EM217 Strength of Materials

United States Naval Academy
Mechanical Engineering Department

Catalog Description: EM217 Strength of Materials **Credit:** 4 (3-2-4)
Designation: Required, engineering sciences

A first course in mechanics of deformable bodies with emphasis on the engineering approach to the responses of these bodies to various types of loadings. Topics include stress-strain relationships, stress-strain analysis, stress and strain transformation (Mohr's circle), load-deflection, bending, torsion, buckling, and temperature effects.

Prerequisites: EM211 Statics
Corequisites: SM212 Differential Equations
Textbooks: Philpot, Mechanics of Materials, John Wiley & Sons, 2008.
Course Director: Assistant Professor Joel J. Schubbe

Course Content:

No.	Topic or Subtopic	hrs.
1	Statics review and review of sectioning	4
2	Introduction to stress and stress components	2
3	Stress on inclined planes	1
4	Stress transformation	2
5	Mohr's circle of plane stress	4
6	Introduction to strain and strain components	1
7	Strain transformation	1
8	Mohr's circle of strain	1
9	Strain gage rosette analysis	1
10	Tensile mechanical properties	3
11	Stress-strain relationships	1
12	Thermal strain	1
13	Design loads and factors of safety	1
14	Deformation of axially loaded members	1
15	Statically indeterminate axially loaded members	1
16	Stress concentrations	2
17	Thin walled pressure vessels	2
18	Torsion	6
19	Beam bending, stress-strain	11
20	Combined loading	6
21	Beam deflection	7
22	Statically indeterminate beams	1
22	Beam design	3
23	Buckling	2

Assessment Methods:

	YES	NO
A. Quizzes	X	
B. Homework	X	
C. Exams	X	
D. Laboratory Reports	X	
E. Oral Presentations	X	
F. Design Reports/Notebooks		X
G. Prototypes/Demonstrations		X
H. Projects		X
I. Other		X

Course Outcomes[1] :

1. Apply forces, pressures, and temperature changes to affect the shape of deformable bodies. (A,B,C,D,E)
2. Demonstrate knowledge of the definitions of and relationships between stress and strain. (A,B,C,D,E)
3. Demonstrate the ability to accomplish stress and strain component transformations using equations and the Mohr's circle construction. Students will understand the concepts of principal stresses, principal strains, maximum shear stress, and maximum shear strain. (A,B,C,D,E)
4. Demonstrate the ability to predict stresses and strains in structural elements undergoing axial, torsional, and bending loads (including thin-walled pressure vessels) in a combined loading state. (A,B,C,D,E)
5. Demonstrate the ability to obtain the elastic curve of elastic beam deflection. (A,B,C,D,E)
6. Demonstrate the ability to solve statically indeterminate problems. (A,B,C,D,E)
7. Demonstrate the ability to integrate strength as well as deformation considerations in design applications. (A,B,C)
8. Demonstrate the ability to predict the buckling load for cases of long thin columns loaded axially. (A,B,C)
9. Demonstrate familiarity with the experimental measurement of strain in the engineering laboratory and be able to demonstrate how these measurements are used to validate the predicted stresses in the structural element or structure. (D)
10. Demonstrate the ability to write complete and accurate technical reports that describe the experiments conducted, analyze results, and report appropriate conclusions. (D)

[1] Letters in parenthesis represent assessment method used.

	Course Outcomes									
Program Outcomes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
a.	X	X	X	X	X	X	X	X	X	X
b.									X	X
c.							X			
d.										
e.	X	X	X	X	X	X	X	X	X	X
f.										
g.										X
h.										
i.										
j.										
k.	X	X	X	X	X	X	X	X	X	X

Date of Latest Revision: 5 JAN 2010, Assistant Professor Joel J. Schubbe