

Devi Ahilya University, Indore, India Institute of Engineering & Technology				1 Year M.E. (Design & Thermal Engg.) Full Time			
Subject Code & Name	Instructions Hours per Week			Credits			
DTR1E2 Fatigue Creep and Fracture	L	T	P	L	T	P	Total
		3	1	2	3	1	1
Duration of Theory Paper: 3 Hours							

Objective of the subject

The objectives of this course will be achieved by learning the phenomenon of fatigue creep & fracture Mechanism inside the metallic bodies also the behavior of the material can be understand under these states.

Prerequisites

Strength of Material, Machine Design & Material Science.

COURSE CONTENTS

UNIT-1

Introduction

Introduction & types of fatigue creep & Fracture phenomenon. Stress Analysis under fatigue, creep & Fracture. Material selection under the given conditions.

UNIT -2

Fatigue

Types of fatigue leading and failure, Fatigue test, endurance limit, S-N diagram; Various failure relations, Viz., Soderberg, Modified Goodman-, Gerber parabolic-, Elliptical-relations; Factors influencing fatigue strength; Influence of stress concentration on fatigue test; Fretting corrosion; Effect of environment-corrosion fatigue; Increased fatigue life due to surface protection.

UNIT -3

Creep

Mechanics of creep, inter-granular, trans-granular creep, Creep test, Creep strain rate-time curves, Deformation mechanism map; High temperature properties of materials; Long time creep-stress-time relations; Creep contribution to the fracture mechanism; Creep contribution to the fracture mechanism; DVM, DVL German-standard, Hatfield time yield test.

UNIT -4

Fracture

Damage tolerance analysis, residual strength in presence of cracks; Mechanisms of crack growth and fracture; Basic modes of fracture; Stress Concentration factor, state of stress at a stress concentration, load-flow-times; Measurement of Collapse strength; Griffith's theory of brittle fracture; Irwin's theory of fracture in elastic-plastic materials; Theories of linear elastic plastic fracture mechanics (LEFM); Stress intensity fracture, toughness, stress distribution at crack tip: plane stress, plane strain cases; Theories of elastic plastic fracture mechanics (EPFM); Crack opening displacement (COD) Criterion, COD tests, crack tip opening displacement (CTOD) measurement; Crack arresters; Implementation of fracture control.

UNIT -5

Design against Creep

Types of creep, Introduction to Design against creep. Combined creep and fatigue failure prevention. Shearby Dorn Parameter, Larson Miller Parameter, Manson- Haferd Parameter.

BOOKS RECOMMENDED:

- [1]. Norman E. Dowling, "Mechanical Behavior of Materials: Engineering Methods for Deformation, Fracture, and Fatigue," 3rd edition, Pearson Prentice Hall, 2007.
- [2] Shigley J.E. , "Mechanical Engineering Design" McGraw Hill 2003.
- [3] Mubeen A. , "Machine Design "Khanna Publications (P) Ltd