



CE 336 – Sec: 001
MATERIALS SCIENCE FOR CIVIL ENGINEERS

The Pennsylvania State University
Department of Civil and Environmental Engineering
Spring 2013

Hours

Lecture	MWF	10:10-11:00am	WILLARD 158
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Instructor

Prof. Farshad Rajabipour
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Email: farshad@psu.edu
Office Hours: M 11am – 2pm or by appointment

Textbooks

Required: M.S. Mamlouk, and J.P. Zaniewski, (2010) “Materials for Civil and Construction Engineers”, 3rd Ed., Pearson Prentice Hall, New Jersey

Recommended: W.D. Callister, D.G. Rethwisch (2009) “Materials Science and Engineering: An Introduction”, 8th Ed., Wiley, New York

Course Objectives

The main objective of this course is to enable students to relate (1) manufacturing and processing of construction materials to (2) their microstructure and (3) macroscopic properties. By understanding the interconnection between these three elements, students will be able to predict the short- and long-term performance of various construction materials. In addition, students will be able to design material processing and production that results in optimal mechanical and durability related properties suited for different construction applications. As such, this course provides a bridge between engineering mechanics (e.g., properties) and engineering design (e.g., processing) of materials.

By the end of semester, students will be able to understand, explain, characterize, and predict the behavior of particulate materials (aggregates), Portland cement and concrete, bituminous materials, structural steel, and wood. Durability, life expectancy, and recycling of materials will be discussed in addition to the mechanical properties (e.g., elastic, viscoelastic, etc.) and ability to resist fracturing and mechanical failure. The students will achieve these objectives through in-class practices, homework exercises, and reading assignments. In addition, in a following laboratory course, CE 337, students will link their knowledge of material behavior with testing and characterization of materials.

Prerequisites

E MCH 213 – Strength of Materials

STAT 401 – Experimental Methods

Attendance

Students are expected (**REQUIRED**) to attend all classes and examinations. Class attendance will be checked using unannounced quizzes and/or attendance sheets that will be given at the BEGINNING of class.

Exception: If you are experiencing flu-like symptoms, I ask that you do not attend class to safeguard the health of your classmates. No doctor's note is required; however, I ask that you inform me by email no later than 9am on the day of the class. If there is homework due on the day of your absence, you are still required to submit the homework by email or through a classmate. If you miss a quiz due to your absence, you will be given a chance to take the quiz at a later date.

Exams Absence: If you feel flu-like symptoms before an exam day, I ask that you inform me at least 24 hours in advance. Proper arrangements will be made for you to take the exam in quarantine at the same date and time as other students.

Grading

Exams (3 exams)	60%
Homeworks (8)	28%
Quizzes	5%
Attendance	3.5%
Participation	3.5%

The course is NOT graded on a CURVE. Final letter grades are assigned based on the total number of percentage points accumulated as follows:

93 – 100	A	76 – 79	C+
89 – 93	A-	69 – 76	C
86 – 89	B+	60 – 69	D
83 – 86	B	below 60	F
79 – 83	B-		

You are welcome to discuss any grade with me. You should submit a WRITTEN request for grade review within 2 days after the graded homework or exam is returned.

Homeworks

There will be 8 homework assignments in this course. The tentative due dates for these assignments are included in your syllabus; exact due dates will be announced in class. Homework is due at the beginning of each class (e.g., 10:10am on the due date). No late submissions will be accepted; however, in extreme circumstances, the instructor may consider a late submission and assign a penalty for not meeting the due date/time. Homework solutions will be made available on the ANGEL Course Management system within 3 days of the due date.

All homeworks should be submitted in a format that is consistent with professional engineering practice. Solutions must be prepared using word processing software (e.g., Microsoft Word) or **legibly** hand written on either plain (i.e., unlined paper) or engineering paper. Graphs should be prepared using Excel, Grapher, or similar software. No hand-drawn graph will be accepted. You can use both side of paper to prepare homework solutions; however, each sheet/side of paper must not include more than one problem. All sheets should

contain your name and assignment number. All pages must be stapled together. The student will be responsible for missing pages if sheets are not stapled.

It is expected that the solution contain a clear description of the problem including what are the problem givens, nomenclature, and the unknowns. The solution is to be worked in an organized manner with relevant calculations and notes as appropriate. The answer is to be placed in a box or underlined 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 results. These rules are applied to the exams as well.

Failure to follow these guidelines may result in loss of credit regardless of the correctness of your answers. Students are expected, even encouraged, to consult with one another on homework assignments. However, all work submitted by the student is expected to be her/his own effort. If there is a reason to believe that work has been copied from another student, university regulations may be invoked regarding punitive action. Furthermore, the instructor reserves the right to assign a failing grade for either the specific work or for the entire course.

Exams

There will be three exams in this course. Two **mid-term exams** will be given during class on **2/11/13** and **3/18/13**, and a **final exam** will be given on during finals week. All exams are closed book and closed notes. Relevant formulas will be provided with the exam sheet. 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 regarding 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.

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 (see followings for details). 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 (except for the influenza policy stated above). 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 letter's author. In such case, the instructor reserves the right to accept or decline the excuse.

Academic Integrity

Students are expected to uphold the highest academic integrity. Any deviation will result in disciplinary measures consistent with University policies, including a grade of zero points for that assignment and potentially a failing grade in the class. Please consult the university and College of Engineering policies at <http://www.engr.psu.edu/CurrentStudents/acadinteg.aspx>

Syllabus

	Date	Lecture Number	Day	Lecture Title	Mamlouk & Zaniewski	Handouts	Due
Week 1:	1/7/13	1	M	Introduction		✓	
	1/9/13	2	W	Review Mechanics	1.2	✓	
	1/11/13	3	F	Review Mechanics	1.2-3	✓	
Week 2:	1/14/13	4	M	Mechanical Failure	1.2.9	✓	
	1/16/13	5	W	Fracture Mechanics		✓	
	1/18/13	6	F	Fracture Mechanics		✓	HW1
Week 3:	1/21/13		M	MLK Day - No Class			
	1/23/13	7	W	Viscosity		✓	
	1/25/13	8	F	Viscosity		✓	HW2
Week 4:	1/28/13	9	M	Viscosity		✓	
	1/30/13	10	W	Viscoelasticity	1.2.6-8	✓	
	2/1/13	11	F	Viscoelasticity	1.2.6-8	✓	
Week 5:	2/4/13	12	M	Viscoelasticity	1.2.6-8	✓	
	2/6/13	13	W	Atomic and Molecular Bonding	2.1	✓	
	2/8/13	14	F	Review and exam prep		✓	HW3
Week 6:	2/11/13	15	M	Midterm Exam 1			
	2/13/13	16	W	Microstructure of Solids	2.2	✓	
	2/15/13	17	F	Microstructure of Solids	2.2	✓	
Week 7:	2/18/13	18	M	Exam 1 Solutions			
	2/20/13	19	W	Structural Steel	3	✓	
	2/22/13	20	F	Case Studies in Steel Failures		✓	HW4
Week 8:	2/25/13	21	M	Aggregate Mineralogies	5.1-4	✓	
	2/27/13	22	W	Weight to Vol Conversions	5.5	✓	
	3/1/13	23	F	Aggregate Gradations	5.5.8-11	✓	
Week 9:	3/4/13		M	Spring Break			
	3/6/13		W	Spring Break			
	3/8/13		F	Spring Break			
Week 10:	3/11/13	24	M	Introduction to Concrete		✓	HW5
	3/13/13	25	W	Concrete Microstructure, Porosity	6.6.8	✓	
	3/15/13	26	F	Review and exam prep		✓	
Week 11:	3/18/13	27	M	Midterm Exam 2			
	3/20/13	28	W	PCC Mix Design	7.1	✓	
	3/22/13	29	F	PCC Mix Design	7.1	✓	
Week 12:	3/25/13	30	M	Exam 2 Solutions		✓	
	3/27/13	31	W	Portland Cement	6.1-4,9	✓	
	3/29/13	32	F	Cement Hydration	6.5-6	✓	HW6
Week 13:	4/1/13	33	M	Supplementary Cementitious Materials	6.11	✓	
	4/3/13	34	W	Asphalt Binders	9.1-4	✓	
	4/5/13	35	F	Binder Gradation	9.5-6	✓	
	4/8/13	36	M	Binder Gradation	9.7-8	✓	
	4/10/13	37	W	HMA Volumetric Calculations	9.9.2	✓	
	4/12/13	38	F	HMA Volumetric Calculations	9.9.2	✓	
Week 14:	4/15/13	39	M	HMA Mix Design	9.9	✓	
	4/17/13	40	W	HMA Mix Design	9.9	✓	
	4/19/13	41	F	Wood	10.1-5	✓	HW7
Week 15:	4/22/13	42	M	Wood	10.6-13	✓	
	4/24/13	43	W	Engineering Materials for Sustainability		✓	
	4/26/13	44	F	Review and exam prep		✓	HW8
Week 16:	Final Exam: During the exam week April 29 - May 3						