain at a point, Different states of strain, Mohr's circle for plane strain. Constitutive Relationships: Generalized Hooke's law, Lame's constant, elastic modulus, bulk modulus, Relationship between different elastic constants.

Beam Statics: Reactions and support conditions, Method of sections, Axial forces, shear forces and bending moments, BM and SF diagrams for cantilevers, simply supported and fixed beams with or without overhangs and calculation of maximum BM and SF and the point of contraflexure, Effect of concentrated moments.

Beam Bending: Symmetric (pure) bending, Prismatic homogenous beams (Elastic flexure formula, neutral axis, bending stress, elastic section modulus), Beams of composite section, Unsymmetrical (skew) bending, Generalised flexure formula, Combined axial and bending stresses. Torsion: Geometry of

deformation of a twisted circular shaft, Stress and deformation in twisted circular solid and hollow shafts, Strain energy due to torsion, Power transmitted by circular shafts.

Shear Stress: Shear flow, Shear stress formula for beams, Beams of rectangular cross section, variation across height of cross section, Flanged sections (I-section), Shear stresses in flanges for thin-walled sections, Shear centre.

Columns and Struts: Stable and unstable equilibrium, Euler's formula for long columns, Members with eccentric loading, Rankine's formula.

XII. **Reference Books**:

1. E. P. Popov, Mechanics of Materials, Pearson Education, 2015
2. Hibbeler, Mechanics of Materials, Pearson Education, 2013
3. A. Pytel, Mechanics of Materials, Cengage Learning, 2015
4. Gere and Timoshenko, Mechanics of Materials, CBS, 2006
5. Beer, Johnston, Dewolf, Mazurek and Sanghi, Mechanics of Materials, McGraw Hill Education, 2017
6. R. K. Bansal, A Textbook of Strength of Materials, Laxmi Publications, 2017
7. S. S. Rattan, Strength of Materials, McGraw Hill Education, 2017
8. R. S. Khurmi, Strength of Materials, S. Chand, 2006
9. R. K. Rajput, Essentials of Strength of Materials, S. Chand, 2015

XIII. **Assessment Scheme**:

Students will be assessed on how well they understand and use the concepts of mechanics of materials through the problems they solve during the lecture classes and examinations. These problems will assess concept understanding, critical thinking, and problem-solving skills.

Quizzes and Homework Assignments – 20%

Laboratory – 30%

Mid-term examination – 20%

Final Examination – 30%

Students must score above 40% to pass the course.