

School of Mechanical Engineering and Computer Science
Mech 489/589: Material Failure in Mechanical Design

Catalog Data:	Mech 489/589 Material Failure in Mechanical Design ; 3 credits Analysis, design, and prevention from failure of materials in mechanical design. Properties and behavior of engineering materials including stress-strain relations, strength, deformation mechanisms, cyclic fatigue, fracture, creep, and wear. Special topics such as damage tolerances in machine element design.
Class Schedule:	Three 50-minute lecture sessions per week, for one semester.
Laboratory Schedule:	None
Prerequisites by Course:	MECH 215: <i>Mechanics of Material</i> , MECH 309: <i>Introduction to Engineering Materials</i> ,
Prerequisites by Topic:	<ol style="list-style-type: none"> 1. Stress and strain in a deformable body 2. Mechanical properties of engineering materials
Required Texts:	Norman E. Dowling, <i>Mechanical Behavior of Materials</i> , Prentice Hall, 3rd Edition. Jack A. Collins, <i>Failure of Materials in Mechanical Design</i> , John Wiley & Sons, 2 nd Edition.
Course Coordinator:	Dr. Dave (Dae-Wook) Kim
Course Objectives:	<ol style="list-style-type: none"> 1. Describe material structures, mechanical properties, mechanical failure modes and failure theories of engineering materials. 2. Design pressure vessels to prevent failures. 3. Describe the fundamentals of linear elastic fracture mechanics. 4. Demonstrate the knowledge of the design methods and procedures for treating cyclic fatigue in the design of mechanical and structural components and devices. 5. Describe the regulatory requirements for damage tolerant design. 6. Demonstrate the knowledge of wear mechanisms and the relations with fatigue damage. 7. Estimate creep deformation for the elevated temperature applications.
Topics Covered:	<ol style="list-style-type: none"> 1. Mechanical failure modes and failure theories. 2. Material structures, material behavior, and mechanical properties. 3. Fracture of cracked members. 4. Pressure vessels –failures, design methods and procedures. 5. Fatigue of materials. 6. Design mechanical components to prevent fatigue crack initiation. 7. Fatigue crack growth, damage tolerance design. 8. Wear and fretting-fatigue 9. Time-dependent behavior: creep and damping

Course Outcomes:	Students will be able to:		
	Assessed for Program Outcomes	<p>C-2. Carries out design process (such as concept generation, modeling, evaluation, iteration) to satisfy safety requirements for mechanical component design.</p> <p>E-1. Classify information to identify engineering problems.</p> <p>E-2. Develop appropriate models to formulate solutions.</p> <p>I-3. Recognizes the need to accept personal responsibility for learning and of the importance of life-long learning.</p>	
	Other	<p>A-2. Describes fundamental scientific and/or engineering principles (engineering mechanics) in material failure.</p> <p>A-3. Applies scientific and engineering principles (engineering mechanics) toward solving material failure problems in mechanical design.</p> <p>E-3. Uses analytical and computational methods to obtain solutions.</p> <p>F-1. Evaluates ethical issues (such as safety intellectual property, reporting data, etc.) that may occur in professional practice using professional code of ethics.</p>	
Required or Elective Courses	Elective		
Contribution of Course to Program:	Engineering Topics		
Relationship of Course to Program:	Meets: Educational Objectives <u>1, 2, 3, 4</u> Program Outcomes <u>A,C,E, F, I</u>		
Prepared by:	Dr. Dave (Dae-Wook) Kim	Date:	October 10, 2008
Approved by CAC:			