

Elasticity and Solid Mechanics

1. Cartesian Tensors

- (a) Summation notation
- (b) Translation and rotation of coordinates
- (c) Definition of scalars, vectors, and Cartesian tensors
- (d) Invariants of tensors

2. Stress Tensor

- (a) Stress tensor
 - i. Cauchy's formula and Cauchy Stress
 - ii. Other measures
- (b) Stress transformation
- (c) Principal Stresses and Stress invariants
- (d) Equations of Equilibrium

3. Analysis of Strain

- (a) Deformation
- (b) Green's strain tensor
- (c) Almansi's strain tensor
- (d) Geometrical interpretation of strain
- (e) Principal strains and invariants
- (f) Equations of Compatibility
- (g) Single valued displacements requirement
- (h) Finite Deformations

4. Theory of Elasticity

- (a) Constitutive Equations and Theory
 - i. Generalized Hooke's law
 - ii. Elastic Moduli for Isotropic materials
 - iii. Strain-energy function
 - iv. Uniqueness of solutions
- (b) Complete equations for three dimensional problems in elasticity
- (c) Torsion of circular and noncircular shafts

- (d) Plane strain and plane stress and Airy's stress function
- (e) Variational Methods and weak formulation

5. Theory of Plasticity

- (a) Theories of failure
- (b) Flow Theories
- (c) Ideal plasticity applied to torsion and flexure.