

UNIVERSITY OF SOUTHERN CALIFORNIA

Viterbi School of Engineering

The instructor reserves the right to modify this syllabus. Students will be notified of any changes.

CE 334L – Mechanical Behavior of Materials

Term: Fall 2018

Instructor: Bora Gencturk, Ph.D., P.E.

Office: KAP 234B

Office Hours: Mondays and Wednesdays 10 am – 12.00 pm

Office Phone: (213) 821-1036

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Teaching Assistants:

- Lauren Crawford (crawforl@usc.edu), Office Hours: Mondays 10-11 am, KAP B28
- Mohammad Hanifehzadeh (hanifzadehm@gmail.com), Office Hours: Thursdays 3.30-4.30 pm, KAP B28
- Xiaoying Pan (xiaoynp@usc.edu), Office Hours: Wednesdays 3.30-4.30 pm
- Jinwoo Im (jinwooim@usc.edu), Office Hours: Fridays 10-11 am, KAP B28

Lectures: Mondays and Wednesdays, 2:00 pm – 3:20 pm, KAP 158

Laboratory Sessions: Mondays, 11 am – 1:50 pm, KAP B28 (TAs: Lauren and Jinwoo)

Tuesdays, 11 am – 1:50 pm, KAP B28 (TAs: Mohammad and Xiaoying)

Thursdays, 2-4.50 pm, KAP B28 (TAs: Mohammad and Xiaoying)

Fridays, 1-3:50 pm, KAP B28 (TAs: Lauren and Jinwoo)

Required Textbook:

- *Materials for Civil and Construction Engineers*, S. M. Mamlouk and J. P. Zaniewski, 4th ed., Pearson, 2016.

Recommended Textbook:

- *Introduction to Materials Science for Engineers*, J. M. Shackelford, 8th ed., Pearson, 2014.
- *Mechanical Behavior of Materials*, N. M. Dowling, 4th ed., Pearson, 2013.
- *Mechanics of Materials*, R. C. Hibbeler, 10th ed., Pearson, 2015.
- *Experimental Methods for Engineers*, J.P. Holman, 8th ed., McGraw Hill, 2011.
- *Introduction to Engineering Experimentation*, A. J. Wheeler and A. R. Ganji, 3rd ed., Pearson, 2010.
- *Design and Control of Concrete Mixtures*, S. H. Kosmatka and M. L. Wilson, 16th ed., Portland Cement Association, 2016.

Website: <https://blackboard.usc.edu> (login with myUSC credentials)

Announcements, notes, handouts, homework assignments, laboratory data, etc. will be posted on the Web Site. Students are responsible for checking and downloading the

material in a timely manner. Printed copies of certain (but not all) course material will be provided.

Software: Most of the material will be in PDF or will require a Microsoft Office application to open. Adobe Reader may downloaded for free from <https://get.adobe.com/reader/> while Microsoft (MS) Office is available free of charge for USC students. Students are encouraged to use Matlab for post-processing laboratory data and creating graphs. Matlab is available to USC students free of charge. See <https://itservices.usc.edu/> for MS Office and Matlab.

Prerequisites: AME 204 or CE225, CHEM 105a or CHEM 115a, and PHYS 152

Co-requisites: N/A

Course Objectives and Emphasis: The primary goal of this course is to provide the students with a foundation on the basic science and engineering of typical materials used in civil engineering, and the testing procedures, instrumentation, and the role of testing for analysis and design in civil engineering. The students are expected to build upon previously acquired skills in mathematics, physics, chemistry and mechanics of materials. Laboratory sessions provide hands-on experience and understanding of the mechanical behavior of various types of materials and testing techniques including instrumentation.

Course Outcomes of Instruction and Laboratory Sessions:

- Students demonstrate an understanding of elastic deformation, including the concept of elastic moduli from linear elastic deformation to anisotropic elasticity as they relate to both theory and experiments.
- Students demonstrate an understanding of plastic deformation, including plastic flow, stress-strain behavior, and yield and failure criteria as they relate to both theory and experiments.
- Students demonstrate an understanding of the differences in physical and mechanical properties of typical engineering materials, including metals, concrete, wood and other composite materials.
- Students demonstrate an understanding of the design of experiments from instrumentation to data collection, processing and reporting.

Course Student Outcomes (ABET):

- An ability to apply knowledge of mathematics, science, and engineering,
- An ability to design and conduct experiments, as well as to analyze and interpret data,
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability,
- An ability to identify, formulate, and solve engineering problems,
- An understanding of professional and ethical responsibility,
- An ability to communicate effectively,

- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Fundamentals of Engineering Exam (FE): One of the objectives of this course is to prepare the students for the FE Exam. FE includes questions in the following areas related to mechanical behavior of materials

- Stresses and strains (e.g., axial, torsion, bending, shear and thermal),
- Deformations (e.g., axial, torsion, bending, thermal),
- Combined stresses,
- Principal stresses,
- Mohr's circle,
- Elastic and plastic deformations,
- Stress-strain diagrams,
- Mix design (e.g., concrete and asphalt),
- Test methods and specifications (e.g., steel, concrete, aggregates, asphalt, wood),
- Physical and mechanical properties of concrete, ferrous and nonferrous metals, masonry, wood, engineered materials (e.g., FRP, laminated lumber, wood/plastic composites), and asphalt.

Course Administration:

- TAs will be holding office hours (4 h/week). Any questions regarding the laboratory sessions should be first directed to the TAs.
- A grader will be grading the homework and lab reports. Questions related to homework or lab grades should be directed to the instructor and he will solicit an explanation from the grader. Any questions regarding the exam grades should be directed to the instructor.
- Visit instructor only during office hours or schedule a separate meeting via email.
- The students are required to come to class prepared by reviewing the material covered in the previous class and reading the relevant materials from a recommended textbook or provided handouts for the upcoming class.
- Students are encouraged to work together and exchange ideas regarding homework assignments; however, each student is responsible for making a separate submission of his/her own (unless it is a group assignment). Any indication of copying/cheating in the submitted assignments will at a minimum result in a zero grade.
- Unless specifically mentioned by the instructor during the class session, cell phones, smart phones, tablet or laptop PCs, and all other electronic equipment are to be turned off and placed in book bag during the class. First and second noncompliance will result in a warning; third will result in a zero grade for in class-participation. The student(s) will also be dismissed from that day's class.
- Only calculators approved by the National Council of Examiners for Engineering and Surveying (NCEES) for use in the Fundamentals of Engineering (FE) and Principles and Practice of Engineering (PE) exams can be used during exams/tests/quizzes. The NCEES calculator policy is available at (<http://ncees.org/exams/calculator/>). The approved calculators are:

- Casio: All fx-115 and fx-991 models. Any Casio calculator must contain fx-115 or fx-991 in its model name.
- Hewlett-Packard: The HP33s and HP 35s models, but no others.
- Texas Instruments: All TI-30X and TI-36X models. Any Texas Instruments calculator must contain either TI-30X or TI-36X in its model name.

Course Components:

- Laboratory attendance is mandatory! If you do miss a lab and your absence has not been approved you will be dropped from the class. If it is past the W drop date you will receive an F in the course.
- If you have an emergency situation and have to miss a lab or an exam you must inform the instructor ASAP. Leave a voice message or send an e-mail if you cannot reach via phone. The instructor will make the decision as to whether you have a valid excuse to miss a laboratory period or an examination.
- If you miss a class, you are responsible for all material covered in class and should get any missed material from a classmate.
- Homework and laboratory work will be assigned throughout the course; the number is to be determined.
- Homework and lab reports are to be turned in at the beginning of lecture or lab period that they are due. Lab reports need to be submitted in hard copy and also in digital via an email to the TA with copy to the course instructor. The homework are to be submitted in hard copy only to the course instructor directly.
- Students are authorized two late days for the course. Students who do not use the late days will receive 1% bonus per late day not used. Late passes could be used towards a homework or a lab report. If they are used towards a group assignment, all the students in the same group will have used one pass. If any of students has already used two late passes, the group will not be able to use another pass although another student is still allowed to use the passes. Otherwise, all late submittals will result in a zero grade.
- Students are required to participate in the teaching of the material by helping with demonstrations and answering questions of the instructor as well as their peers. Attendance and in class participation will be recorded after each class and will constitute 5% of the total grade.
- Homework and lab reports constitute 30% of the total grade.
- Two midterm exams will be administered. The midterm exams constitute 30% (15% each) of the total grade.
- There will be a final exam that constitutes 35% of the total grade. The final exam will be administered on Friday, December 7, 2018 between 2 pm and 4 pm.
- All exams will be closed notes/books.

Grading:

Attendance and in class participation	5%
Homework assignments and lab reports (# TBD)	30%
Midterm exams (2)	30%
Final exam	35%

Grade cutoffs are shown in the table below.

A+	> 96.67%	B	83.33% - 86.67%	C-	70.00% - 73.33%
A	93.33% - 96.67%	B-	80.00% - 83.33%	D	65.00% - 70.00%
A-	90.00% - 93.33%	C+	76.67% - 80.00%	F	<65.00%
B+	86.67% - 90.00%	C	73.33% - 76.67%		

Note: Earning less than 65% on both Midterms and the Final Exam or earning less than 50% on the Final Exam might result in the failure of the course, regardless of your course grade.

Academic Honesty:

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. Scampus, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <https://policy.usc.edu/student/scampus/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The review process can be found at: <https://sjacs.usc.edu/students/scampus/>.

National Society of Professional Engineers (NSPE) Code of Ethics for Engineers - Preamble and Fundamental Canons:

Preamble

Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the highest standards of honesty and integrity. Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct.

I. Fundamental Canons

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.

6. Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

Visit www.nspe.org/Ethics/ for complete NSPE ethics statement including Rules of Practice and Professional Obligations

Disability Accommodations: Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me or the TA as early in the semester as possible. DSP is located in GFS 120 and is open 8:30 a.m. – 4:30 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Campus Safety: To ensure you receive emergency email notifications and text messages, the students are encouraged to register with the TrojansAlert. The entire emergency management plan as well as instructions on how to register your information in the system can be reviewed here: <https://trojansalert.usc.edu>.

COURSE TOPICS

- Laboratory safety
- Basic material sciences, atomic bonding and crystalline structures
- Structural and material behavior and characterization including steel, concrete, wood and composites
- Stress-strain, elasticity, plasticity and failure criteria
- Sensors and instrumentation for static and dynamic measurements
- Signal conditioning, and data acquisition, processing and presentation
- Measurement and analysis of stress and strain
- Loading systems, laboratory techniques, scale models and similitude (if time permits)

LABORATORY SCHEDULE

Week of	Lab/Exam	Lab Work Description
Aug. 20, 2017	No Lab	Lab tour, lab safety training, introduction to measuring devices and test equipment (Wednesday only, during lecture)
Aug. 27, 2017	Lab 1	Tensile tests of metal bars
Sept. 3, 2017 (Labor Day)	Lab 2	Strain gage and transducer (mounting and wiring). No lab session on Monday, other sessions will be held as normal.
Sept. 10, 2017	Lab 3	Static bending test of mild steel bar
Sept. 17, 2017	Lab 4	Stress analysis of steel beams (measurements, instrumentation)
Sept. 24, 2017	Lab 4 (cont.)	Stress analysis of steel beams (testing)
Oct. 1, 2017	Midterm Exam 1 (10/4) Lab 5	Aggregate gradation, specific gravity, absorption and voids measurements
Oct. 8, 2017	Lab 5 (cont.)	Concrete mixing, concrete fresh property measurements
Oct. 15, 2017	Lab 5 (cont.)	Concrete testing (7-days)
Oct. 22, 2017	Lab 6	Microscopic inspection of concrete
Oct. 29, 2017	Lab 7	Bending test of wood
Nov. 5, 2017	Lab 6 (cont.)	Concrete testing (28-days)
Nov. 12, 2017	Midterm Exam 2 (11/15) Lab 8	Tensile properties of composites
Nov. 19, 2017	No Lab	Thanksgiving Holiday (Monday labs only, no other labs this week)
Nov. 26, 2017	No Lab	No labs this week

TENTATIVE CLASS SCHEDULE
SEE COURSE WEBSITE FOR AN UPDATED CLASS SCHEDULE.

Class	Date	Topics	Assignments	Reading	Labs
1	8/20/18	Introduction, syllabus, HO1-HO3 discussion	HO1-HO3	M&Z 1.1, Ho Ch. 15, ASTM C670	No labs
2	8/22/18	TP1: Basic Concepts slides (1-25), Hand Notes (1)	Lab 01	M&Z 1.2-1.4, Hi Ch. 3	
3	8/27/18	TP1: Basic Concepts slides (26-27), Hand Notes (2-5)	---	---	Lab 01: Tensile Tests of Metal Bars
4	8/29/18	TP1: Basic Concepts slides (54-63), Hand Notes (6-9)	HO4, Lab 02	W&G Ch. 8	Lab 02: Strain Gauge, and Strain Gauge Transducer
5	9/3/18	Labor Day	---	---	Lab 03: Static Bending Test of Mild Steel Bar
6	9/5/18	TP1: Basic Concepts slides (28-53), Hand Notes (11-12)	Lab 03	M&Z 1.2.5-1.8, Hi Ch. 6	
7	9/10/18	TP2: Mechanics of Materials Basics slides (1-6), Hand Notes (13-16)	---	Hi Ch. 6	
8	9/12/18	TP2: Mechanics of Materials Basics slides (17-27), Hand Notes (17-20)	Lab 04	Hi Ch. 7, 9, D Ch. 6	
9	9/18/18	TP2: Mechanics of Materials Basics slides (28-34), Hand Notes (20-24)	---	Hi Ch. 9, D Ch. 6	Lab 04: Stress Analysis of Steel Beams
10	9/19/18	TP2: Mechanics of Materials Basics slides (35-52), Hand Notes (25-27)	---	Hi Ch. 10, D Ch. 6-7	
11	9/24/18	TP2: Mechanics of Materials Basics slides (45-52, 7-17), Hand Notes (27-32)	---	Hi Ch. 10, D Ch. 7	Lab 04: Stress Analysis of Steel Beams
12	9/26/18	TP3: Aggregates, Cement and Concrete slides (1-28)	---	M&Z Ch. 5, K&W Ch. 6	Lab 05: Aggregate gradation, specific gravity, absorption and voids
13	10/1/18	TP3: Aggregates, Cement and Concrete slides (29-48)	Lab 05 - Part I	M&Z Ch. 5, K&W Ch. 6	
14	10/3/18	Midterm Exam I	---	---	
15	10/8/18	TP3: Aggregates, Cement and Concrete slides (90-119)	Lab 05 - Part II, III, HO5	M&Z Ch. 7, K&W Ch. 12	Lab 05: Concrete mixing, concrete fresh property measurements
16	10/10/18	TP3: Aggregates, Cement and Concrete slides (119)	---	M&Z Ch. 7, K&W Ch. 12	
17	10/15/18	TP3: Aggregates, Cement and Concrete slides (120-178)	Lab 05, Part IV	M&Z Ch. 7, K&W Ch. 9, 12	Lab 05: Concrete testing (7-days)
18	10/18/18	TP3: Aggregates, Cement and Concrete slides (49-88), Exam 1 discussion	---	M&Z Ch. 6, K&W Ch. 3, 5, 7	
19	10/22/18	TP4: Wood and Composites slides (1-9), Exam 1 discussion	Lab 06	M&Z Ch. 10	Lab 06: Microscopic inspection of concrete
20	10/24/18	TP4: Wood and Composites slides (10-53)	---	M&Z Ch. 10	
21	10/29/18	TP4: Wood and Composites slides (54-102)	Lab 07	M&Z Ch. 11	Lab 07: Bending test of wood
22	10/31/18	TP5: Material Fundamentals slides (1-28)	---	M&Z Ch. 2, 5 Ch. 2	
23	11/5/18	TP5: Material Fundamentals slides (29-62)	---	M&Z Ch. 2, 5 Ch. 3-4	
24	11/7/18	TP5: Material Fundamentals slides (63-81)	---	M&Z Ch. 2, 5 Ch. 9	Lab 05: Concrete testing (28-days)
25	11/12/18	TP5: Material Fundamentals slides (82-98)	---	M&Z Ch. 2, D Ch. 3, 5 Ch. 9, 11-12	
26	11/14/18	Midterm Exam II	---	---	No labs
27	11/19/18	TP6: Structural Steel slides (1-20)	---	M&Z Ch. 3, D Ch. 3, 5 Ch. 9, 11	No labs
28	11/21/18	Thanksgiving Holiday	---	---	
29	11/26/18	TP6: Structural Steel slides (21-29), Exam 2 discussion	Lab 08	M&Z Ch. 3, D Ch. 3, 5 Ch. 9, 11	Lab 08: Tensile properties of composites
30	11/28/18	TP6: Structural Steel slides (30-78, 94-98)	---	M&Z Ch. 3	

CE 334L Late Pass

Printed Name

Signature

Date



**Even I was late
once or twice in my
life!**

The fine print!

I understand that by signing this document I have exactly 24 hours to turn this assignment to my instructor or I will receive zero points for this assignment. I also acknowledge that CEE 334L is truly the best course ever.

CE 334L Late Pass

Printed Name

Signature

Date



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