**ME706: FRACTURE MECHANICS IN ENGINEERING (3-1-0:4)**

**Introduction**

Definition of failure, yield criteria, brief review of tensile, bending, torsion and fatigue test, origin of fracture mechanics, photoelastic testing process, ductile and brittle fracture, fracture in microscopic view point, examples using finite element method (FEM).

**Linear Elastic Fracture Mechanics (LEFM)**

Brief introduction to elasticity, elliptical hole in a plate, energy release rate (G), R-curve, interfacial fracture, Irwin’s modification, pop-in phenomenon, Airy stress function, crack tip opening displacement, development of William’s stress intensity factor (K), relation between K and G for crack initiation, evaluation of K for different geometries and embedded cracks, leak before break criterion, Dugdale’s model, fracture toughness testing, examples using FEM.

**Elasto-Plastic Fracture Mechanics (EPFM)**

Triaxiality, Irwin’s plastic zone model, concept of fracture toughness, Eshelby’s line integrals, J-Integral, path independence, Hutchison- Rice-Rosengren (HRR) field, crack tip opening displacement (CTOD), relationship between J and CTOD, mixed mode fracture, J-R curve evaluation, fracture instability, examples by FEM.

**Fatigue Crack Growth Model**

Crack initiation, Paris law, sigmoidal curve, crack closure effect, plastic wake, emperical crack growth models, slip bands.

**Crack Arrest and Repair**

Strain energy density criterion, crack arrest principle, toughening methods, use of patches and hole, self healing polymers, metallic stitching.

**References:**

1. P. Kumar, “Elements of Fracture Mechanics”, Tata McGraw Hill.
2. T. Kundu, “Fundamentals of Fracture Mechanics”, CRC Press.
3. T. L. Anderson, “Fracture Mechanics - Fundamentals and Applications”, CRC Press.
4. D. Broek, “Elementary Engineering Fracture Mechanics”, Kluwer Academic Publishers.