

## **MM1703: Creep, Fatigue and Fracture (3-1-0)**

### UNIT-I:

Creep of solids, temperature - stress – strain relationships, Creep and stress rupture tests, deformation mechanisms at elevated temperature, deformation mechanism maps, parametric relationships. Design of materials for elevated temperature application, Superplasticity and Life Prediction.

### UNIT-II:

Cyclic stress-and-strain controlled fatigue, S-N curve, effect of notch on fatigue life, fatigue crack initiation mechanisms, macroscopic fracture modes, microscopic fracture mechanisms, creep-fatigue interaction, corrosion fatigue, parameters affecting fatigue, fatigue crack growth, Paris law, Fatigue threshold, Life estimation.

### UNIT-III:

Fracture: Introduction, Types of fracture in metals, Theoretical cohesive strength of metals, Griffith theory, Fracture of single crystals, Metallographic aspects of fracture, Fractography, Dislocation theories of brittle fracture. Ductile fracture, Notch effects, Concept of fracture curve, Fracture under combined stress, effect of high hydrostatic pressure on fracture.

### UNIT-IV:

Elements of fracture mechanics, Stress energy release rate, stress intensity factor, fracture toughness and design,  $K_{IC}$ , Plain strain toughness testing, plasticity corrections, crack opening displacement, J Integral, R curve, Probabilistic aspects of fracture mechanics, toughness of materials.

### UNIT-V:

Microstructural aspects of Fracture: Some useful generalities, toughness and microstructural anisotropy, Improved alloy cleanliness, Optimizing microstructures for maximum toughness, microstructural refinement, Metallurgical embrittlement.  
Environment assisted cracking: Embrittlement Models, Fracture Mechanics Test methods, Life and crack length calculations.

### Text Books:

1. Deformation and Fracture of Engineering Materials by R.W. Hertzberg
2. Mechanical Behaviour of Materials by T.H. Courtney
3. Mechanical Metallurgy by G.E. Dieter