ME 4214 Mechanical Behavior of Materials (Elective)

Catalog Description: ME 4214 Mechanical Behavior of Materials (3-0-3)
Prerequisites: COE 3001 Mechanics of 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 materials.

1.1 Students will demonstrate an understanding of the mechanical properties and behavior of materials.

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 determine states of stress in three dimensions.

2.2 Students will demonstrate the ability to apply constitutive laws to solve deformable body problems.

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

3.1 Students will demonstrate the ability to identify engineering problems involving plastic deformation, fatigue, and fracture, 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 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 including professional and ethical responsibility.

Correlation between Course Outcomes and Student Outcomes:

ME 4214											
	Mechanical Engineering Student Outcomes										
Course Outcomes	a	b	c	d	e	f	g	h	i	j	k
Course Outcome 1.1	X										X
Course Outcome 1.2	X	X									X
Course Outcome 2.1	X										X
Course Outcome 2.2	X										X
Course Outcome 3.1	X		X		X						X
Course Outcome 3.2	X		X		X						X
Course Outcome 3.3	X	X	X		X	X					X

GWW School of Mechanical Engineering Student Outcomes:

(a) an ability to apply knowledge of mathematics, science and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Prepared by: Richard W. Neu