AME 101 – Introduction to Mechanical Engineering and Graphics - Fall 2019

Lecture: Tuesdays and Thursdays 8:00 - 9:20 OR 9:30 - 10:50 am, VPD 105

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. 17, 4:30 pm – 6:30 pm, location TBD
9:30 AM class: Thursday, Dec. 12, 11:00 am – 1:00 pm, location TBD

Web page: http://ronney.usc.edu/ame101/

Instructor: Paul Ronney
Office: Olin Hall 430J
Phone: 213-740-0490
Email: ronney at usc dot edu
Office hours: Thursdays 1:00 – 4:00 pm; other times by appointment.

Teaching Assistants

Name	Email	Lab section	Office hours
Steven Luna	lunastev at usc dot edu	SAL 109, Tues	Weds 6 - 9 pm
Zhenghong (Harris) Zhou	zhenghoz at usc dot edu	SAL 127, Tues	Weds 2 - 4 pm
Karina Hemmendinger	khemmend at usc dot edu	SAL 127 Thurs	Fri 11 am - 1 pm
Patharapong (Winry) Bhuripanyo	patharap at usc dot edu	---	Thurs 6 - 9 pm

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

The graders just that - graders … they are not part of the teaching staff of the course; ask the TAs or PDR, not the graders, questions about homework or other aspects of the class. For questions / disputes about grading, contact graders via email at AME101F19 at gmail dot com.

Texts:

- Lecture notes (posted on course website)
- Presentation files for laboratory sessions (posted on the AME 101 Blackboard page under "Content Collection")
- OPTIONAL) *An Introduction to Mechanical Engineering* by Jonathan Wickert and Kemper Lewis, 4th edition, Cencage Learning, 2017, ISBN-10: 1260113302; ISBN-13: 978-1260113303 (The closest equivalent to the AME 101 lecture notes).
- (OPTIONAL) *Introduction to Solid Modeling Using SolidWorks* 2019, by William Howard and Joseph Musto, McGraw-Hill, 2017, ISBN-10: 1259820173; ISBN-13: 978-1259820175. (The closest equivalent to the SolidWorks lecture notes)
- (OPTIONAL) *Thinking Like an Engineer: An Active Learning Approach*, 4th Ed., by Elizabeth Stephan, David Bowman, William Park, Benjamin Still, and Matthew Ohland, Prentice Hall, 2018, ISBN-10: 0134639677; ISBN-13: 978-0134639673. (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%

The midterm exams and final exam will be curved separately, so that, for example, obtaining a class-average score on the first midterm and the second midterm will count the same toward the course grade, even if the class average is very different for the two midterm exams.

- 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.
- Electronic versions of homework and exam solutions will not be posted. Hard copies will be distributed in class or during office hours.
- The deadline for disputing grading of homework or exams is **two weeks from the day the graded material is returned.** To dispute a homework grade, please send a scanned copy of the disputed item to the graders (AME101F19 at gmail dot com) with an explanation as to what you think was misgraded and what grade you think you deserve. If you and the graders cannot come to an agreement, I will make the final decision. For exams, send the scan directly to me, not the graders.
- **No extra credit assignments will be offered.** The problem is that if I offer extra credit to one student I must offer it to all students, then it becomes like just another assignment… and this course has enough 'moving parts' already.
- Grading policy
  - The average course grade will be close to the Viterbi School undergraduate average of about 3.3/4.0, perhaps a bit higher if I decide in the end that this class is better than average, or a bit lower if... well you get the idea. But it's very unlikely that the average grade will be above 3.4 or below 3.2.
  - I'll adjust the weighting of the two midterms separately so that getting an average grade on either will give you the same number of points toward your total course points. The same consideration applies to the final exam, though the final is weighted 1.5 times higher than each midterm.
  - I try hard not to give any grade below C, since you need to maintain a C average to stay here, so if I give you a grade below C that implicitly means I believe you effectively failed the course. Rarely do I have to give below a C to someone who did all the work. The major source of low grades is students not doing the homework or in-class quizzes and thus losing 25% of their grade. Viterbi students as a group are

extremely competitive in the sense that the standard deviation of scores is small, so losing 25% of your total score would typically move one from the A range to the C range.

Classroom etiquette:

- **No electronics (laptops, tablets, cell phones, texting, …) during class! (Except for the in-class quizzes, of course)**
- 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…)

Tutoring:

- Free peer tutoring for AME 101 is offered through the Viterbi Academic Resource Center (VARC) (http://viterbiundergrad.usc.edu/varc/) located in RTH 222.
- Students can make a VARC tutoring appointment through their myviterbi.usc.edu portal.

AME 101 Computer Aided Design Lab - Fall 2019

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 2019, which is available in all the ISD-managed computer laboratories. The Student Edition of this software (also know as Student Design Kit, SDK) is available for installation on your own machines should you desire to work at home. Go to www.solidworks.com/sdk and enter SDK-ID: 92016SDK on the web form.

In lieu of a formal course textbook, a short presentation will be posted on Blackboard each week before the class. Log on to Blackboard using your USC account, navigate to the AME 101 course page, then navigate to "Content Collection". 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 10-point scale
        - 9 - 10 points = "perfect"
        - 6 - 8 points = "looks right" (appropriate form but wrong dimensions)
        - 3 - 5 points = "got the concept" (key concepts taught are incorporated)
        - 1 - 2 points = "you turned something in" (model w/ your name on it)
        - 0 points = Missing or late assignment

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 TA) as It's 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. Website for DSP and contact information: (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX), email: ability@usc.edu.

It's especially important that students with any type of disability let me know before you start working in the lab with potentially hazardous equipment so that we may accommodate your needs and ensure your safety.

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 University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

- For AME 101 you may
    - Work with others to find solutions to lecture and lab homework assignments
    - Study with others for exams
- For AME 101 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 (https://sjacs.usc.edu/)

Emergency preparedness / course continuity in a crisis

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies. See the university's site on Campus Safety and Emergency Preparedness (http://safety.usc.edu)

Violation	USC - Recommended Sanction for Undergraduates*	AME - Recommended Sanction for Undergraduates and Graduates
Copying answers from other students on any course work.**	F for course.	First offense: F on assignment. Second offense: F for course.
One person allowing another to cheat from his/her exam or assignment.	F for course for both persons.	If assignment: First offense: F on assignment. Second offense: F for course. If exam: F for course.
Possessing or using material during exam (crib sheets, notes, books, etc.) which is not expressly permitted by the instructor.	F for course.	First offense: F on exam. Second offense: F for course.
Continuing to write after exam has ended.	F for course.	F on exam
Taking exam from room and later claiming that the instructor lost it.	F for course and recommendation for further disciplinary action (possible suspension).	F for course
Changing answers after exam has been returned.	F for course and recommendation for further disciplinary action (possible suspension).	F for course
Fraudulent possession of exam prior to administration.	F for course and recommendation for suspension.	F for course
Obtaining a copy of an exam or answer key prior to administration.	Suspension or expulsion from the university; F for course.	F for course
Having someone else complete course work for oneself.	Suspension or expulsion from the university for both students; F for course.	F for course
Plagiarism — Submitting other's work as one's own or giving an improper citation.	F for course.	First offense: F on assignment. Second offense: F for course.
Submission of purchased term papers or papers done by others.	F for course and recommendation for further disciplinary action (possible suspension).	F for course
Submission of the same assignment to more than one instructor, where no previous approval has been given.	F for both courses.	F for both courses
Unauthorized collaboration on an assignment.	F for the course for both students.	First offense: F on assignment. Second offense: F for course.
Falsification of information in admission applications (including supporting documentation).	Revocation of university admission without opportunity to reapply.	Revocation of university admission without opportunity to reapply.
Documentary falsification (e.g., petitions and supporting materials; medical documentation.)	Suspension or expulsion from the university; F for course when related to a specific course.	Suspension or expulsion from the university; F for course when related to a specific course.
Plagiarism in a graduate thesis or dissertation.	Expulsion from the university when discovered prior to graduation; revocation of degree when discovered subsequent to graduation.***	Expulsion from the university when discovered prior to graduation; revocation of degree when discovered subsequent to graduation.***

*Assuming first offense
**Exam, quiz, tests, assignments or other course work.
***Applies to graduate students

Tentative schedule

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

Week #	Week of	Lecture subject	Lab subject	Tues. lecture	Thurs. lecture	Assignment due
1	8/26	Introduction, units	Introduction	PDR	PDR	
2	9/2	Units	Sketching 1	PDR	PDR	
3	9/9	Engineering scrutiny	Lab safety, Sketching 2, 3	PDR	PDR	L1
4	9/16	Statics	Lab safety, Sketching 2, 3	PDR	PDR	
5	9/23	Statics	Lab tours (SAE, RL, ADT	PDR	PDR	L2
6	9/30	Materials & stresses	Features 1	PDR	PDR	G1
7	10/7	Materials & stresses	Features 2	PDR	P1	
8	10/14	Materials & stresses	Features 3	PDR	PDR	L3
9	10/21	Fluid flows	Finite element analysis	Q1	PDR	G2
10	10/28	Fluid flows	Assemblies 1	PDR	PDR	R1
11	11/4	Fluid flows	Assemblies 2	PDR	PDR	L4
12	11/11	Thermodynamics	Drafting 1	PDR	PDR	G3
13	11/18	Thermodynamics	Drafting 2	PDR	Q2	
14	11/25	XXX	XXX	P2	XXX	G4*
15	12/2	Heat transfer	Final project help	PDR	PDR	L5
				XXX	Final**	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 (12/12)
Pn	Design project n contest
Rn	Design project n report due
XXX	Break / holiday / end of semester

* - Due Monday 12/2 because of Thanksgiving holiday

** - Final for 8:00 AM class: Tuesday, Dec. 17, 4:30 pm – 6:30 pm
Final for 9:30 AM class: Thursday, Dec. 12, 11:00 am – 1:00 pm

Major homework topics

1. Units and scrutiny
2. Statics
3. Materials and stresses
4. Fluid flows
5. Energy and thermal systems

Design projects

1. "King of the Hill" – week 7
2. 3D Printed Bridge – 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. 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?
2. 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.)**
3. 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?)

Suggestions for how to do well in this class (applies to almost any class, really):

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. Also, exams will mirror lectures … obviously the stuff I discuss most in class is the stuff mostly likely to appear on exams.
2. **Read the lecture notes!** 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. **Pick up your graded homework and exams and their solutions.** It's remarkable that many students don't. How can you know what you did correctly or incorrectly without comparing your answers to the "correct" ones? And without such feedback, how can you do better on subsequent homeworks and exams?
4. **Check your USC email often!** I send a number of "broadcast" emails over the semester, and all of them contain information that is "important" for the class. I try not to spam students too often, but I do send announcements and reminders of homework assignments, exams, changes in schedule or due dates, occasional job and scholarship opportunities if I feel they're especially relevant to AME 101 students, etc. If you don't like using your USC email, have it forwarded to your preferred email address.
5. **Tips for studying for and taking exams**
    a. Do the posted sample exams, homework and examples in lecture notes without looking at answers. Some students have a tendency to spend too much time on the first problem and try to get it "just right" before moving on to the next one. If you're particularly prone to that, after getting your graded exam back, try re-doing the exam backwards, i.e. last problem to first problem.
    b. Since electronic versions of the lecture notes are not allowed during exams, put hard copies of all the lecture notes into a 3-ring binder then (and here's the important part) create a system of tabs or some type of indexing (e.g. where key topics like "principal stresses" "Reynolds number" "unit conversion table" etc. are located) so you can find things quickly. Just the process of doing this organization will force you to ask yourself, "What are the important topics in this course? Where can I find them in the notes?"

c. 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
d. During the exam, budget your time and pick the low hanging fruit.

Class objectives

- Furnish you with some basic tools of engineering
  - Units – English and metric system
  - "Engineering scrutiny"
  - 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
  - Statistics
  - 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 Carol Folt, Professor of Biological Sciences – sets policy and directs others to execute that policy – not unlike the role of the U.S. President
- Provost Elizabeth Graddy, Professor of Public Policy – 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 (a new Provost will probably be chosen by the new President, when selected.)
- Dean of Engineering Yannis Yortsos – overall responsibility for the operation of the School of Engineering
    - Executive Vice Dean Gaurav Sukhatme (Professor of Computer Science) – 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 (retiring)
    - Many other Associate Deans – see http://viterbi.usc.edu/about/administration/
- Chairman Julian Domaradzki, Department of Aerospace and Mechanical Engineering (AME) – overall responsibility for the operation of AME
- AME faculty – 24 tenure-track + 9 teaching and (hopefully) growing
- AME students – ≈ 130 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