COURSE INFORMATION

Course Title	**Creep, Fatigue and Fracture**
Instructor	Dr. Ahmad Ghasemi Ghalebahman
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Office Location	Mechanical Engineering Department, Semnan University, Semnan, Iran
Duration	16-week period
Grading Policy	Midterm Exam: 35%, Final Exam: 45%, Homework: 12% Project: 8%
Textbook(s)	**Fracture Mechanics: fundamentals and applications** by T.L. Anderson, 3rd edition **Fracture Mechanics: an introduction** by E.E. Gdoutos, 2nd edition **Metal Fatigue in Engineering** by R.I. Stephens, A. Fatemi, R.R. Stephens, and H.O Fuchs **Multiaxial Fatigue** by D.F. Socie and G.B. Marquis, 1st edition

COURSE OUTLINE

Topic	**Week**
Introduction Brittle and Ductile fracture Fracture Mechanics Approach to Design Ductile-Brittle Transition Modes of Fracture Failure Mixed-Mode Fracture Concept of Fatigue Crack Growth	**1**
Linear Elastic Fracture Mechanics (LEFM) Atomic View of Fracture Griffith Energy Balance During Crack Growth Energy Release Rate Crack Instability and the R Curves Compliance	**2**
Singular Elasticity Problems (Wedge, Half-Plane, Contact, Dislocation, Crack) Michell-Based Solution	**3**
Williams-Asymptotic Solution for the Notched and Cracked Bodies T-Stress Concept0	**4**
Calculation of Coefficients of Singular and Non-Singular Terms Over-Deterministic (FEOD) Method Displacement Extrapolation Method	**5**
Finite Element Modeling and Cohesive Zone Model Singular Elements at the Crack Tip Extended Finite Element Method (XFEM)	**6**
Fracture Criteria Fracture Locus and Crack Branching Angle in Mixed-Mode Fracture Maximum Tangential Stress (MTS) Criterion	**7**
Maximum Energy Release Rate (MERR) Criterion Strain Energy Density (SED) Criterion Generalized (Modified) MTS Criterion/T-Stress Effect on Mixed-Mode Fracture	**8**
Small Scale Yielding Crack Tip Plastic Zone Thickness Effect and Plane Strain Fracture Toughness First-Order Uniaxial Stress Criterion Second- Order Uniaxial Stress Criterion: The Irwin Approach	**9**

Dugdale Criterion	
First-Order Multiaxial Yield Criterion ELASTIC PLASTIC FRACTURE MECHANICS (EPFM) **Fracture Toughness Testing** ASTM Standard E399 Test Procedure for Plane Strain Fracture Toughness	**10**
Elastic-Plastic Fracture Mechanics(EPFM) J-Integral as the Nonlinear Energy Release Rate J as a Path Independent Line Integral Crack Tip Opening Displacement (CTOD)	**11**
Fatigue Failure Basic Concepts Life Prediction LCF and HCF Damages Strain-Based Fatigue Models Cyclic Stress-Strain Curve Coffin-Manson Law Influence of Mean Stress	**12**
Stress-Based Fatigue Models Stress-life and Basquin's Law Fracture Mechanics-Based Fatigue Models Paris-Erdoğan Law Other Rate Relations	**13**
Fatigue Extension via Overload and Stop-Hole Techniques **Multi-Axial Fatigue** Critical Plane Observations Recent Models	**14**
Cyclic Plasticity Non-Proportional Fatigue Models	**15**
Creep Effects of Stress and Temperature on Creep Creep mechanisms Power-Law Creep Larson-Miller parameter	**16**