CE 584
CONCRETE MATERIALS AND PROPERTIES

The Pennsylvania State University
Department of Civil and Environmental Engineering
Spring 2014

Hours

Lecture	TR	8-9:15am	SACKETT 318

Instructor

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Office Hours: T 9:30 – 11am or by appointment

Textbooks

Required: S. Mindess, J.F. Young, D. Darwin (2003). "Concrete", 2nd Ed., Prentice Hall, Upper Saddle River, New Jersey

Other References: S.H. Kosmatka, M.L. Wilson (2011). "Design and control of concrete mixtures",15th Ed., Portland Cement Association, Skokie, Illinois

P.K. Mehta, P.J.M. Monteiro (2013). "Concrete: Microstructure, Properties, and Materials", 4th Ed., McGraw Hill, New York

J. Bensted, P. Barned (2002). "Structure and Performance of Cements", 2nd Ed., Spon Press, New York

Course Objectives

This course provides a comprehensive treatment of the materials engineering principles that result in design, production, construction, and maintenance of high quality concrete materials for buildings and infrastructure. By the end of semester, students will acquire necessary knowledge to design, inspect the quality, and evaluate the performance of various cement-based materials. This knowledge is gained through lectures, homework assignments, simple computer simulations, and an independent study. Particularly, students will practice and learn to characterize and predict the mechanical and durability behavior of aggregates, portland cement, alternative cements and other concrete products. Novel eco-friendly concretes such as geo-polymers will be covered as well.

Prerequisites

CE 336 – Materials Science for CE or an equivalent undergraduate materials science course

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 or telephone 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 (2 exams)	60%
Homeworks	15%
Project/Presentation	15%
Quizzes	6%
Attendance and Participation	4%

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

92 – 100	A	75 – 78	C+
88 – 92	A-	68 – 75	C
85 – 88	B+	60 – 68	D
82 – 85	B	below 60	F
78 – 82	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.

Homework Assignments

There will be at least 4 homework assignments in this course. The tentative due dates for these assignments will be included in your syllabus; exact due dates will be announced in class. Homework is due at the beginning of each class (e.g., 8am 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.

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, SigmaPlot, 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 the sheets should contain your name and assignment number. All pages must be stapled together.

It is expected that the solution 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 (use straight-edges in making these diagrams). 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. 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. Finally, all pages are to be stapled together before submission. The student will be responsible for missing pages if sheets are not stapled. These rules are also 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 his/her 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.

Course Project

Details of the course project will be discussed in class during the first 2 weeks of the semester.

Exams

There will be two exams in this course. A **mid-term exam** will be given during class on **3/6/14**, and a **final exam** will be given on during finals week. 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

Schedule (tentative)

	Date	Lecture Number	Day	Lecture Title	MYD Chapters	PCA Chapters	B&B Chapters	Handouts
Week 1:	1/14/14	1	T	Aggregates 1	7	6		√
	1/16/14	2	R	Intro; Concrete as a Composite	1,2	1,2		√
Week 2:	1/21/14	3	T	Aggregates 2 + Water	6,7	5,6		√
	1/23/14	4	R	Portland Cement: Manufacturing and Comp	3	3	1,2	√
Week 3:	1/28/14	5	T	PC Hydration	4		3	√
	1/30/14	6	R	Microstructure of Hardened Cement Paste	4		3	√
Week 4:	2/4/14	7	T	Mixture Proportioning	10	12		√
	2/6/14	8	R	Mineral Admixtures	5	4	12, 14	√
Week 5:	2/11/14	9	T	Chemical Admixtures	8	7		√
	2/13/14	10	R	Fresh Properties, Curing, Maturity	9, 12	9,15		√
Week 6:	2/18/14	11	T	Mechanical Properties 1	13	9		√
	2/20/14	12	R	Mechanical Properties 2	13	9		
Week 7:	2/25/14	13	T	Construction Operations	11	13,14		
	2/27/14	14	R	Concrete w ith Recycled Agg				√
Week 8:	3/4/14	15	T	Review and Exam Prep				
	3/6/14	16	R	Mid-term Exam				
Week 9:	3/11/14		T	Spring Break - No Class				
	3/13/14		R	Spring Break - No Class				
Week 10:	3/18/14	17	T	Alternative Cements: Geopolymers				√
	3/20/14	18	R	Alternative Cements: CACs and CSACs			4,6	√
Week 11:	3/25/14	19	T	Durability: Corrosion	18	11		√
	3/27/14	20	R	Duarbility: ASR	7	11	9	√
Week 12:	4/1/14	21	T	Drying and Shrinkage	16	10		√
	4/3/14	22	R	CITEL visit				√
Week 13:	4/8/14	23	T	Drying and Shrinkage	16	10		√
	4/10/14	24	R	Thermodynamic Modeling				√
Week 14:	4/15/14	25	T	Oilw ell Cements			7	√
	4/17/14	26	R	NDE Methods				√
Week 15:	4/22/14	27	T	Review and Exam Prep				√
	4/24/14	28	R	Student Presentations				
Week 16:	4/29/14	29	T	Student Presentations				
	5/1/14	30	R	Student Presentations				√
Week 17:	Final Exam: During the exam w eek May 5 - 9							