PPD5I102 MATERIALS DEFORMATION PROCESSES

Module I (10 Hours)
Introduction: Scope of the subject, elastic, plastic, and anelastic deformation. Constitutive equations in elasticity for isotropic and anisotropic materials, strain energy, elastic stiffness and compliance tensor, crystal structure and elastic constants. Plastic response of materials - different types of uniaxial stress-strain curves. Equivalent stress and strain.

Module II (10 Hours)
Levy-Mises and Prandlt-Reuss equations. Deformation theory of plasticity. Yield surface, Isotropic and kinematic hardening - Bauschinger effect. Elements of dislocation theory - crystallography, elastic properties, dislocations and their interactions in different crystal structures, origin and multiplication of dislocations, thermally activated dislocation motion. Critical resolved shear stress in single crystals.

Module III (10 Hours)
Work hardening in single and polycrystals. Strengthening mechanisms in polycrystals –role of grain boundaries, solid solution, precipitates and dispersoids, orderdisorder transformation, Mechanical properties of composites. Elevated termperature deformation mechanisms - cross slip, climb and grain boundary sliding. Deformation mechanism maps.

Module IV(10 Hours)
Fracture – mechanisms of ductile and brittle fracture; fracture in creep and stress corrosion conditions; fractograohy. Griffith theory of brittle fracture. Concepts of stress concentrations and stress intensity factors, rack tip plastic zone. J and CTOD parameters. Ductile to brittle transition behavior.