Syllabus
MAE 150: Mechanics of Structures — Fall Quarter 2014
(Required for AE, ME, MSE)

Instructor: *Lorenzo Valdevit*
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Office hours: Th, 10am-12pm

Class schedule: *Lecture:* T Th 8.00 – 9.20am, HSLH 100A
Discussions: (1) M 8-8.50am, ET 204
(2) M 9-9.50am, ELH 110
(3) M 10-10.50am, ICF 102
(4) F 1-1.50pm, ICF 102
(5) F 2-2.50pm, ICF 102
(6) F 3-3.50am, ICF 102

Textbook: R. C. Hibbeler, *Mechanics of Materials*, 9th Ed., Prentice Hall, 2013.
The textbook is available at the UCI bookstore as a special package with the required Mastering Engineering access code.

References: For the portions of the syllabus not covered by the textbook, hand-outs from the instructor will be posted on the course website.

Course website: https://eee.uci.edu/14f/13300/

Course Messageboard: https://eee.uci.edu/boards/f14/13300/
The messageboard contains a forum for the class, where students can ask questions and suggest answers to other students' questions. The instructor and teaching assistant will act as moderators, and periodically log in to provide answers to students' questions that haven't been answered by fellow students. **Students are encouraged to ask questions on the board as opposed to emailing the instructors, as this will lead to faster response**. The moderators reserve the right to remove duplicate questions, wrong answers, or any irrelevant material. **Students will receive extra credit for volunteering good answers; this credit is part of the class participation credit (which amounts to a maximum of 5%).**

Course description: The objective of this course is to introduce students to the concepts of stress, strain and constitutive behavior of materials. You will learn how to calculate stress and strain distributions in one-dimensional structural elements (cables, bars, columns and beams) under various loading conditions. The most common failure criteria for combined loading scenarios will be introduced. This knowledge is then applied to the analysis of trusses: the finite element method for the solution of arbitrarily complex trusses is presented and discussed. Application of these fundamental concepts to the solution of relevant engineering problems is emphasized throughout the course.

During the course of this 10-week class, you will:

- Learn the fundamentals of stress, strain and elastic behavior.
- Draw axial force, shear and bending moment diagrams of one-dimensional members subject to simple and combined loading.
- Compute stresses and strains in cables, bars, beams and columns; compute deflection of beams; and compute buckling load of compression members.
- Learn the most widely used failure criteria to assess the safety of structures.
- Learn the basic principles of mechanics of materials and apply them to assemblies of one-dimensional elements (trusses and frames).
- Learn how to write a finite element program (e.g. in MATLAB) for the analysis of arbitrarily complex trusses and frames.
- Identify, formulate, and solve engineering problems that are related to the response of materials to various types of loads.

Prerequisites By Topic: Newtonian mechanics, kinematics and dynamics of motion. Statics of solid bodies and structures. Differential and integral calculus of real functions in real variables. Linear algebra: elementary matrix manipulations. Familiarity with scientific programming.

Computer Usage: A commercial programming language (e.g. MATLAB) will be used to develop codes for matrix analysis of structures. In addition, students will be exposed to a commercial Finite Element code (ABAQUS) for the structural analysis of more complex structures and the Cambridge Engineering Selector (CES) code for materials selection. These programs might be used to tackle the design projects.

Design Project Description: This class will not have a final design project. Rather, several design-based assignments will be handed out during the course. These assignments will cover issues like materials selection, geometry optimization, mass minimization, etc… Some problems might require the use of scientific software to perform computations and plot results. The Office suite, MATLAB and other scientific software discussed above are available in three computer labs (see below). The design assignments will be carefully graded and will count towards the Design Component grade

Grading Criteria:
Homework: 13%
Design Project: 12%
Midterm: 30%
Final: 40%
Class Participation: 5%
Attendance to lectures and discussion sessions is mandatory. Class participation is measured by the quality of answers in class (with i-clickers) and on the messageboard.

Homework Policy:
There will be weekly homework assignments throughout the course. Most of the

assignments will be entirely web-based, using the Pearson "Mastering Engineering" educational platform. Homework assignments are posted on the website on Friday afternoon. They are due 9 days later (on Mondays at 4.00pm). Solutions will be posted on the website on the same day at 6.30pm.

Late homework is not accepted and will not be graded.

Homework grading is performed automatically and comprehensively through the Mastering Engineering platform. Accurate and complete solutions will be posted promptly on the website, and students are strongly encouraged to discuss problem solving procedures with the instructor and the TAs as often as needed to get a good understanding of the material. As an incentive to work seriously on the homework, a fraction of midterm and final exam problems will be taken directly from the homework.

Working together is strongly encouraged (but NOT copying each other). Identical homework assignments from two students will be considered cheating and not tolerated.

Midterm and final examinations

There will be one midterm and one final examination. The final examination has been set by the registrar's office on Tuesday, Dec 16, 2014, 8.00-10.00am. The midterm will tentatively within the 7th week of class. The exact date will be announced in class. The midterm will take place in class at normal lecture time.

Midterm and final are closed-book exams. However, students are allowed to bring ONE 3"X5'' card with any writing on it (front and back) at the midterm. Two cards are allowed during the final exam. Standard scientific calculators (but not computers) can be used during midterm and final exam.

For all exams (as well as for the non-web-based HW assignments), these factors ALL contribute to the grade:

- Conceptually sound problem-solving approach.
- Numerical accuracy of results.
- Neatness of the presentation and description of the procedure.

Please, format your work in a clear way. The TAs don't have to make effort in interpreting or guessing your thinking process. All the fundamental steps of your derivations need to be clearly stated. Illegible homework will not be graded.

A correct solution obtained with a wrong or unclear methodology will be given no credit. Conversely, numerical mistakes associated with sound and reasonable approaches will result in partial credit.