

School of Engineering and Computer Science
MECH 489: Material Failure in Mechanical Design

Catalog Data:		489 Material Failure in Mechanical Design 3 Course Prerequisite: MECH 215; MECH 309. Analysis, design and prevention from failure of materials in mechanical design; mechanical behavior of materials such as fatigue, fracture and wear. Credit not granted for both MECH 489 and MECH 589. Offered at 400 and 500 level. Typically offered Spring.
Class Schedule:		Three 50-minute lecture sessions per week, for one semester.
Laboratory Schedule:		None
Prerequisites by Course:		MECH 215; MECH 309
Prerequisites by Topic:		1. Stress and strain in a deformable body 2. Mechanical properties of engineering materials
Textbook:		Norman E. Dowling, <i>Mechanical Behavior of Materials</i> , Prentice Hall, 4th Edition. Jack A. Collins, <i>Failure of Materials in Mechanical Design</i> , John Wiley & Sons, 2nd Edition.
Course Coordinator:		Dr. Dave Kim
Course Objectives:		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 other time-dependent failures (such as corrosion and wear) and their relations with fatigue damage.
Topics Covered:		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. Corrosion and wear
Lab Experiments and Activities:		None
Course Outcomes:		Students will be able to:
	Assessed for Student Outcomes	1-b. Evaluate loading conditions and environmental information to identify appropriate material failure modes. 1-c. Use appropriate material failure theories to formulate solutions in the context of mechanical component design and service. 4-b. Make ethical decisions on mechanical component design and service.
	Other	1-a. Describe fundamental materials science, fracture mechanics in material failure. 1-d. Apply engineering mechanics toward solving material failure problems in mechanical design. 2-b. Carry out design process (such as concept generation, modeling, evaluation, iteration) to satisfy safety requirements for mechanical component design.

<i>Required or Elective Course:</i>	Elective		
<i>Relationship of Course to Program:</i>	Meets: Educational Objectives <u>1, 2, 3</u> Student Outcomes <u>1, 2, 4</u>		
<i>Prepared by:</i>	Dr. Dave Kim	Date:	3/26/2018 (4/23/18 mb)
<i>Approved by USC:</i>	4/16/2018		