MSE 3005: Mechanical Behavior - Materials

Credit hours and contact hours: 3-0-0-3

Instructor: Christopher Muhlstein

Textbook: Marc Meyers and Krishan Chawla, *Mechanical Behavior of Materials*, 2nd Edition, Cambridge University Press, 2009.

Specific course information

Catalog description: The correlation of mechanical properties with atomic bonding, microstructure, and micromechanics, for applications relevant to materials selection and design, mechanical forming, and failure of materials.

Prerequisites: MSE 2001 – Principles & Applications -Engineering Materials and COE 3001 – Deformable Bodies

Course: Required

Specific goals for the course

Outcomes of instruction:

Outcome 1: The student will possess the fundamental knowledge and skills to function effectively in materials science and engineering- related positions in industry and government, or to successfully pursue advanced studies.

1.1 The student will demonstrate a basic understanding of the relationships between structure, chemistry, and mechanical properties of materials (e.g., elastic modulus, strength, ductility, and fracture toughness)

1.2 The student will demonstrate an understanding of the fundamental principles of linear elastic fracture mechanics.

1.3 The students will demonstrate an understanding of material degradation mechanisms

Outcome 2: The student will demonstrate technical competence using current engineering techniques, skills and tools.

2.1 The student will demonstrate a basic understanding of the relationships between structure, chemistry, and mechanical properties of materials (e.g., elastic modulus, strength, ductility, and fracture toughness)

2.2 The student will demonstrate an understanding of the fundamental principles of linear elastic fracture mechanics.

Outcome 3: The student will demonstrate an ability to identify, formulate, and solve engineering problems

3.1 The student will demonstrate the ability to perform basic stress analyses and evaluate the performance of the design (e.g., stiffness, strength, fatigue resistance).

Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

Topics covered:

1. Elasticity and viscoelasticity
2. Plasticity
3. Imperfections: point, line, and volume defects
4. Strengthening mechanisms
5. Fracture
6. Fatigue
7. Creep
8. Environmental degradation

Correlation between Outcomes of Instruction and Student Outcomes:

Outcomes of Instruction	**Student Outcomes**						
	1	**2**	**3**	**4**	**5**	**6**	**7**
1.1 The student will demonstrate a basic understanding of the relationships between structure, chemistry, and mechanical properties of materials (e.g., elastic modulus, strength, ductility, and fracture toughness)	X						
1.2 The student will demonstrate an understanding of the fundamental principles of linear elastic fracture mechanics.	X						
1.3 The students will demonstrate an understanding of material degradation mechanisms	X						
2.1 The student will demonstrate a basic understanding of the relationships between structure, chemistry, and mechanical properties of materials (e.g., elastic modulus, strength, ductility, and fracture toughness)	X						
3.1 The student will demonstrate the ability to perform basic stress analyses and evaluate the performance of the design (e.g., stiffness, strength, fatigue resistance).	X						

School of Materials Science and Engineering Student Outcomes:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
(2) An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
(3) An ability to communicate effectively with a range of audiences.
(4) An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
(6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
(7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.