

## **ME 4214 Mechanical Behavior of Materials (Elective)**

**Catalog Description:** ME 4214 Mechanical Behavior of Materials (3-0-3)  
Prerequisites: COE 3001 Deformable Bodies  
Problems involving resistance of materials to plastic deformation, fracture, fatigue, and creep; mechanical testing; computer-based methods; case studies of failure.

**Textbook:** N.E. Dowling, *Mechanical Behavior of Materials*, 3rd Edition, Pearson Prentice Hall, 2007.

### **Topics Covered:**

1. Mechanical testing
2. Stress-strain relationships
3. 3D states of stress
4. Failure criteria
5. Fracture mechanics
6. Fatigue (stress-based approach)
7. Fatigue crack growth
8. 3D non-linear stress-strain relationships (plasticity)
9. Constrained plasticity problems
10. Residual stresses
11. Fatigue (strain-based approach)
12. Other failure mechanisms (creep, wear, corrosion, environment assisted cracking)
13. Failure analysis

### **Course Outcomes:**

Outcome 1: To teach students the mechanical properties and behavior of metals, ceramics, polymers, and composites.

- 1.1 Students will demonstrate an understanding of the mechanical properties and behavior of metals, ceramics, polymers, and composites.
- 1.2 Students will demonstrate the knowledge of how these properties are measured.

Outcome 2: To develop the student's ability to understand and apply the definitions of stress and strain in three dimensions along with the application of simple constitutive laws.

- 2.1 Students will demonstrate the ability to define stress and strain.
- 2.2 Students will demonstrate the ability to analyze states of stress in three dimensions.
- 2.3 Students will demonstrate the ability to apply constitutive laws to solve deformable bodies problems including non-linear behavior.

Outcome 3: To train students to identify, formulate and solve engineering problems involving resistance to plastic deformation, fatigue, fracture, creep, and corrosion.

- 3.1 Students will demonstrate the ability to identify engineering problems involving plastic deformation, fatigue, fracture, creep and corrosion, and the tools required to solve these problems.
- 3.2 Students will demonstrate the ability to formulate problems involving multidimensions and apply failure theories.
- 3.3 Students will demonstrate the ability to apply appropriate engineering approximations to solve these problems.

3.4 Students will demonstrate that they can apply the knowledge in Objective 1 to make engineering judgments.

3.5 Students will demonstrate recognition of failure mechanisms and identify key mechanical properties and analyses and/or experiments needed to determine cause of failure and evaluate solutions to prevent failure.

**Correlation between Course Outcomes and Program Educational Outcomes:**

ME 4213												
	Mechanical Engineering Program Educational Outcomes											
Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l
Course Outcome 1.1	X										X	X
Course Outcome 1.2	X	X									X	X
Course Outcome 2.1	X										X	X
Course Outcome 2.2	X										X	X
Course Outcome 2.3	X		X		X						X	X
Course Outcome 3.1	X				X						X	X
Course Outcome 3.2	X		X		X						X	X
Course Outcome 3.3	X		X		X						X	X
Course Outcome 3.4	X		X		X		X	X			X	X
Course Outcome 3.5	X	X	X		X	X	X	X	X		X	X