Syllabus
CE 3600: Civil Engineering Materials
TTh 9:30 to 11:00, Lafferre E2511
Fall 2013

Instructor: Dr. Sarah Orton
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Office hours: Stop in any time (generally available TTh 11-12 pm); or call or email for appointment.

Course Description: This course will cover civil engineering materials including concrete, metals, polymers, and wood. The composition and fabrication of the materials will be discussed and class and physical and mechanical characteristics of the materials measured in the laboratory.

Recommended
The books listed below also treat some of the topics covered in the course in an excellent manner. Additional references include documents from the Portland Cement Association (PCA), the American Concrete Institute's (ACI) Manual of Concrete Practice and the American Society for Testing and Materials (ASTM) standards. These documents can be accessed through Blackboard.

For general reference on almost all topics in class, and asphalt and wood

Detailed reference for Concrete

Detailed reference for metals, fracture and fatigue, composites


Detailed reference on fiber reinforced concrete

Detailed reference on composites

PREREQUISITES: CV ENG 2200 (Strengths of Materials)

TOPICS

1. Materials Introduction
   a. Material Selection
   b. Mechanical and Non-Mechanical properties
   c. Material Variability
   d. Laboratory Measuring Devices

2. Concrete I
   a. Aggregates
      i. Properties
      ii. Test methods
      iii. Gradation
   b. Cement
      i. Types
      ii. Production
      iii. Hydration Process
   c. Water and Air
      i. Water cement ratio
      ii. Air entrainment
      iii. Additives in concrete

Reference
Mamlouk
PCA, ACI, ASTM
d. Proportioning (Mix Design)
   i. Concrete proportioning
   ii. Mixing, handling, placing methods
   iii. Curing

3. Metals
   a. Structure of metals
      i. Metallic state
      ii. Lattice defects
      iii. Phase diagram
   b. Mechanical Properties of Metals
      i. Stress strain diagram
      ii. Yield criterion
      iii. Hardness
   c. Steel – manufacture and composition
   d. Heat Treatment and Alloyming
      i. TTT diagram
      ii. Effects of alloys
   e. Aluminum
      i. Benefits
      ii. Manufacture

4. Concrete II
   a. Hardened Properties of Concrete
   b. Concrete composites
   c. Concrete durability

5. Corrosion
   a. Electrochemical Process
   b. Galvanic Cell
   c. Corrosion Control

6. Fatigue and Fracture
   a. Process of fracture
   b. S-N diagram
   c. Propagation of fatigue cracks
   d. Factors affecting fatigue life

7. Composites/Polymers
   a. Polymerization - Basic Concepts
   b. Mechanical Behavior of Polymers

8. Wood
   a. Mechanical Properties - Compression
   b. Mechanical Properties - Tension
   c. Mechanical Properties - Flexure

9. Masonry
   a. Manufacture process of masonry units
   b. Mortars, grouts, plasters
   c. Test methods

10. Asphalt
    a. Types
    b. Desirable properties
    c. Mix design process

CREDIT DISTRIBUTION
Homework 5%
3 Exams 40%
Lab Reports 35%
Final Exam (May 14th 10am) or
Optional Final Project 20%
Total 100%
**GRADING SCALE**

**Undergraduate:**
- 92-100 (A), 90-91 (A-), 88-89 (B+), 83-87 (B), 80-82 (B-), 78-79 (C+), 73-77 (C), 70-72 (C-), 60-69 (D), 59 or less (F)

Students must receive a grade of 60% or better in the lab reports in order to receive a grade of D or better for the class.

**Homework and Labs:** All homework and lab reports will be completed in a neat and clear manner. Homework is due at the beginning of class on the due date. Labs are due by 3pm on the Friday one week after the lab is performed in the mailbox labeled “CE Materials Lab” in the CE department office. Late homework and labs are not accepted except in special circumstances.

**Calculators:** Only calculators of the type permitted on the FE exam may be used for exams in this class. For a list of calculators go to [http://www.ncees.org/Exams/Calculator_policy.php](http://www.ncees.org/Exams/Calculator_policy.php)

**Reviews:** At the end of each series of lecture slides students will receive a list of review questions to help them determine if they have learned the needed material. The answers to the questions will be discussed in the next day’s class. Students must attend class to know the answers to the questions.

**ADA Statement:** If you need accommodations because of a disability, if you have emergency medical information to share with me, or if you need special arrangements in case the building must be evacuated, please inform me immediately. Please see me privately after class, or at my office.

To request academic accommodations (for example, a notetaker), students must also register with the Office of Disability Services, S5 Memorial Union, 882-4696. It is the campus office responsible for reviewing documentation provided by students requesting academic accommodations, and for accommodations planning in cooperation with students and instructors, as needed and consistent with course requirements. For other MU resources for students with disabilities, click on "Disability Resources“ on the MU homepage.

**Academic Integrity:** Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from The University. Since such dishonesty harms the individual, all students, and the integrity of The University, policies on scholastic dishonesty will be strictly enforced.

Academic honesty is fundamental to the activities and principles of a university. All members of the academic community must be confident that each person’s work has been responsibly and honorably acquired, developed, and presented. Any effort to gain an advantage not given to all students is dishonest, whether or not the effort is successful. The academic community regards breaches of the academic integrity rules as extremely serious matters. Sanctions for such a breach may include academic sanctions from the instructor, including failing the course for any violation, to disciplinary sanctions ranging from probation to expulsion. When in doubt about collaboration, plagiarism, paraphrasing or quoting, please consult with me.

The University community welcomes intellectual diversity and respects student rights. Students who have questions concerning the quality of instruction in this class may address concerns to either the Departmental Chair or Divisional leader or Director of the Office of Students Rights and Responsibilities (http://osrr.missouri.edu/). All students will have the opportunity to submit an anonymous evaluation of the instructor(s) at the end of the course.

**Recording:** University of Missouri System Executive Order No. 38 lays out principles regarding the sanctity of classroom discussions at the university. The policy is described fully in Section 200.015 of the Collected Rules and Regulations. In this class, students may make audio or video recordings of course activity unless specifically prohibited by the faculty member. However, the redistribution of audio or video recordings of statements or comments from the course to individuals who are not students in the course is prohibited without the express permission of the faculty member and of any students who are recorded. Students found to have violated this policy are subject to discipline in accordance with provisions of Section 200.020 of the Collected Rules and Regulations of the University of Missouri pertaining to student conduct matters.