ME 664 Theory of Elasticity (3-0-0-6)

Surface and body forces, stress tensor and transformation laws, Lagrangian and Eulerian description, strain tensor, equations of elasticity (equilibrium, constitutive law and compatibility, boundary conditions), Uniqueness and St. Venant's principle, Strain energy functions. Two-dimensional problems in rectangular coordinates (polynomial solution, bending of beam, Fourier series solution). Two-dimensional problems in polar coordinates (axisymmetric problems – rotating discs, walled cylinders, plate with a hole, infinite plate with point load, curved beams). Two-dimensional problems in curvilnear coordinates (stress functions in terms of harmonic and complex functions, complex potential function, elliptic coordinates, plate with elliptic holes). Three-dimensional problems (extension of bar under its body weight, pure bending of bars and plates, twist of circular shafts). Torsion (circular and non-circular cross section, membrane analogy, thin walled members, hydrodynamic analogy). Bending of bars with circular, elliptic and rectangular cross section and shear center.

Textbooks/References:

[1] Timoshenko and Goodier, *Theory of Elasticity*, McGraw-Hill International, 3rd edition, 1970.

[2] I. S. Sokolnikoff, *Mathematical Theory of Elasticity*, McGraw-Hill International, 2nd ed., 1957.

[3] Y C Fung, *Foundation of Solid Mechanics*, Prentice Hall Inc., 1965.

[4] Xu Zhilun, *Applied Elasticity*, Willey Eastern Ltd., 1992