# Indian Institute of Technology
# Course Details Report

## Course No: OE1011

## Course Name: Structural mechanics

**Course Type:**

Theory

**Description:**

To enable learning of the stress and displacement in deformable bodies subjected to various loads. To find whether the body would fail under a given loading condition.

**Course Content:**

- Kinetics: Concepts of force, traction, stress; transformation of stress components; Mohr's circle, extremum normal stress and shear stress, plane stress, pure shear & deviatoric stress.
- Kinematics: Concepts of displacement, deformation, relative displacement, stretch, strain; relation between displacement and components of linearized strain; transformation of linearized strain components due to change in coordinate system, principal strain, plane strain.
- Basic equations: Equilibrium equations in Cartesian and cylindrical polar coordinates; Constitutive relations, elasticity; Hooke's law, material modulus and their relations, isotropy; strain energy, energy theorems. 2D and 3D theory of elasticity, Plane stress and plane strain.
- Boundary value problems: Displacement formulation for linearized elasticity; Axial element, columns, trusses, cables; Bending moment and shear force diagrams for statically determinate beams; Bending action; Euler Bernoulli assumption, symmetrical and unsymmetrical bending; Twisting action & Torsion of circular shafts, stress distribution in cylinders and spheres thick and thin walled. Bending stress and strain in beams.
- Yield and failure theories: Ductile and brittle failure; Yield condition, Tresca and von Mises criteria; Rankine failure theory, Mohr's failure theory; Fatigue failure.
- Structural Instability: Behavior of ideal column; Euler theory; behavior of real columns, effect of imperfections.

**Text Books:**


1. Beer F.P., Johnson E.R., and DeWolf, J.T., Mechanics of Materials, Tata McGraw-Hill, 2004.
2. Popov E.P., Engineering Mechanics of Solids, Prentice Hall of India Private Limited, 2004.


**Reference Books:**


1. Dias da Silva V., Mechanics and Strength of Materials, Springer, 2006
2. Timoshenko, S.P. and Gere, J.D., Mechanics of Materials, CBS; 2nd edition, 2006
3. Gere, J.M., and Goodno, B.J., Mechanics of Materials, Global Engineering, 8th edition, 2012.
4. Introduction to Mechanics of Solids, Crandall, Dahl and Lardener, Tata McGraw Hill, 2009