CE 231: Engineering Materials I (Fall 2013)

School of Civil Engineering, Purdue University

Hours

Lecture	All	M and W	8:30am – 9:20am	HAMP 1144
Lab Prep.	All	F	8:30am – 9:20am	HAMP 1144
Labs	DIV 03	M	11:30am - 1:20pm	HAMP G150C (Lyles i2i Lab)
	DIV 04	M	1:30pm - 3:20pm	HAMP G150C (Lyles i2i Lab)
	DIV 05	T	9:30am - 11:20am	HAMP G150C (Lyles i2i Lab)
	DIV 06	T	11:30am - 1:20pm	HAMP G150C (Lyles i2i Lab)

Instructors:

Prof. Jan Olek, Office: HAMP G221, Phone: 494-5015, e-mail: olek@purdue.edu, web site: http://engineering.purdue.edu/~olek

Office hours: Monday-Wednesday 1:30-2:30pm, whenever I am in my office, or by appointment.

Prof. Pablo Zavattieri, Office: HAMP G217, Phone: 496-9644, e-mail: zavattie@purdue.edu, web site: http://engineering.purdue.edu/~zavattie

Office hours: Monday-Wednesday 9:30-10:30pm, whenever I am in my office, or by appointment.

Teaching Assistants:

Yi-Cheng (Charles) Chiu,	chiu8@purdue.edu	Office hours: TBD	in HAMP G150C/D
Hadi Shagerdi esmaeeli,	hshagerd@purdue.edu	Office hours: TBD	in HAMP G150C/D

Course information will posted on **Blackboard Learn: https://mycourses.purdue.edu/**

Textbooks:

Shackelford, J.F., "Introduction to Materials Science for Engineers", 7th Ed. Prentice Hall, Upper Saddle River, NJ.

Hibbeler, R. C., "Mechanics of Materials" 9th Ed. Prentice Hall, Upper Saddle River, NJ (8th edition is also fine)

Winslow, D., "Experiments with Construction Materials: A Laboratory Manual, McGraw-Hill., 1990, NY

Other requirements:

- We will make use of the *i>Clicker* technology in the lecturers, and some labs to encourage participation and critical thinking about what is being learned in class. http://www.itap.purdue.edu/learning/tools/iclicker/
- Safety Glasses. More information on Lab Safety and rules will be given in the first Lab Preparation class.

Course Objectives

The objective of this course is that by the end of the semester the student will be able to successfully utilize fundamental material science and mechanics concepts to understand, explain, and describe the performance of a wide range of engineering materials. The student will be able to describe and predict the mechanical response of a material under an arbitrary state of stress. The student will be able to assess the failure behavior of different materials and describe this behavior based on mechanics and material science arguments that will include microstructural evidence, failure theories, and material composition. In addition, the student will be able to successfully implement, analyze, and report on laboratory tests performed on typical civil engineering materials. These objectives will be achieved through weekly laboratory and homework exercises.

Topics Covered

An introduction to the fundamental concepts of stress and strain, the basis for material elasticity from both the theoretical and physical point of view, atomic structure and its influence on material properties, the fundamental of brittle behavior, yielding, and material plasticity, strength behavior and yield criteria, fracture and toughness, behavior of materials under fatigue loading, ductile strengthening, corrosion.

ABET Outcome Criteria:

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- e- an ability to identify, formulate, and solve engineering problems

GENERAL POLICIES AND RULES

Read these rules CAREFULLY. It will be assumed that you have read this material and understood it.

Attendance

Students are expected (required) to attend all classes, laboratory sessions, and examinations. Students are expected to attend and actively participate in weekly laboratory sessions, consisting of either problem solving sessions or running experiments. You are expected to have read the reading assignment before you come to lecture or labs. Students should expect short, unannounced quizzes.

Labs will not be able to be made up except in the case of EXTREME circumstances. If you have a foreseeable conflict please contact Prof. Olek or Prof. Zavattieri WELL BEFORE the scheduled lab and possible options can be discussed.

Laboratory Reports/Homework

All homework is to be in a format that would be consistent with professional engineering practice. An example will be provided. All homework is to be submitted on either plain (i.e., unlined paper) or engineering paper with the problem worked only on one side of paper. All the sheets should contain the student's name, assignment number, division number (of the enrolled division) and the problem number. In addition it is anticipated that the problem will contain a clear description of the problem including what are the problem givens, nomenclature, and the unknowns. In addition a sketch of the problem is needed as well as a free body

diagram whenever applicable (straight-edges are to be used in constructing these diagrams). The solution is to be worked in an organized manner with relevant calculations and notes as appropriate. The problem is to be worked methodically down the page. The answer is to be placed in a box at the end of the problem containing units. The details of your calculations must be shown for all problems that involve calculations. A result may be graded as completely wrong if given without supporting calculations. Any numerical result or answer that requires a unit is incorrect, and will be counted as such, if that unit is omitted or given incorrectly. Example: 50 is not the same as 50 mph or 50 km/hr. Each problem is expected to begin on a new page. You are expected to understand the concept of significant figures and to use the proper number of significant figures in the final statement of your lab results. Finally, all pages are to be stapled together before submission. Failure to follow these guidelines may result in loss of credit regardless of the correctness of the answer.

Lab reports are due one week after you perform the experiment or one week after you get all the data needed for the report. These are due at the beginning of the appropriate class meeting. No late reports will be accepted. Lab reports should follow the required format.

Students are expected, even encouraged, to consult with one another on homework assignments and lab write-ups; however all work submitted by the student is expected to be their own effort. If there is reason to believe that work has been copied from another student, university regulations may be invoked as regards punitive action. Furthermore, the Professor reserves the right to assign a failing grade for either the specific work or for the entire course.

Solutions to the Homework will be posted after the assignment is submitted. Problems will be graded for correctness or checked for completeness, regardless of approach or solution at the discretion of the Instructor.

Exams

All exams are closed book, closed notes. Relevant formulas will be provided with the exam; a sample of which equations will be provided will be posted prior to the test. Programmable calculators are permitted; however grading will be based solely on the information shown on the exam sheet. For this reason all necessary steps, figures, and calculations are to be shown in order to obtain credit. All work that you submit must be strictly your own. If there is reason to believe that work has been copied or done in collaboration with another student, university regulations may be invoked as regards punitive action. Instances of cheating during exams will result in full loss of credit for that exam. Additional measures including the immediate failure of the course may be applied at the discretion of the instructor and/or University Staff.

Make-Up Exams

There will be NO MAKE UP EXAMS in this course. Any student absent from an exam will receive a score of "zero" for the exam, unless the absence was related to a substantive personal or family health emergency. The dates of the exams are indicated on the syllabus. Therefore, all travel plans associated within or outside the university functions shall be made with this policy in mind. Any student missing an exam due to a substantive personal or family health emergency shall provide a written letter from a physician or a recognized individual authenticating the seriousness of the emergency and how it led to the student's absence from the exam. The letter should state the specific reason for the absence and the date and duration of the incident. The letter shall include the name, title, relationship to the student, address, and telephone number of the letters author. In such case, the instructor reserves the right to accept or decline the excuse.

Grading

Exams (3 exams)	50%
Homework and Quizzes	10%
Laboratory Reports	40%

In order to pass the course, a 150 actual exam points (out of a total 300 points) is required. Failure to accumulate that minimum number of actual exam points will result in a grade of F, regardless of the overall average computed from all completed assignments. You are also required to submit a minimum of 80% of lab reports. Less than 80% of Lab reports will also result in a grade of F.

The course is NOT graded on A CURVE. Final letter grades are assigned based on the total number of percentage points accumulated. These percentage points are weighed so that the approximate breakdown looks as follows: As a guide, letter grades will generally be assigned as follows: Total percentage in the 90's- A, 80's- B, 70's- C, 60's- D, below 60's- F; providing that you have accumulated the minimum number of points needed for passing the course (150), and minimum number of lab reports. "+" and "-" will be adopted.

You are welcome to discuss any grade with Prof. Olek or Prof. Zavattieri. It is important that this is done shortly after the graded work is returned. There will be no general review of prior work to find "extra points" toward the end of the semester. You are free to contest laboratory, homework, or exam grades; however this must be done in writing and submitted in person to Prof. Olek or Prof. Zavattieri. This written explanation should include the location of the problem you are requesting review for along with a where the error is believed to have occurred. The item in dispute must be submitted before the end of the first lecture following the return of the homework, lab assignment, or lecture.

It is important that you always check your grades on Blackboard, and estimate your own overall grade. If you have questions or concerns about your grades, or performance in general, contact Prof. Olek or Prof. Zavattieri.

Academic Integrity:

Academic integrity is expected of all students at all times. Information on what constitutes academic integrity may be found in the handbook University Regulations. Purdue prohibits "dishonesty in connection with any University activity. Cheating, plagiarism, or knowingly furnishing false information to the University are examples of dishonesty." [Part 5, Section III-B-2-a, University Regulations] Furthermore, the University Senate has stipulated that "the commitment of acts of cheating, lying, and deceit in any of their diverse forms (such as the use of substitutes for taking examinations, the use of illegal cribs, plagiarism, and copying during examinations) is dishonest and must not be tolerated. Moreover, knowingly to aid and abet, directly or indirectly, other parties in committing dishonest acts is in itself dishonest." [University Senate Document 72-18, December 15, 1972]

Information on what constitutes academic integrity may be found in the Purdue's student guide for academic integrity (http://www.purdue.edu/odos/aboutodos/academicintegrity.php)

Use of Copyrighted Materials

Among the materials that may be protected by copyright law are the lectures, notes, and other material presented in class or as part of the course. Always assume the materials presented by an instructor are

protected by copyright unless the instructor has stated otherwise. Students enrolled in, and authorized visitors to, Purdue University courses are permitted to take notes, which they may use for individual/group study or for other non-commercial purposes reasonably arising from enrollment in the course or the University generally.

Notes taken in class are, however, generally considered to be "derivative works" of the instructor's presentations and materials, and they are thus subject to the instructor's copyright in such presentations and materials. No individual is permitted to sell or otherwise barter notes, either to other students or to any commercial concern, for a course without the express written permission of the course instructor. To obtain permission to sell or barter notes, the individual wishing to sell or barter the notes must be registered in the course or must be an approved visitor to the class. Course instructors may choose to grant or not grant such permission at their own discretion, and may require a review of the notes prior to their being sold or bartered. If they do grant such permission, they may revoke it at any time, if they so choose.

Violent Behavior Policy

Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity. See the following website for additional information: http://www.purdue.edu/policies/pages/facilities_lands/i_2_3.shtml

Students with Disabilities

Purdue University is required to respond to the needs of the students with disabilities as outlined in both the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 through the provision of auxiliary aids and services that allow a student with a disability to fully access and participate in the programs, services, and activities at Purdue University. If you have a disability that requires special academic accommodation, please make an appointment to speak with me within the first three (3) weeks of the semester in order to discuss any adjustments. It is important that we talk about this at the beginning of the semester. It is the student's responsibility to notify the Disability Resource Center (http://www.purdue.edu/drc) of an impairment/condition that may require accommodations and/or classroom modifications.

Nondiscrimination

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Purdue University prohibits discrimination against any member of the University community on the basis of race, religion, color, sex, age, national origin or ancestry, genetic information, marital status, parental status, sexual orientation, gender identity and expression, disability, or status as a veteran. The University will conduct its programs, services and activities consistent with applicable

federal, state and local laws, regulations and orders and in conformance with the procedures and limitations as set forth in Executive Memorandum No. D-1, which provides specific contractual rights and remedies. Any student who believes they have been discriminated against may visit www.purdue.edu/report-hate to submit a complaint to the Office of Institutional Equity. Information may be reported anonymously.

Emergency Procedures:

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances. Information will be provided via email and/or Blackboard. If a student suspects he or she may have symptoms associated with the swine flu, you are encouraged to seek medical help and not come to class. Please see Purdue's Emergency Preparedness website at http://www.purdue.edu/emergency_preparedness/index.htm, and the Adverse Winter Weather Procedures and Announcements.

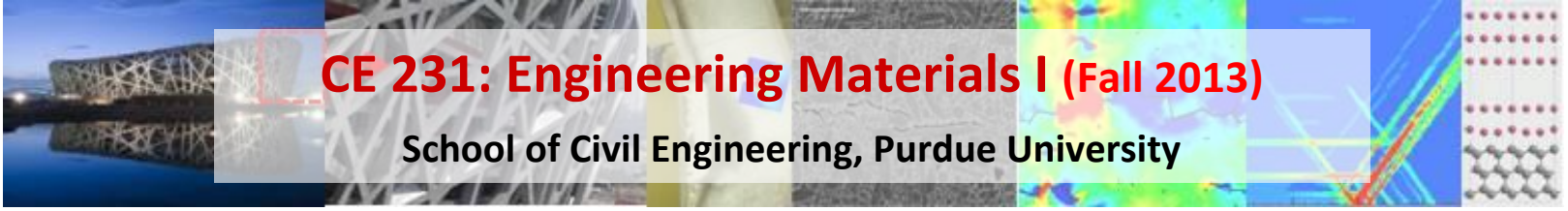
Emergency exist plans have been prepared for all classrooms located in engineering buildings. The following link provides critical information Evacuation and Shelter-in-place for our main classroom HAMP 1144: https://engineering.purdue.edu/Intranet/Groups/Administration/RPM/Safety/ClassroomEmergencyPlanning/CIVL/CIVL%201144.pdf

Here are ways to get information about changes in this course:

- Course information on Blackboard: http://www.itap.purdue.edu/tlt/blackboard/index.cfm
- Instructors' contact information: Prof. Jan Olek, (765) 494-5015, olek@purdue.edu, Prof. Pablo Zavattieri, (765) 496-9644, zavattie@purdue.edu
- Instructors' web pages:
    - http://engineering.purdue.edu/~olek
    - http://engineering.purdue.edu/~zavattie

Others

No food in the lab. Absolutely no cell phones in the classroom or lab.



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Schedule

This is a tentative schedule and it is intended to be a guide for the reading assignments. Students are expected to anticipate the topics that will be covered in class by attending the classes and following this guide**. You are expected to have read the reading assignment before you come to lecture or labs.** Any type of change to this schedule will be announced at the beginning of the class.

Mon	19-Aug	Introduction to the course	Chapter 1	Chapter 1	
Mon, Tues	19,20-Aug	**No Lab Week**			
Wed	21-Aug	Statics, Forces, Stress	1.2-1.3		
Fri	23-Aug	LAB PREP 1, Machine Operation & Material Variability	1.3-1.5		1
Mon	26-Aug	Stress 3D	1.3-1.5		
Mon, Tues	26,27-Aug	LAB 1, Machine Operation & Material Variability			1
Wed	28-Aug	Plane Stress	Chapter 9.1		
Fri	30-Aug	**Lecture**: Stress Transformation	9.2-9.3		
Mon	2-Sep	**LABOR DAY (No Classes)**			
Mon, Tues	2,3-Sep	**No Lab Week**			
Wed	4-Sep	Stress Transformation	9.2-9.3		
Fri	6-Sep	LAB PREP 2, Strain Measurement / Mohr's Circle			2,3
Mon	9-Sep	Principal Stress	9.2-9.3		
Mon, Tues	9,10-Sep	LAB 2, Strain Measurement / Mohr's Circle			2,3
Wed	11-Sep	Mohr's Circle	Chapter 10.2		
Fri	13-Sep	LAB PREP 3, Compression Testing			4
Mon	16-Sep	Mohr's Circle - Examples	9.4		
Mon, Tues	16,17-Sep	LAB 3, Compression Testing			4
Wed	18-Sep	Mohr's Circle for Strain	10.3-10.5		
Fri	20-Sep	LAB PREP 4, Tensile Testing			7
Mon	23-Sep	Stress-Strain Behavior	4.7-4.9	Chapter 6	
Mon, Tues	23,24-Sep	LAB 4, Tensile Testing			7
Wed	25-Sep	Stress-Strain Behavior	4.7-4.9	Chapter 6	
Fri	27-Sep	**Exam 1**			
Mon	30-Sep	Elastic Stress-Strain Behavior	"	"	
Mon, Tues	30-Sep,1-Oct	**No Lab Week**			
Wed	2-Oct	Generalized Hooke's Law	"	"	
Fri	4-Oct	Elasticity Problems 1	"	"	
Mon	7-Oct	**OCTOBER BREAK (No Classes)**			
Mon, Tues	7,8-Oct	**No Lab Week**			
Wed	9-Oct	Elasticity Problems 2	"	"	
Fri	11-Oct	LAB PREP 5, Torsion Test			8
Mon	14-Oct	Inelastic Behavior	4.7-4.9	6.1-6.3	
Mon, Tues	14,15-Oct	LAB 5, Torsion Test			8
Wed	16-Oct	Inelastic Behavior	4.7-4.9	6.1-6.3	
Fri	18-Oct	LAB PREP 6, Hardness Test Lab			9
Mon	21-Oct	Inelastic Behavior	4.7-4.9	6.1-6.3	
Mon, Tues	21,22-Oct	LAB 6, Hardness Test Lab			9
Wed	23-Oct	Finite Element Method (FEM) - Theory		handouts	
Fri	25-Oct	LAB PREP 7, Finite Element Lab		handouts	
Mon	28-Oct	Lab 7, Finite Element Lab			10
Mon, Tues	28,29-Oct	Lab 7, Finite Element Lab-continuation		handouts	
Wed	30-Oct	Atoms		Chapter 2/3	
Fri	1-Nov	LAB PREP 8, Dynamic Impact Lab			10
Mon	4-Nov	**Exam 2**			

Mon, Tues	4,5-Nov	Lab 8, Dynamic Impact Lab			10
Wed	6-Nov	Atomic Bonding		Chapter 2/3	
Fri	8-Nov	LAB PREP 9, Crystal Structure			5
Mon	11-Nov	Atomic Bonding/Crystal Lattices		Chapter 3	
Mon, Tues	11,12-Nov	Lab 9, Crystal Structure			5
Wed	13-Nov	Theoretical Properties		handous	
Fri	15-Nov	LAB PREP 10, Non-Conventional Materials		handouts	
Mon	18-Nov	Phase Diagrams		Chapter 9	
Mon, Tues	18,19-Nov	Lab 10, Non-Conventional Materials		handouts	
Wed	20-Nov	Phase Diagram		Chapter 9	
Fri	22-Nov	**Lecture**: Phase Diagram (Fe-C) - steel		Chapter 9	
Mon	25-Nov	Kinetics - Heat treatment		Chapter 10	
Mon, Tues	25,26-Nov	**No Lab Week**			
Wed	27-Nov	**THANKSGIVING VACATION (No Classes)**			
Fri	29-Nov				
Mon	2-Dec	Corrosion		Chapter 14.4	
Mon, Tues	2,3-Dec	**No Lab Week**			
Wed	4-Dec	Corrosion		Chapter 14.4	
Fri	6-Dec	Review Session		all	
Final Exam		**TBA**