LECTURE SECTION

Instructor: Professor Rapoff; Steinmetz 219; rapoff@union.edu; 388-8384

When & Where: Mondays, Wednesdays & Fridays 8:00 to 9:05 am; NWSE 201

Office Hours: any time or officially Mondays & Wednesdays 10:00 to 11:30 am

Text: Beer FP, Johnston ER Jr, DeWolf JT, Mazurek DF. Mechanics of materials. 5e. McGraw Hill, 2009.

Course Website: See link at engineering.union.edu/~rapoffa

Register Description: "A basic engineering course required in the mechanical engineering curricula. Strength of materials is a branch of applied mechanics that deals with the behavior of solid bodies subjected to various types of loading. The solid bodies considered in this course include axially-loaded members, shafts in torsion, thin shells, beams, columns, and structures that are assemblies of these components. Strength of materials analysis determines the stresses, strains, and displacements produced by the loads. Classroom lectures are supplemented with demonstrations. Includes a laboratory where students build an appreciation for the phenomenon being discussed in lecture." Prerequisite: MER 212.

Homework Problems: Homework problems have been suggested for each block of lecture material. Problems will not be collected. The most successful students will work as many problems in the text as they can. Solutions will be available. Several problem sessions are scheduled throughout the term.

Exams: Three exams will be administered, two midterm exams during regularly scheduled lecture time and one final exam during the period scheduled by the College. All exams will be comprehensive and will include all previously covered lecture material. A single side, letter size formula sheet will be allowed for each exam.

Laboratories: Please see the Laboratory Syllabus and the course website for details regarding Lab Notebooks and Reports.

Grades: Course grades will be determined using these weights: 25% for each exam (75% total) and 25% for the laboratories (four Reports plus Notebook); and using this scale:

$\geq$93=A, 90-92=A-, 87-89=B+, 83-86=B, 80-82=B-, 77-79=C+, 73-76=C, 70-72=C-, 60-69=D, $\leq$59=F

All grading must be contested prior to the beginning of the lecture period following the period at which the original assignment was returned. Contestations must be accompanied by a written explanation of how your solution was incorrectly penalized.

Attendance & Punctuality: Each student will be responsible for knowledge of all scheduling changes and announcements made in class. Without exception, no prior, late or makeup assignment will be administered, accepted or allowed without a College approved excuse. Laboratory attendance is mandatory, and an absence will result in no credit for the associated assignments.

Classroom Decorum: Consider the classroom as our place of business (that is not to say that we won't have a laugh nor have fun). Arrive in time so that you are prepared to work when the class period begins. Do not begin packing to leave until class is dismissed. Food is not allowed in the classrooms. Refrain from rising and leaving during class for a break unless it is absolutely necessary. No one will be allowed back in to the classroom if they leave during an exam.

Academic Honesty: Without exception, all work in this course must represent the sole work of each individual student. Students may seek from others clarifications of concepts but nothing else. From the Student Handbook: "As a student at Union College, [we] hereby dedicate [ourselves] to ... support and uphold the following principles: academic openness in the pursuit of knowledge, academic honesty, awareness of and respect for others' rights - regardless of race, creed, sex, sexual orientation or position, and dignity and pride in [ourselves], [our] actions, and [our] College."

Students with Disabilities: From the Disabled Student Services website: "The Director of Student Support Services provides assistance to students with disabilities ... Students with disabilities who require accommodations must make a formal request by submitting documentation of the disability and accommodations requested." Please present the approved request to the Instructor within the first two weeks of the term, in total confidence and at your discretion.

Week	Class	Day	Date	Month	Sections	CHAPTER Topic	Suggested Problems
1	1	W	9	September	1.1 1.2 1.3 1.4	**INTRODUCTION - CONCEPT OF STRESS** Introduction A Short Review of the Methods of Statics Stresses in the Members of a Structure Analysis and Design	**1.1, 1.5**
	2	F	11	September	1.5 1.6 1.7 1.8 1.9 1.10	Axial Loading; Normal Stress Shearing Stress Bearing Stress in Connections Application to the Analysis and Design of Simple Structures Method of Problem Solution Numerical Accuracy	**1.12, 1.27**
2	3	M	14	September	1.11 1.12 1.13	Stress on an Oblique Plane under Axial Loading Stress under General Loading Conditions; Components of Stress Design Considerations	**1.33, 1.37**
	4	W	16	September	2.1 2.2 2.3 2.5 2.6 2.7 2.8	**STRESS AND STRAIN - AXIAL LOADING** Introduction Normal Strain under Axial Loading Stress-Strain Diagram Hooke's Law; Modulus of Elasticity Elastic versus Plastic Behavior of a Material Repeated Loadings; Fatigue Deformations of Members under Axial Loading	**2.14, 2.28**
	5	F	18	September	2.9 2.10	Statically Indeterminate Problems Problems Involving Temperature Changes	**2.41, 2.58**
3	6	M	21	September	2.11 2.12 2.13 2.14 2.15 2.17 2.18	Poisson's Ratio Multiaxial Loading; Generalized Hooke's Law Dilatation; Bulk Modulus Shearing Strain ... Relation among E, ν, and G Stress and Strain Distribution ...; Saint-Venant's Principle Stress Concentrations	**2.69, 2.95**
	7	**W**	**23**	**September**	**PROBLEM SESSION**		
	8	F	25	September	3.1 3.2 3.3 3.4	**TORSION** Introduction Preliminary Discussion of the Stresses in a Shaft Deformations in a Circular Shaft Stresses in the Elastic Range	**3.11, 3.23**
4	9	M	28	September	3.5 3.6	Angle of Twist in the Elastic Range Statically Indeterminate Shafts	**3.34, 3.54**
	10	W	30	September	3.8	Stress Concentrations in Circular Shafts	**3.91**
	11	**F**	**2**	**October**	**PROBLEM SESSION**		
5	**12**	**M**	**5**	**October**	**EXAM 1**		
	13	W	7	October	4.1 4.2 4.3	**PURE BENDING** Introduction Symmetric Member in Pure Bending Deformations in a Symmetric Member in Pure Bending	**4.20, 4.29**
	14	F	9	October	4.4 4.5	Stresses and Deformations in the Elastic Range Deformations in a Transverse Cross Section	

Week	Class	Day	Date	Month	Sections	CHAPTER Topic	Suggested Problems
6	15	M	12	October	4.6 4.7 4.12	Bending of Members Made of Several Materials Stress Concentrations Eccentric Axial Loading in a Plane of Symmetry	**4.40, 4.122**
	16	W	14	October	5.1 5.2 5.3	**ANALYSIS AND DESIGN OF BEAMS FOR BENDING** Introduction Shear and Bending-Moment Diagrams Relations among Load, Shear, and Bending Moment	**5.10, 5.43**
	17	F	16	October	5.4 5.6	Design of Prismatic Beams for Bending Nonprismatic Beams	**5.72, 5.138**
7	**18**	**M**	**19**	**October**	**PROBLEM SESSION**		
	19	W	21	October	6.1 6.2 6.3 6.4 6.5	**SHEARING STRESSES IN BEAMS AND THIN-WALLED MEMBERS** Introduction Shear on the Horizontal Face of a Beam Element Determination of the Shearing Stresses in a Beam Shearing Stresses in Common Types of Beams ... Distribution of Stresses in a Narrow Rectangular Beam	**6.3, 6.24**
	20	F	23	October	6.6 6.7	Longitudinal Shear on a Beam Element of Arbitrary Shape Shearing Stresses in Thin-Walled Members	**6.42, 6.53**
8	21	M	26	October	6.9	Unsymmetric Loading of Thin-Walled Members; Shear Center	**6.62, 6.77**
	22	**W**	**28**	**October**	**PROBLEM SESSION**		
	23	**F**	**30**	**October**	**EXAM 2**		
9	24	M	2	November	7.1 7.2 7.3	**TRANSFORMATIONS OF STRESS AND STRAIN** Introduction Transformation of Plane Stress Principal Stresses: Maximum Shearing Stress	**7.8, 7.12**
	25	W	4	November	7.4	Mohr's Circle for Plane Stress	**7.34**
	26	F	6	November	7.5 7.6	General State of Stress Application of Mohr's Circle to the [3D] Analysis of Stress	**7.68, 7.78**
10	27	M	9	November	7.9	Stresses in Thin-Walled Pressure Vessels	**7.104, 7.116**
	28	W	11	November	7.10 7.11 7.12 7.13	Transformation of Plane Strain Mohr's Circle for Plane Strain Three-Dimensional Analysis of Strain Measurements of Strain; Strain Rosette	**7.138, 7.147**
	29	F	13	November	8.1 8.2 8.4	**PRINCIPAL STRESSES UNDER A GIVEN LOADING** Introduction Principal Stresses in a Beam Stresses under Combined Loadings	**8.8, 8.52**
11	**30**	**M**	**16**	**November**	**PROBLEM SESSION & COURSE EVALUATIONS**		
Finals		**?**	**?**	**November**	**FINAL EXAM**		