

MECH 4010 Materials Failure in Mechanical Applications

Course Code: MECH4010	Course Title: Materials Failure in Mechanical Applications
Required Course Or Elective Course: elective	Terms Offered (Credits): Fall (3 credits)
Faculty In Charge: JangKyo Kim	Pre/Co-Requisites: MECH 3020 Solid Mechanics II MECH 3420 Engineering Materials II
Course Structure: two lectures (80 min each) and one tutorial (50 min) per week	
Textbook/Required Material: Norman E. DOWLING, "Mechanical Behaviour of Materials: Engineering Methods for Deformation , Fracture, and Fatigue" Pearson Education Limited, 2013	
Course Description: 1. This is an elective course for the BEng in Mechanical Engineering with Option in Solid mechanics and materials. 2. Failure analysis, brittle and ductile fracture, creep rupture, fatigue cracking, environmental degradation of materials, damage tolerance design, life prediction of engineering components, case studies.	
Course Topics: 1. Introduction & Review 2. Linear Elastic Fracture Mechanics and Fracture Mechanics beyond elasticity 3. Fatigue of Materials a) Fatigue of Materials: Introduction and Stress-Based Approach b) Stress-Based Approach to Fatigue: Notched Members c) Fatigue Crack Growth d) Strain-Based Approach to Fatigue 4. Time-Dependent Behavior: Creep and Damping 5. Case Studies	
Course Objectives:	1. To provide comprehensive understanding of principles of fracture mechanics, failure mechanisms of engineering materials of various nature and applications, including brittle and ductile fracture, creep rupture, cyclic stress/strain fatigue, fatigue crack propagation, environmental degradation and microstructural aspects of fracture toughness. 2. To study damage tolerance design and life prediction of engineering components.
Course Outcomes:	A. The students will become engineers with the knowledge of material damage and failures. B. The students will have a thorough understanding of the fundamental failure mechanisms of engineering materials. C. The students will be able to conduct simple failure analysis for industrial practice [1], and moreover the students will be able to estimate the service life of an engineering component. D. The students will enhance the self-learning ability.

Assessment Tools:

Four Assignments

Small Group Project solving a failure analysis case study

Mid-term and Final exams