BTech Bridging Unit (BBU) in Mechanical Engineering
(*Statics and Mechanics of Materials)*

Objectives

- Draw a free body diagram and identify unknown reaction forces and moments.
- Solve statically determinate problems involving rigid bodies, pin-jointed structures and cables with and without friction.
- Understand the concepts of engineering stress, strain and linear elastic material behaviour.
- Determine stress and deformation of axial force members.
- Determine torque distributions, shear stress and angles of twist in torsional members.
- Determine bending moment and shear force distributions in laterally-loaded beams.
- Determine normal stresses and transverse deflections in beams.

Description

- Introduction – Definitions; Vectors; Vectorial Law; Principle of Transmissibility; Scalar Product; Cross Product;
- Equilibrium of a Particle – Free Body Diagram. Moment and Equilibrium.
- Moment of a Force – Moment of a Couple, Equilibrium of a Two-Force Body. Equilibrium of a Rigid Body in 2-D
- Equilibrium of a Rigid Body – Statically Indeterminate System; Partial Constraints; Improper Constraints. Equilibrium of a Three-Force Body, Equilibrium of a Body in 3-D
- Distributed Forces – Centre of Gravity of a 2-D Body, Distributed Loans on Beam
- Analysis of Truss – Simple Trusses, Analysis of Trusses by Method of Joint, Analysis of Truss by Method of Section.
- Friction – Dry Friction, Coefficients of Friction
- Introduction to Mechanics of Materials
  Deformable Bodies – Stress and Strain and Sign Convention; Linear Elastic Stress-Strain Relationships.
- Axial Force Members – Solution of Axially-Loaded Structures; Statically Indeterminate Axially Loaded Structures.
- Torsion of Cylindrical Shafts – Torque and Torsional Deformation (Relationships between Torque, Angle of Twist, Shear Stresses and Shear Strains); Solid and Hollow Shafts; Polar Second Moment of Area: Stepped Shafts; Torque Distribution; Composite Shafts.
- Flexure (Bending) of Beams – Idealized Loads and Supports; Shear Force and Bending Moment Diagrams; Relationships between Load-Intensity, Shear Force and Bending Moment, Singularity Functions.
- Normal Stresses in Beams Subjected to Bending Curvature- Longitudinal Strains; Normal Stresses; Neutral Axis; Flexural Formula; Second Moment of Area; Design of Beams for Bending.
- Beam Deflection Induced by Bending – Equations for Deflection and Slope; Relationships between Deflection, Slope, Shear Force and Bending Moment; Macaulay's Method of Double Integration; Application to Determinate Beams.

Assessment Component

- Tests/Quizzes: 20%
- Others (e.g. Projects, assignments, homework, class participation): 20%
- Final Examination: 60%