Syllabus **California State University, Sacramento**

ENGR 112: Mechanics of Materials **Fall 2014**

Tuesdays and Thursdays, 7:30 – 8:45 AM or 10:30 – 11:45 AM
1012 Riverside Hall
Course website: http://sacct.csus.edu

Instructor:
Richard Armstrong, Ph.D., P.E.
4046 Riverside Hall (or in 1012 Riverside Hall)
Office hours: Tuesday, Thursday 7:00 – 7:30 AM and 10:00 – 10:30 AM (or by appointment)
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Textbook (suggested):

Paper copy of 8th edition of Mechanics of Materials by R.C. Hibbeler with Mastering Engineering CD (see Sac State bookstore). Also acceptable hardback 8th or 9th editions of the same textbook.

Prerequisites:

ENGR 030 (Statics), ENGR 045 (Engineering Materials), and Math 045 (Differential Equations), all with grade of C- or better

Course description:

This course develops the theory behind fundamental topics of mechanics of materials and demonstrates how this theory is applied to analyze and design structural elements and solids. The concepts from this course will be used in subsequent courses in various fields of engineering.

Grading:

Grades will be weighted as follows:

Homework Assignments	**30%**
Quiz	
Midterm Exam 1	**20%**
Midterm Exam 2	**20%**
Final Exam	**30%**

Grades will be based upon the standard percentages:
A: 90-100, B: 80-89, C: 70-79, D: 60-69, F: below 60 (+/- grades also given)

Homework-assignment details:

Homework assignments will typically be assigned each week. The due date will be one week after the homework is assigned. Late assignments will not be accepted without a compelling reason.

Quiz details:

Given at the beginning of a class; frequency will vary.

Tentative schedule:

Module	Topic	Dates	Suggested Reading (8^{th} ed. Hibbeler)
Module 1	**Introduction**	9/2, 9/4	1.2 - 1.4, 2.2, 3.4 - 3.6
Module 2	**Axial members and normal stress**		
	Part 1: Statically determinate and indeterminate axial members	9/9, 9/11	4.1 - 4.4
	Part 2: Thermal loading	9/16	4.6
Module 3	**Torsional members and shear stress**		
	Part 1: Statically determinate torsional members and pure shear	9/18, 9/23	5.1, 5.2, 5.4
	Part 2: Power transmission and statically indeterminate members	9/23	5.3, 5.5
	Part 3: Shear flow	9/25	5.7
Module 4	**Shear and bending moment diagrams**	9/30, 10/2	6.1, 6.2
Review		10/14	
Midterm Exam 1 (covers Modules 1 – 4)		10/16	
Module 5	**Beams, basic and advanced topics**		
	Part 1: Curvature, strain and bending stresses	10/21, 10/23	6.3, 6.4
	Part 2: Shear stresses	10/23, 10/28	7.1 - 7.3
	Part 3: Shear flow in thin-walled members	~~10/16~~	~~7.4, 7.5~~
	Part 4: Inclined loading and composite beams	~~10/23, 10/30~~	~~6.5, 6.6~~
Module 6	**General stress and strain**		
	Part 1: Plane stress and principal stresses	10/30	9.1 - 9.3
	Part 2: Mohr's circle – stress	10/30	9.4
	Part 3: Plane strain and principal strains	11/4	10.1, 10.2
	Part 4: Mohr's circle – strain	11/4	10.3
	Part 5: Generalized linear elasticity	11/6	10.6
Review		11/13	
Midterm Exam 2 (covers Modules 5 – 6)		11/18	
Module 7	**Application of stress analysis**		
	Part 1: Thin-walled pressure vessels	11/20	8.1
	Part 2: Combined loading	11/25	8.2
Module 8	**Deflection of beams**	12/2, 4	12.1, 12.2, 12.5, 12.6, 12.9
Module 9	**Column stability**	12/4	13.1 - 13.3
Final review and make-up		12/9, 12/11	

Learning Objectives:

Module	Topic	Learning Objective
Module 1	**Introduction**	☐ Review the principles of statics ☐ Define and apply the concepts normal and shear stress ☐ Define and apply the concepts of norm and shear strain ☐ Define and apply the concepts of linear elasticity, ~~strain energy~~, and Poisson's Ratio
Module 2	**Axial members and normal stress**	
	Part 1: Statically determinate and indeterminate axial members	☐ Determine the elastic deformations of axially loaded members ☐ Apply the principle of superposition ☐ Define and apply the concepts of normal stress ☐ Define and analyze statically determinate axial members ☐ Define and analyze statically indeterminate axial members
	Part 2: Thermal loading	☐ Determine deformations and stress due to thermal loading
Module 3	**Torsional members and shear stress**	
	Part 1: Statically determinate torsional members and pure shear	☐ Describe torsional members and pure shear ☐ Determine shear stress and the angle of twist in a circular shaft due to torsion
	Part 2: Power transmission and statically indeterminate torsional members	☐ Determine the power transmission in an circular shaft ☐ Define and analyze statically indeterminate torsional members ☐ Determine shear stress and the angle of twist in a circular shaft due to torsion
	Part 3: Shear flow	☐ Define and analyze shear flow and the angle of twist in thin-walled tubes
Module 4	**Shear and bending moment diagrams**	☐ Define sign convention for shear and bending moments ☐ Determine shear and bending moment diagrams
Module 5	**Beams, basic and advanced topics**	
	Part 1: Curvature, strain and bending stresses	☐ Define and determine the curvature of a beam ☐ Define and determine the longitudinal stresses and strains in a beam
	Part 2: Shear stresses	☐ Define and determine the transverse shear stresses and shear flow in rectangular, circular, and built-up beams
	Part 3: Shear flow in thin-walled members	~~☐ Define and determine shear flow and shear center in thin-walled members~~
	Part 4: Inclined loading and composite beams	~~☐ Define and determine the stresses of a beam with an inclined load~~ ~~☐ Compute stresses of a composite beam~~

Learning Objectives (continued):

Module	Topic	Learning Objective
Module 6	**General stress and strain**	
	Part 1: Plane stress and principal stresses	☐ Define the general state of plane stress ☐ Define and determine the state of plane stress of an inclined plane ☐ Define and determine principal stresses
	Part 2: Mohr's circle – stress	☐ Apply the concept of Mohr's circle to determine the state of plane stress of an inclined plane and the principal stresses
	Part 3: Plane strain and principle strains	☐ Define the general state of plane strain ☐ Define and determine the state of plane stain for a rotated element ☐ Define and determine principal strains
	Part 4: Mohr's circle – strain	☐ Apply the concept of Mohr's circle to determine the state of plane strain of a rotated element and the principal strains
	Part 5: Generalized linear elasticity	☐ Define the relationship between a generalized state of stress and strain ☐ Determine the stresses and strains of a structural solid in multi-direction loading
Module 7	**Application of stress analysis**	
	Part 1: Thin-walled pressure vessels	☐ Define and determine the stress of a thin-walled pressure vessel
	Part 2: Combined loading	☐ Determine the state of stress by combined loading
Module 8	**Deflection of beams**	☐ Define moment shear relation ☐ Calculate deflections using second-order ODE ☐ Calculate deflections using tabulated solutions ☐ Identify redundant forces in indeterminate beams ☐ Determine deflections using differential equations and method of superposition
Module 9	**Column stability**	☐ Define the differential equation for Euler column buckling ☐ Calculate slenderness ratio ☐ Determine the buckling equation for pinned conditions ☐ Determine the critical Euler buckling loads for various end conditions