AE6007 FATIGUE AND FRACTURE

DETAILED SYLLABUS

OBJECTIVES:

- To understand the basic concepts involved in fatigue analysis and to study the importance of fracture mechanics in aerospace applications.

UNIT I FATIGUE OF STRUCTURES

S.N. curves - Endurance limits - Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors – Plastic stress concentration factors - Notched S.N. curves – Fatigue of composite materials.

UNIT II STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR

Low cycle and high cycle fatigue - Coffin - Manson's relation - Transition life - cyclic strain hardening and softening - Analysis of load histories - Cycle counting techniques -Cumulative damage - Miner's theory - Other theories.

UNIT III PHYSICAL ASPECTS OF FATIGUE

Phase in fatigue life - Crack initiation - Crack growth - Final Fracture - Dislocations - fatigue fracture surfaces.

UNIT IV FRACTURE MECHANICS

Strength of cracked bodies - Potential energy and surface energy - Griffith's theory - Irwin – Orwin extension of Griffith's theory to ductile materials - stress analysis of "cracked bodies - Effect of thickness on fracture toughness" - stress intensity factors for typical 'geometries.

UNIT V FATIGUE DESIGN AND TESTING

Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.

TEXT BOOKS:

1. Prasanth Kumar, "Elements of fracture mechanics", Wheeter publication, 1999.

2. Barrois W, Ripely, E.L., "Fatigue of aircraft structure," Pergamon press. Oxford, 1983.

REFERENCES:

1. Sih C.G., "Mechanics of fracture." Vol - I, Sijthoff and w Noordhoff International Publishing Co., Netherlands, 1989.

2. Knott, J.F., "Fundamentals of Fracture Mechanics," - Buterworth & Co., Ltd., London, 1983.

3. Kare Hellan, 'Introduction to Fracture Mechanics', McGraw Hill, Singapore,1985