AME 101 – Introduction to Mechanical Engineering and Graphics - Fall 2014

Lecture: Tuesdays and Thursdays 8:00 - 9:20 OR 9:30 - 10:50 am, ZHS 252

Labs: Tuesdays 12:30 – 1:50 pm, SAL 109 OR SAL 127 OR Thursdays 12:30 – 1:50 pm, SAL 127

Final exam: 8:00 AM class: Tuesday, Dec. 16, 4:30 pm – 6:30 pm
9:30 AM class: Thursday, Dec. 11, 11:00 am – 1:00 pm

Web page: http://ronney.usc.edu/courses/ame-101/

Instructor: Paul Ronney
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Phone: 213-740-0490
Email: ronney@usc.edu
Office hours: Thursdays 1:00 – 4:00 pm; other times by appointment.

Teaching Assistants (to be filled in later)

Name	Email	Lab section	Office hours
Longlong Chang	longlonc@usc.edu	SAL 127, Th	9:00 AM – noon Fridays
Brendan Colvert	brendancolvert@gmail.com	SAL 109, Tu	6:30 – 9:30 PM Wednesdays
Tailai Ye	yetailai@gmail.com	SAL 127, Tu	1:20 PM – 3:20 PM Wednesdays

Office hours for all TAs will be held in the SAL common area, between SAL 109 and 127

Graders:
To be determined

Texts:

- Lecture notes
- Handouts in laboratory sessions
- (OPTIONAL) *An Introduction to Mechanical Engineering* by Jonathan Wickert and Kemper Lewis, 3nd edition, Cencage Learning, 2012, ISBN-10: 1111576807; ISBN-13: 978-1111576806 (The closest equivalent to the AME 101 lecture notes).
- (OPTIONAL) *Introduction to Solid Modeling Using SolidWorks* 2014, by William Howard and Joseph Musto, McGraw-Hill, 2014, ISBN-10: 0078021243; ISBN-13: 978-0078021244 (The closest equivalent to the SolidWorks lecture notes)
- (OPTIONAL) *Thinking Like an Engineer: An Active Learning Approach*, 2nd Ed., by Elizabeth Stephan, William Park, Benjamin Still, David Bowman and Matthew Ohland, Pearson, 2012, ISBN-10: 013276671X; ISBN013: 978-0132766715 (Some suspiciously similar material to that in the AME 101 lecture notes, but nevertheless a useful supplement especially for the sections on Units).

Grading:

Homework	20%
Design projects & competitions	15%
Laboratory	30%
Midterm exams (2)	10% each
Final exam	15%

- Breakdown of laboratory grade
  - 4 homeworks (60% of lab grade)
  - 1 mini-project (40% of lab grade)

- **NO LATE HOMEWORK WILL BE ACCEPTED, PERIOD, NO EXCEPTIONS** in either lecture or lab. The fact that it was "someone else's fault" (e.g., your roommate overslept or forgot to turn it in, your computer crashed, the printer ran out of ink, etc.) doesn't matter. Since everyone has some valid reason for missing or doing poorly on at least one homework assignment, your lowest homework score (or one missing score) from both lecture and lab will be eliminated. **(The grade for the laboratory mini-project cannot be dropped, only one of the 4 lab homework assignments before the project can be dropped!)** The only exceptions to this policy will be for documented medical reasons.

Classroom etiquette:

- If you arrive late, need to leave early or need to ___ during class, please use the rear door
- **No electronics (laptops, tablets, cell phones, texting, …) during class!**
- If you fall asleep, I'm going to wake you up (I presume that if you wanted to sleep, you would not have attended class)

Academic integrity:

SCampus, the Student Guidebook, (www.usc.edu/scampus or http://scampus.usc.edu) contains the University Student Conduct Code (see University Governance, Section 11.00).

- You may
  - Work with others to find solutions to lecture and lab homework assignments
  - Study with others for exams
- You may NOT
  - Copy lecture and lab homework assignments from others – even if you work together, you must prepare and turn in assignments that were created by you only
  - Work together during exams
  - Sit in on both midterm exams (for the 8:00 am and 9:30 am sections) or both sections of the final exam
- **Violators will be reported to the Office of Committee for Student Judicial Affairs and Community Standards (http://www.usc.edu/student-affairs/SJACS/)**

AME 101 Computer Aided Design Lab - Fall 2014

This lab will introduce you to a powerful Computer Aided Design (CAD) tool, SolidWorks, which is widely used in industry today. As an introductory course, it is not intended to make you an expert with this software; however, you will acquire a basic knowledge of CAD skills extensively used in mechanical engineering today.

This is a hands-on, learn-by-doing class and all instruction will require active use of software, SolidWorks 2014, which is available in all the ISD-managed computer laboratories. This software is also available for installation on your own machines should you desire to work at home. Detailed instructions for home version installation will be posted on the Blackboard web page for this course (https://blackboard.usc.edu/). Log on to Blackboard using your USC account, navigate to the AME 101 course page, then navigate to Content / Lab Stuff.

In lieu of a formal course textbook, a short presentation will be posted on Blackboard each week before the class (again, in the Content / Lab Stuff folder). The presentation will cover the material for the week and conclude with one or more tutorials and/or exercises. The tutorials and exercises are designed to show you how certain tasks may be accomplished and allow you to practice either on your own or in the lab sessions where help will be available. Your mastery of the material will depend entirely on how much you work with the software.

Grading:

- Homework Details
  - Each homework assignment is due at the end of the lab session. The final project will be due two weeks after it is assigned.
  - Submission
    - One hard copy including names, submission dates, and images of the problems, submitted in class (use the template);
    - SolidWorks files of the assignment submitted on Blackboard
  - Graded on a 4 point scale
    - 4 points = "perfect"
    - 3 points = "looks right" (appropriate form but wrong dimensions)
    - 2 points = "got the concept" (key concepts taught are incorporated)
    - 1 point = "you turned something in" (model w/ your name on it)
    - 0 points = "late assignment"

Tentative schedule

"Plans are nothing… planning is everything" – Dwight D. Eisenhower

Week	Monday Date	Lecture subject	Lab subject	Tues. lecture	Thurs. lecture	Assignment due
1	8/25	Introduction, units	Introduction	PDR	PDR	
2	9/1	Units	Lab safety, Sketching I	PDR	PDR	
3	9/8	Engineering scrutiny	Lab safety, Sketching I	PDR	PDR	L1
4	9/15	Excel for engineers; statistics	Lab tours (SAE, RL, ADT)	PDR	PDR	
5	9/22	Forces and moments	Sketching 2, 3	PDR	PDR	L2
6	9/29	Forces and moments	Features 1	PDR	PDR	G1
7	10/6	Forces and moments	Features 2	PDR	P1	L3
8	10/13	Materials and stresses	Features 3	PDR	Q1	G2
9	10/20	Materials and stresses	Finite element analysis	PDR	PDR	R1
10	10/27	Fluid flows	Assemblies 1	PDR	PDR	L4
11	11/3	Fluid flows	Assemblies 2	PDR	PDR	G3
12	11/10	Thermodynamics	Drafting 1	PDR	PDR	L5
13	11/17	Thermodynamics	Drafting 2	PDR	Q2	
14	11/24	XXX	XXX	P2	XXX	G4*
15	12/1	Heat transfer	Final project help	PDR	PDR	L6
				XXX	Final (12/11 or 12/16)	GP, R2

Legend for schedule

PDR	PDR lectures
SL	Substitute lecturer
Qn	Midterm exam n
Ln	Lecture homework n due
Gn	Lab homework n due
GP	Lab project due (12/13)
Pn	Design project n contest
Rn	Design project n report due
XXX	Break / holiday / end of semester

* - Due Monday 12/1 because of Thanksgiving holiday

Homework topics

1. Units
2. Scrutiny, Excel, statistics
3. Forces & torques
4. Materials and stresses
5. Fluid flows
6. Energy and thermal systems

Design projects

1. "Pop Pop" boat (thermal, fluid, energy systems) – week 7
2. Spaghetti bridge (materials, stresses) – week 14

Design teams will be assigned **at random** and different for each project in order for students to become better acquainted with each other and to avoid the "A-list, B-list, C-list" group dynamics.

(Possibly) useful information and disclaimers

1. **Come to lectures!** There IS a very good correlation between attendance and performance in the course. The lecture notes are a **supplement** to lectures, not a replacement. **Do not assume that you can learn everything by reading the lecture notes. If a topic is clarified or expanded upon in class but not in the lecture notes, it's fair game for homework and exam questions.** The fact that you "didn't know" something that was discussed in class is not an excuse.
2. **Read the lecture notes!** Practically everything on the homework and exams is covered in class and in the lecture notes. If you just come to class and read the notes, it will make the course SO much easier for you. I promise.
3. I will call on students in class. This is not a popular practice with students, but I do it anyway because (a) it encourages students to attend class (though I don't take attendance); (b) it encourages students to pay attention in class and (c) it helps me to get to know the students, and the students to get to know each other by name - many of you will be together for 4 years, so why not get acquainted now?
4. Exams will mirror lectures; be sure you understand the lectures. Please ask questions inside and outside class! **(If you choose to buy the optional textbook, please understand that it's just an additional reference, not something that I will follow.)**
5. Tips for studying for and taking exams
    1. Do the sample exam, homework and examples in lecture notes without looking at answers
    2. Work both independently and as part of a group. As much as you may think otherwise, you really don't understand something until you have to explain it to someone else.
    3. During the exam, budget your time and pick the low hanging fruit
6. This is the 9th time I have taught this course, and since (in my humble opinion) all available textbooks are weak at best, my plan is to turn my lecture notes into a textbook. Thus, constructive suggestions are most welcome! Note: the lecture notes are still a work in progress, **so there will be changes**. I will do my utmost to inform students of changes and make the updating as painless as possible.
7. This course is sort of like engineering boot camp; not always popular but students do come back in a year or two and tell me that what they learned in this class was useful and made their subsequent classes easier. (At least, that's what they tell me right before they ask me for a letter of recommendation… so it must be true, right?)

Class objectives

- Furnish you with some basic tools of engineering
  - Units – English and metric system
  - "Engineering scrutiny"
  - Statistics
  - Approaches to problem-solving and teamwork
- Provide introductory knowledge of engineering topics
  - Forces and torques
  - Fluid flows
  - Materials and stresses
  - Thermal and energy systems
- Provide introductory knowledge of Computer Aided Design (laboratory section)
  - Solid modeling
  - Views and shading
  - Dimensions
  - Fillets, rounds, patterns
  - Assemblies
- Retention-related objectives
  - Provide a "roadmap" of what subjects you will be learning, and what will you do in the future with the knowledge gained
  - Making an intelligent choice of major - make your first engineering class a positive enough experience that you make a choice based on knowledge, not fear or intimidation
  - Develop confidence in your ability – "pride of ownership" of knowledge gained
- Topics NOT covered in this class (but should be)
  - Electrical circuits
  - Ethics (covered to some extent in WRIT 130 and 340)
  - Computer animation (covered in AME 308)
  - History of engineering
  - Philosophy of engineering
  - Written and oral reporting

Hidden agenda: To start teaching you to think like engineers. Over and over, engineering faculty hear from practicing engineers and corporate recruiters words like, "teach the students how to think and we'll teach them the rest."

> "You come in here with a skull full of mush and if you survive you leave thinking like a lawyer" - Actor John Houseman, portraying Harvard Law School Professor Charles Kingsfield in *The Paper Chase* (1973). [Substitute 'engineer' for 'lawyer'.]

USC and the Viterbi School

Why USC engineering?

- Aggressive, proactive leadership – buildings, rankings
- Engineering has a high priority from the USC central administration
- Student services and programs (Merit research, work study, counseling and tutoring, professional organizations, under-represented group organizations, …)
- Breadth of courses and escape routes for those who decide engineering is not in their future
- Class sizes and faculty to student ratios
- But it's up to you to take advantage of all the opportunities and not develop "early senioritis"

USC Viterbi School of Engineering mission statement

"The School of Engineering seeks to provide undergraduate and graduate programs of instruction for qualified students leading to academic degrees in engineering; to extend the frontiers of engineering knowledge by encouraging and assisting faculty in the pursuit and publication of research; to stimulate and encourage in its students those qualities of scholarship, leadership, and character that mark the true academic and professional engineer; to serve California and the nation in providing for the continuing education of engineering and scientific personnel; and to provide professional engineering leadership in the solution of community, regional, national and global problems."

Who's in charge here???

- The USC Board of Trustees has the ultimate say in what happens on campus. "As a private corporation, USC is governed by a board of trustees which has approximately 50 voting members. The board is a self-perpetuating body, electing one-fifth of its members each year for a five-year term of office."
- President Max Nikias, Professor of Electrical Engineering - Systems – sets policy and directs others to execute that policy – not unlike the role of the U.S. President
- Provost Elizabeth Garrett, Professor of Law – the single person most responsible for making the vision of the President actually happen – role similar to that of "chief executive officer" of a corporation
- Dean of Engineering Yannis Yortsos – overall responsibility for the operation of the School of Engineering
    - Executive Vice Dean John O'Brien (Professor of Electrical Engineering – Electrophysics) – responsible for the overall Academic Affairs portfolio of the School, including Undergraduate and Graduate Programs, Faculty Affairs and Academic Programs
    - Senior Associate Dean for Admissions and Student Affairs Louise Yates
    - 9 other Associate Deans – see http://viterbi.usc.edu/about/administration/
- Chairman Geoff Spedding, Department of Aerospace and Mechanical Engineering (AME) – overall responsibility for the operation of AME
- AME faculty – 21 and (hopefully) growing
- AME students – ≈ 125 freshmen - In what ways are you in charge?
    - Participate in aforementioned activities
    - Teaching evaluations
    - Directed research
    - (Someday) alumni activities

ABET

Engineering programs are accredited by the Accreditation Board for Engineering and Technology (ABET) (http://www.abet.org). Each course is expected to have a "course objective" and a list of "course outcomes." At the end of the semester, there will be a survey passed out to all students asking to what extent (on a 1 – 5 scale) the course outcomes were or were not met.

Course objective for AME 101:

To introduce the student to the science and art of Mechanical Engineering by providing (1) basic tools of engineering practice, (2) introductory knowledge of engineering topics, (3) facility with Computer-Aided Design software and (4) a perspective on how the large number of subjects covered in the mechanical engineering curriculum are inter-related.

Course outcomes for AME 101:

By the end of the course, the student will

1. Understand the courses required for his/her Mechanical Engineering education at USC and why these courses are useful
2. Understand and manipulate the units of engineered systems
3. Scrutinize a calculated or measured result for "obvious" mistakes
4. Be able to work productively as part of an engineering team working toward a common objective
5. Create simple 2-D and 3-D models of parts and assemblies using Computer-Aided Design (CAD) software such as Solidworks
6. Have a basic understanding of the forces and torques on rigid, solid objects
7. Have a basic understanding of engineered materials and the stresses they can withstand
8. Have a basic understanding of the flow of fluids and the forces they exert on structures
9. Have a basic understanding of thermodynamics, in particular application of the principle of conservation of energy to very simple systems.
10. Have a basic understanding of the three modes of heat transfer and be able to apply the basic equations of heat transfer to very simple systems.

ABET Program Objectives

In addition to course-specific objectives and outcomes, ABET also specifies a set of "Program objectives" which are broad statements that describe the career and professional accomplishments that the program (in your case, Mechanical Engineering at USC) is preparing the graduates to achieve. For all engineering disciplines, the Program Objectives are:

1. Graduates will be professionals working in engineering or in related areas such as computer science, business, law, medicine or public service, at both large- and small-scale businesses.
2. Graduates will engage in lifelong learning, such as continuing their education through graduate school or professional development courses.
3. Graduates will make use of modern and cutting-edge tools, such as advanced computer software and state-of-the-art laboratory equipment.

4. Graduates will be both competent technical innovators and industrial leaders.
5. Graduates will incorporate societal, ethical and environmental considerations into technical decisions.
6. Graduates will effectively communicate and work with persons and teams of diverse technical and non-technical backgrounds.

ABET Program Outcomes

Again at the "Program" level, ABET also specifies a set of "Program Outcomes" which are narrower statements that describe what students are expected to know and be able to do by the time of graduation. For all engineering disciplines these Program Outcomes are that the student should have

1. an ability to apply knowledge of mathematics, science, and engineering
2. an ability to design and conduct experiments, as well as to analyze and interpret data
3. 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
4. an ability to function on multidisciplinary teams
5. an ability to identify, formulate, and solve engineering problems
6. an understanding of professional and ethical responsibility
7. an ability to communicate effectively
8. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. a recognition of the need for, and an ability to engage in life-long learning
10. a knowledge of contemporary issues
11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

For Mechanical Engineering, the USC AME department has developed a more specific set of Program Outcomes, name that the student should have:

1. a knowledge of chemistry and calculus-based physics with depth in at least one
2. an ability to apply advanced mathematics through multivariate calculus and differential equations
3. a familiarity with statistics and linear algebra
4. an ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems
5. (*Petroleum concentration only)* a knowledge of petroleum engineering topics