CE 436 – Sec: 001
CONSTRUCTION ENGINEERING MATERIALS

The Pennsylvania State University
Department of Civil and Environmental Engineering
Fall 2010

Hours

Lecture	TR	8-9:15am	WILLARD 073

Instructor

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Office Hours: T 4 – 7pm or by appointment

Textbooks

Required: M.F. Ashby (2009) "Materials and the Environment: Eco-Informed Material Choices", Butterworth-Heinemann, Burlington, Massachusetts

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

Course Objectives

Our industrialized world is producing materials in tens of billions of tons. Much of these materials are used in construction (with concrete being the dominant man-made material). Materials are resource and energy intensive and often result in eco-negative impacts (e.g., CO_2, waste production). As civil engineers, we are responsible to design and build structures that are not only safe but also energy efficient, environmentally benign, and economically viable over their entire life-cycle (i.e., material production, transportation, construction, use, end of first life). This course introduces students to simplified techniques of designing materials to minimize their environmental impact. While the first half of the course provides perspective, background, methods, and data (a toolbox, so to speak) applicable to all materials, the second half focuses on examples and applications related to construction materials: aggregates, cements and concretes, metals, ceramics, polymers, and composites.

By the end of semester, students will be able to explain the link between materials and their eco-impact, utilize principles of life-cycle assessment and eco-data of materials to quantify the energy and carbon footprint of structural materials during the five phases of their service-life, identify the most important material properties for optimizing mechanical, durability, energy, and eco-performance of products, and apply optimization strategies to select the best material choice for particular applications. In addition, the course will complement CE 336 learning objectives by enabling students to characterize and predict the behavior of concrete, composites, and polymeric materials. The course is designed to emphasize active learning through interactive classroom discussions, computer simulations, and laboratory exercises.

Prerequisites

CE 336 – Materials Science for CE 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 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 (8)	24%
Presentation	3%
Quizzes	6%
Attendance and Participation	7%

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.

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., 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 within 2 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, SigmaPlot, or similar software. Homework problems solved using CES software, often include graphs (e.g., bar or bubble charts) created by this 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. 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. 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.

Exams

There will be two exams in this course. A **mid-term exam** will be given during class on **10/26/10**, 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

Syllabus

	Date	Lecture Number	Day	Lecture Title	Ashby	Mamlouk & Zaniewski	Handouts	Due
Week 1:	8/24/10	1	T	Intro: Materials and the Environment	Ch. 1		√	
	8/26/10	2	R	Resource Consumption	Ch. 2		√	
Week 2:	8/31/10	3	T	Choices at End of First Life	Ch. 4, 5		√	
	9/2/10	4	R	CES EduPack Exercise 1: Introduction			√	HW1
Week 3:	9/7/10	5	T	LCA-Basics	Ch. 3		√	
	9/9/10	6	R	LCA-Ecodata of Materials	Ch. 6		√	HW2
Week 4:	9/14/10	7	T	Eco-audits	Ch. 7		√	
	9/16/10	8	R	CES EduPack Exercise 2: Eco-audits			√	
Week 5:	9/21/10	9	T	Selection Strategies	Ch. 8		√	
	9/23/10	10	R	Eco-audits: Case Studies (student pres)	Ch. 7			HW3
Week 6:	9/28/10	11	T	Material Indices	Ch. 8		√	
	9/30/10	12	R	CES EduPack Exercise 3: Selection			√	
Week 7:	10/5/10	13	T	Eco-Design of Materials	Ch. 9		√	
	10/7/10	14	R	Eco-Design Exercises (student pres)	Ch. 9			HW4
Week 8:	10/12/10	15	T	Green Buildings: LEED			√	
	10/14/10	16	R	CE Materials: Aggregates and Concrete		Ch. 5, 6	√	
Week 9:	10/19/10	17	T	Concrete: Fresh Properties		6.7,11; 7.2-3	√	
	10/21/10	18	R	Review and exam prep			√	
Week 10:	10/26/10	19	T	Midterm Exam				
	10/28/10	20	R	Concrete: Mechanical Properties		7.5	√	HW5
Week 11:	11/2/10	21	T	Concrete: Durability 1			√	
	11/4/10	22	R	Concrete: Durability 2			√	
Week 12:	11/9/10	23	T	Concrete Laboratory			√	
	11/11/10	24	R	CE Materials: Composites		Ch. 11	√	HW6
Week 13:	11/16/10	25	T	Micro-mechanics		Ch. 11	√	
	11/18/10	26	R	CE Materials: Ceramics			√	
Week 14:	11/23/10		T	Thanksgiving Break - No Class				
	11/25/10		R	Thanksgiving Break - No Class				
Week 15:	11/30/10	27	T	CE Materials: Polymers			√	
	12/2/10	28	R	CE Materials: Metals		Ch. 3, 4	√	HW7
Week 16:	12/7/10	29	T	Structural Steel		Ch. 3, 4	√	
	12/9/10	30	R	Review and exam prep			√	HW8
Week 17:	Final Exam: During the exam w eek Dec 13-17							