

5th Semester	RAE5D004	Fatigue & Fracture Mechanics	L-T-P 3-0-0	3 CREDITS
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COURSE OUTCOMES

1. Ability to apply mathematical knowledge to define fatigue behaviors
2. Ability to perform fatigue design and Ability to analyse the fracture due to fatigue
3. Analyze for cumulative damage due to fatigue.
4. Analyze for crack initiation & crack growth.
5. Analyze damage tolerant structures

Module-1 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.

Module-2 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.

Module-3 PHYSICAL ASPECTS OF FATIGUE AND FRACTURE

Phase in fatigue life - Crack initiation - Crack growth - Final Fracture - Dislocations - fatigue fracture surfaces - Strength and stress analysis of cracked bodies – Potential energy and surface energy - Griffith's theory - Irwin - Orwin extension of Griffith's theory to ductile materials - Effect of thickness on fracture toughness - stress intensity factors for typical geometries.

Module-4 FATIGUE TESTING

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

Module-5 FUNDAMENTALS OF FAILURE ANALYSIS

Common causes of failure. Principles of failure analysis. Fracture mechanics approach to failure problems. Techniques of failure analysis. Service failure mechanisms - ductile and brittle fracture, fatigue fracture, wear failures, fretting failures, environment induced

Books

1. Prasanth Kumar – “Elements of fracture mechanics” – Wheeler publication, 1999.
2. Barrois W, Ripely, E.L., “Fatigue of aircraft structure”, Pergamon press. Oxford, 1983.
3. Sin, C.G., “Mechanics of fracture” Vol. I, Sijthoff and w Noordhoff International Publishing Co., Netherlands, 1989.
4. Knott, J.F., “Fundamentals of Fracture Mechanics”, Butterworth & Co., Ltd., London, 1983
5. Subra Suresh, “Fatigue of materials” , II edition, 1998.
6. T. L. Anderson, “Fracture mechanics: Fundamentals and applications”, III edition, 2004.