Strength of Materials 1

Course Code: 28262
Credits: 3
Course Type: Theoretical
Prerequisite: Statics
Course Length: 51 hours

Outlines:

1- Concept of Stress

Definition of stress, types, stress vector, stress tensor

2- Stress Analysis in Members Under Axial Loads

normal stress, stress on an oblique plane, shearing stress, safety factor, ultimate and allowable stresses, an introduction to yield strength of materials, tensile test, Saint-Venant's principle, stress concentration, residual stress, stress in joints (bolt, pin and rivet) ,.

3- Strain and Deformations in Members under Axial Loadings

Definition of strain, stress-strain relations, Hooke's law for axial loading, stress-strain diagrams for different materials, deformation under axial loading, thermal strain, use of deformations compatibility equation for solving different problems, lateral strain, Poisson's ratio, generalized Hooke's law for isotropic materials, volumetric strain and Bulk Modulus, shear strain, design consideration and energy relation in axially loaded members.

4- Torsion

Concept and basic hypothesis, torsional stress and angle of twist in circular shafts, torsion in open and closed thin-walled members, introduction to torsion of noncircular members, stress concentration, allowable shear stress, indeterminate torsional system and compatibility equation, stress concentration, power transmission, shaft's coupling and energy relation in torsionally loaded shafts.

5- Pure Bending

Concept and basic hypotheses, moment and curvature relation, bending stress, bending of members made of several materials, bending in beams under eccentric and unsymmetrical loads, general case of eccentric axial loading, kern of cross-section, design consideration, stress concentration and energy relation in beams under pure bending.

6- Shearing and Compound Stresses in Beams

Concept and basic hypothesis, shear flow, shearing stress in beams and its distribution, shearing stress in circular shaft, thin-walled members such as wide flange, angle and channel

shape, design consideration, stresses under combined loadings and energy relation due to shearing stress.

7- Transformations of Stress and Strain

Plane stress and plane strain, stress component on oblique plane, principal stresses, maximum shearing stress, Mohr's circle for stress and its drawing method, strain components on oblique plane, principal strains, Mohr's circle for strain, measurements of strain, strain Rosette.

8- Deflection of Beams

Deflection relation in beams, deflection determination with integration method, Macaulay's method, superposition method, boundary conditions.

9- Thin-Walled Vessels

References:

1- Engineering Mechanics of Solids (2nd Ed.), E.P. Popov, 1998

2- Mechanics of Materials (3rd Ed.) F.P. Beer, E.R. Johnston & J.T. Dewolf, 2002