

# Statics & Strength of Materials

## Undergraduate 3 credit course in Polymer Engineering curriculum

### Amirkabir University of Technology

#### A: Statics

**Chapter 1: Force and moment** (Forces and Moment definitions, Moment of a force about a Point, Varignon's Theorem, Couple- force systems, Three dimensional forces and moments)

**Chapter 2: Equilibrium of Rigid Bodies** (Equilibrium conditions, Free-Body Diagram, Equilibrium of a Two and three -Force Bodies, Reaction at supports and connections)

**Chapter 3: Engineering structures** (Trusses, Frames & Machines, Statically determined and undetermined structures, Analysis of trusses (Method of Joints and Sections), Joints under special loading conditions, Analysis of Frames & Machines)

**Chapter 4: Center of Gravity and Moment of Inertia** (Centroids and First Moments of Areas, Centroids of Areas and Lines, Centroids of Common Shapes of Plates and Composites, Determination of Centroids by Integration, Moment of Inertia and its applications, Determination of Moment of Inertia by Integration and using composites, Polar Moment of Inertia, Radius of Gyration of an Area, Radius of Gyration in polymers)

**Chapter 5: Analysis of beams under bending** (Beams with different Supports, Distributed Loads on Beams, Shear and Bending Moment in a Beam, Relations among Load, Shear, and Bending Moment in a beam, Shear and Bending Moment Diagrams)

#### B: Strength of Materials

**Chapter 1: Concept of stress** (Axial Loading: Normal Stress- Axial Loading distribution, Stress units, Shearing stress, Bearing stress, Stress on an Oblique Plane, Factor of Safety)

**Chapter 2: Axial stress** (Stress- strain curve (Elastic and plastic behavior, Yield stress, ...)Hooke's Law, Elastic modulus, Toughening , Resilience, Deformations Under Axial Loadings, Fatigue, Poisson's Ratio, Generalized Hooke's Law, Bulk Modulus, Composite Modulus, Stress, strain and shear modulus Relation using Poisson's Ratio, Thermal strain & Coefficient of thermal expansion, Stress distribution, Venant's Principle, Stress concentration, Plastic deformation, Stress Concentration, Elastoplastic Materials, Plastic Deformations, Residual stresses)

#### References:

- 1- Engineering Mechanics Statics, Meriam & Kraige; 7th edition.
- 2- Vector Mechanics for Engineers – Statics, Beer & Johnston; 7th edition.
- 3- Statics, A. Javadi, S. Moloudi, Jahadg daneshgahi, Amirkabir University of technology, First edition.
- 4- Mechanics of materials, Beer & Johnston ; fourth edition.