# 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 of stress (normal, shear, bearing), different components of stress

2- **Stress analysis in members under axial loads**

Axial stress, stress on oblique planes, shear stress, yield, ultimate and allowable stresses, safety factor, an introduction to the tensile test, Saint-Venant's principle, stress in joints (bolts, pins and rivets).

3- **Strain and deformation in members under axial loadings**

Concept of strain, the uniaxial tensile test, the yielding of ductile materials, stress-strain relations, Hooke's law for uniaxial loading, stress-strain diagrams for different ductile and brittle materials, thermal strains, utilizing compatibility equations to analyze statically indeterminate structures, lateral strains, Poisson's ratio, generalized Hooke's law for isotropic materials, volumetric strain and Bulk Modulus, shear strain, shear modulus

4- **Torsion**

Concepts and basic hypotheses, distribution of shear stress and angle of twist in circular shafts, torsional analysis in open and closed thin-walled members, various examples on statically determinate and indeterminate torsional structures, power transmission, an introduction to torsion of noncircular bars.

5- **Pure bending**

Concepts and basic hypotheses, moment and curvature relation, stress distribution in bending, bending of members with a cross-section made of several materials, bending in beams under unsymmetrical loads, general case of eccentric axial loading.

**6- Shearing and compound stresses in beams**

Concepts and basic hypotheses, shear flow, shear stress in beams and its distribution, thin-walled members (wide flanges and angles), center of shear.

**7- Transformations of stress and strain**

Plane stress and plane strain states, stress components on oblique planes, principal stresses, the maximum shearing stress, stresses in thin-walled cylindrical and spherical pressure vessels, Mohr's circle for stress, strain components in oblique directions, principal strains, Mohr's circle for strain, combined loading, measurements of strain, strain Rosette, three-dimensional stress analysis with the aid of Mohr's circle.

**8- Deflection of beams**

Deflection equation for beams, integration method, applying different boundary conditions, the use of Macaulay's parentheses, deflection analysis using superposition principle, various examples on deflection analysis of statically determinate and indeterminate beams.

**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