

MTPC3002 MECHANICAL BEHAVIOUR OF MATERIALS (3-0-0)

Course Objective:

To obtain knowledge of the various mechanical properties exhibited by various materials, namely strength, fracture, fatigue and creep. To obtain insight into the different mechanical properties of materials under engineering applications.

Module-I (06 hrs)

Theory of elasticity and plasticity, stress-strain relationship, Types of dislocations, their geometrical and elastic properties, Application of dislocation theory to strengthening mechanism and yield point, Strain ageing and work hardening phenomena.

Module-II (06 hrs)

Fracture: Fracture behaviour, Griffith's theory, linear elastic fracture mechanics, fractography, Ductile to brittle transition, Transition temperature phenomena, Factors affecting transition temperature, fracture toughness, strain energy release rate, Stress concentration, stress intensity factor, Crack growth criteria, Mode of deformation, Environment-assisted fracture.

Module-III (06 hrs)

Fatigue: Introduction to Fatigue, stress cycles, Cyclic stress-strain behaviour - low and high cycle fatigue, S-N curve, structure feature of fatigue, Fatigue crack propagation, Paris law, Effect of mean stress, stress concentration, size, surface, metallurgical variables and temperature on fatigue.

Module-IV (06 hrs)

Creep: Introduction to creep, Creep Curve, Stress Rupture Test, Structural Changes During Creep, Mechanism of Creep deformation, Power Law, Deformation Mechanism Maps, Effect of temperature on creep, Superplasticity, Parametric methods for Prediction of Long Time Properties.

Module-V (06 hrs)

Torsion Test: Mechanical Properties in Torsion, Torsional Stresses for Large Plastic Strains, Types of Torsion Failure, Tension Test Vs. Torsion Test, Hot Torsion Testing.

Impact Test: Notched Bar Impact Tests, Instrumented Charpy Test, Significance of Transition Temperature Curve, Metallurgical Factors affecting Transition Temperature Fracture.

Text Books:

1. Mechanical Metallurgy, G.W. Dieter
2. Mechanical Behaviour of Materials, M. A. Meyers and K. K. Chawla

Reference Books:

1. Mechanical Behaviour of Materials, William F. Hosford
2. Introduction to Dislocations, D. Hull and D.J. Bacon
3. Deformation Behaviour and Fracture Mechanics of Engineering Materials, R. W. Hertzberg
4. Mechanical Behaviour of Materials, Courtney