CE334L
Fall 2014

Mechanical Behavior of Materials

Professor Sami F Masri
masri@usc.edu

GENERAL INFORMATION

Through lectures and laboratory work, this course focuses on the broad field of Experimental Mechanics with emphasis on the experimental study of the mechanical behavior of engineering materials. The theoretical background and techniques used for testing are extensively discussed in class, alongside the lab sessions. The lab work involves several lab projects as well as various testing demonstrations. The majority of the projects involve specimen design, analysis, instrumentation, theoretical prediction, testing, and discussion. The class is divided into groups, with each group responsible for all aspects of a particular project. The course is concluded by presentations of various group final projects.

Class Website:

Blackboard (https://blackboard.usc.edu/) is used as the main source of communication between instructors and students. Class material including announcements, notes, handouts, assignments, and projects will be available on Blackboard during the semester. Students are responsible for downloading the material in a timely manner and printing their own hard copies, if desired. Students are expected to visit the class Blackboard site frequently for updates and announcements.

Text:

Class and lab will be based primarily on lecture notes. There is no required text. However, the following books are relevant reference text books.

1. "Mechanical Behavior of Materials", 4th Edition, by Norman E. Dowling, Pearson, (2013)
2. "The Testing of Engineering Materials". 4th Edition, H.E. Davis, G.E. Troxell, and G.F.W. Hauck. McGraw-Hill, (1982).
3. "Design and Control of Concrete Mixtures". S.H. Kosmatka and W.C. Panarese. Portland Cement Association.
4. "Experimental Stress Analysis", 3rd Edition. James W. Dally and William F. Riley. McGraw Hill, (1991)
5. "LabVIEW 2009 Student Edition," by Robert H. Bishop, National Instruments, Prentice Hall (2010)
6. "Introduction to Data Acquisition with LabVIEW," 2nd Edition, by Robert H. King, McGraw-Hill, (2013).

Grading:

The breakdown of the course final grade is as follows:

5%	Attendance record for lecture and lab
25%	Homework assignments and lab reports
35%	Midterm exam
35%	Final project report and presentation

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	Location	Time
Lecture	KAP 156	Monday 3:30-6:10 pm
Lab	KAP B39	Monday 12:00-2:50 pm Tuesday 11:00-1:50 pm Tuesday 2:00-4:50 pm Thursday 11:00-1:50 pm Thursday 2:00-4:50 pm Friday 1:00-3:50 pm

Professor: Sami F Masri (masri@usc.edu)
Office: KAP 206A
Tel. (213) 740-0602
Office Hours: Tuesday and Thursday, 2:00 - 4:00 pm

Lab Manager Lance Hill (lhill@usc.edu)
Office: KAP B28; Tel. (213) 740-0599

TAs: Mohamed Abdelbarr (abdelbar@usc.edu)
Office: KAP 239
Office Hours: Monday, 1:00 - 3:00 pm; Tuesday, 9:00 - 11:00 am
Lab Session: Tuesday, 11:00-1:50 pm
Lab Session: Thursday, 11:00 am - 1:50 pm

Armen Derkevorkian (derkevor@usc.edu)
Office: KAP 239
Office Hours: Friday, 2:00 - 4:00 pm
Lab Session: Thursday, 2:00-4:50 pm

Mahmoud Kamalzare (kamalzar@usc.edu)
Office: KAP 115
Office Hours: Wednesday, 10:00 am -12:00 pm
Lab Session: Wednesday, 1:00-3:50pm

Charanraj Thimmisetty (thimmise@usc.edu)
Office: KAP 239
Office Hours: Monday, 10:00 am - 12:00 pm; Thursday, 4:00 - 6:00 pm
Lab Session: Monday, 12:00-2:50 pm
Lab Session: Tuesday, 2:00-4:50pm

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Course Outline

- Overview of Course Coverage and Organization; Overview of Experimental Mechanics; lab tour
- Assessment and presentation of experimental data; uncertainty analysis; error propagation
- Review of structural and material behavior; characterization, stress-strain, failure criteria
- Sensors for static and dynamic measurements
- Data acquisition, signal conditioning, and virtual instruments (LabVIEW)
- Elements of digital signal processing and data analysis
- Measurement and analysis of stress and strain
- Measurement of motion
- Loading systems and laboratory techniques, scale models, similitude
- Structural Control and Structural Health Monitoring
- Vision-based approaches for structural condition assessment
- Theoretical overview and background material for each (semi-weekly) lab test
- Class project (semester duration)

Notes:

1) The following schedule is tentative and is subject to change during the semester.
2) See "CE334L Lab Weekly Schedule" (available on Blackboard) for detailed information on lab sessions.

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Class Schedule and Project Assignments

week	Notes	Lab Project	
01. M 25-AUG-2014		(no individual labs during 1st week) laboratory tour on M 26-AUG-2013 at end of class	
* M 01-SEP-2014	Labor Day holiday	Project 1: ***Tensile Tests of Metal Bars****;* (conducted by TA's); measuring stress and strain relationship and strength of different materials using tensile tests; test machine data provided for analysis	
02. M 08-SEP-2014	*Final Project topic due by end of week*	Project 2.1: ***Strain Gauge and Transducer;*** Wire Strain Gauge (mounting, wiring)	
03. M 15-SEP-2014		(continue: Project 2.2; perform testing and analysis) use Wheatstone Bridge; static cantilever beam test; also use LabVIEW to directly acquire data on PC/laptop	
04. M 22-SEP-2014		Project 3: ***Static Bending Test of Mild Steel Bar***; determine plastic moment and first yield moment; compare to theory	
05. M 29-SEP-2014		Project 4.1: ***Stress Analysis of Steel Beam;*** (mounting and wiring strain gauges); use LabVIEW for data acquisition	
06. M 06-OCT-2014		Continue: Project 4.2; perform testing; analyze: principal strain, shear strain, angles)	
07. M 13-OCT-2014		Project 5.1: ***Concrete Mixing and Testing***; (Casting concrete)	
08. M 20-OCT-2014	Midterm Exam	(continue: Project 5.2; do 7-day concrete testing)	
09. M 27-OCT-2014		Project 6: ***Structural Control of a Multistory Building Model*** ; investigate a variety of approaches for vibration mitigation	
10. M 03-NOV-2014		Project 7: ***Structural Health Monitoring and Damage-Detection in a Multistory Building Model;*** conduct studies of vibration-based approaches for change detection in structural systems	
11. M 10-NOV-2014		(continue: Project5.3; concrete 28-day testing)	
12. M 17-NOV-2014		Project 8**: Computer-Vision Approaches for Detecting and Quantifying Cracks in a Concrete Structure**	
13. M 24-NOV-2014	**Course Project Presentations**	**(Monday Lab session to finish last week's Project)* *No other labs this week;* ***(Thanksgiving Holiday)***	
14. M 01-DEC-2014	**Course Project Presentations**	*(no labs this week)*	

Statement for Students with Disabilities

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 to TAs) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

Statement on Academic Integrity

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: http://www.usc.edu/dept/publications/SCAMPUS/gov/. 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: http://www.usc.edu/student-affairs/SJACS/.