

## **BTech Preparatory Unit (BPU) in Mechanical Engineering**

### **Syllabus**

1. Introduction - Definitions; Vectors; Vectorial Law; Principle of Transmissibility; Scalar Product; Cross Product; Equilibrium of a Particle- Free Body Diagram. Moment and Equilibrium.
2. Moment of a Force - Moment of a Couple, Equilibrium of a Two-Force Body. Equilibrium of a Rigid Body in 2-D
3. 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
4. Distributed Forces - Centre of Gravity of a 2-D Body, Distributed Loads on Beam
5. Analysis of Truss - Simple Trusses, Analysis of Trusses by Method of Joint, Analysis of Truss by Method of Section.
6. Friction - Dry Friction, Coefficients of Friction
7. Deformable Bodies- Stress and Strain and Sign Convention; Linear Elastic Stress-Strain Relationships.
8. Axial Force Members- Solution of Axially-Loaded Structures; Statically Indeterminate Axially Loaded Structures.
9. 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.
10. 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.
11. 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.
12. 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.