

AME 101 – Introduction to Mechanical Engineering and Graphics - Fall 2010

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

Labs: Tuesday OR Thursday, 12:30 – 1:50 pm, SAL 127

Final exam: 8:00 AM class: Tuesday, Dec. 14, 4:30 pm – 6:30 pm

9:30 AM class: Thursday, Dec. 9, 11:00 am – 1:00 pm

Note: I will attempt to coordinate a single final on Dec. 14.

Web page: Accessible to registered students through Blackboard at <http://blackboard.usc.edu>. A direct link to the syllabus and other information is <http://ronney.usc.edu/AME101F10/>

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Office hours: Wednesdays 1:00 – 3:30 pm; other times by appointment.

Teaching Assistants (office hours held in VHE 202):

Shalini Reddy (sreddy@usc.edu); Office hours Thursdays 2:00 pm – 5:00 pm

Qianyu (“Cherry”) Liu (qianyu@usc.edu); Office hours Fridays 9:00 am – 12:00 noon

Graders: Vaasu Swaminathan (yswamina@usc.edu), Jing Yan Chen (jingyanc@usc.edu)

Texts:

- Lecture notes
- Handouts in laboratory sessions
- (OPTIONAL) *An Introduction to Mechanical Engineering* by Jonathan Wickert, 2nd edition, Thomson-Engineering Publishing, 2005, ISBN-10: 0534552978; ISBN-13: 978-0534552978
- (OPTIONAL) *Introduction to Solid Modeling Using SolidWorks* 2010, by William Howard and Joseph Musto, McGraw-Hill, 2009, ISBN-10: 0073375438; ISBN-13: 978-0073375434

Grading:

Homework	20%
Design projects & competitions	15%
Laboratory (graphics)	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.

Graphics Laboratory

The Graphics Laboratory aspect of AME 101 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 2009-2010, 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 are posted on the Blackboard (<https://blackboard.usc.edu/>).

In lieu of a formal course textbook, a short presentation will be posted on Blackboard each week before the class. 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.

The lab homeworks must be submitted to the grader with the following attachments:

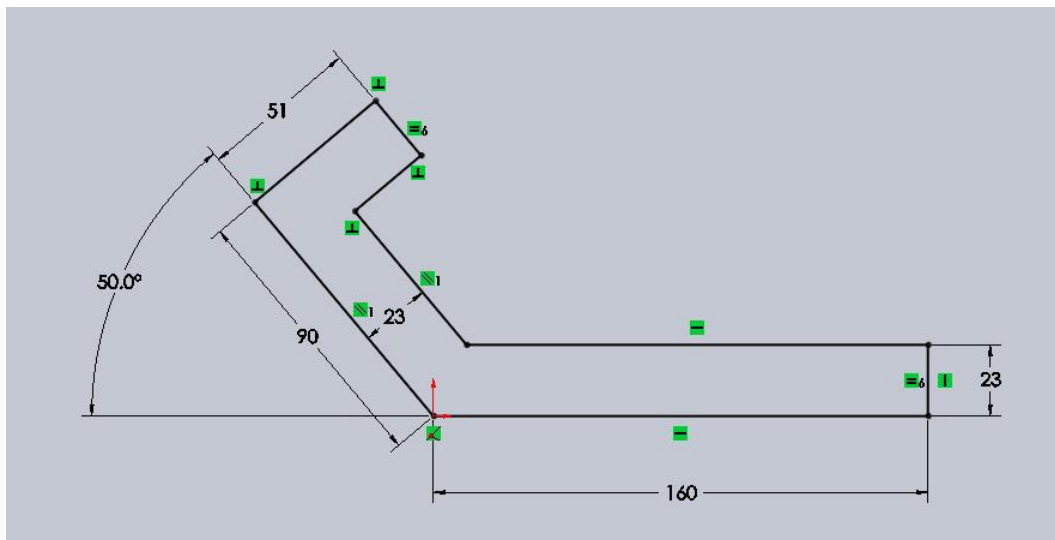
- Template “cover sheet” (see below) including name, date and images of the problems
- SolidWorks files of the assignment

AME 101 Graphics Lab Homework Template

LAB HOMEWORK ASSIGNMENT #1

Name: _____ Lab section: _____ Date: _____

- Problem 1



Tentative schedule

“Plans are nothing... planning is everything” – Dwight D. Eisenhower

Week	Monday Date	Lecture subject	Graphics lab subject	Tues. lecture	Thurs. lecture	Assignment due
1	8/23	Introduction, units	Introduction	PDR	PDR	
2	8/30	Units	Sketch basics 1	PDR	PDR	
3	9/6	Engineering scrutiny	Sketch basics 2	PDR	PDR	L1
4	9/13	Excel for engineers; statistics	Sketch basics 3	PDR	PDR	G1
5	9/20	Forces and moments on structures	Feature basics 1	PDR	PDR	L2
6	9/27	Forces and moments on structures	Feature basics 2	PDR	PDR	
7	10/4	Forces and moments on structures	Feature basics 3	PDR	P1	L3
8	10/11	Materials and stresses	Stress/Simulation	PDR	Q1	G2
9	10/18	Materials and stresses	Stress/Simulation	PDR	PDR	R1
10	10/25	Fluid flows	Assembly	PDR	PDR	L4
11	11/1	Fluid flows	Assembly	PDR	PDR	G3
12	11/8	Energy and thermal systems	Motion	PDR	PDR	L5
13	11/15	Energy and thermal systems	Motion	PDR	Q2	
14	11/22	Energy and thermal systems	Drawing	P2	XXX	G4
15	11/29	Energy and thermal systems	Drawing	PDR	PDR	L6
				XXX	Final (12/9 or 12/14)	GP, R2

Legend for schedule

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

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 King of the Hill (force, torque, mechanical design) – week 7
- 2 Spaghetti bridge (materials, stresses) – week 14

Note: 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. Exams will mirror lectures; be sure you understand the lectures. Please ask questions inside and outside class! (If you choose to buy the textbook, please understand that it's just an additional reference, not something that I will follow closely.)
2. 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?
3. This is my sixth time teaching 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.
4. 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.

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 engineering graphics (laboratory section)
 - Solid modeling
 - Views and shading
 - Dimensions
 - Fillets, rounds, patterns
 - Assemblies
 - Computer Numerical Control (CNC) milling
- Retention-related objectives
 - Provide a “roadmap” of why 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 "senioritis" in your freshman year

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 (to be named) – 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
 - Senior Associate Dean for Academic Affairs John O'Brien (Professor of Electrical Engineering – Electrophysics) – responsible for the integrity and operation of the academic program including teaching, accreditation, promotions and tenure of faculty, etc.
 - Associate Dean, Admissions and Student Affairs Louise Yates – you know her
 - 7 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 – 27 and growing
- AME students – \approx 125 freshman - 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 Solid Edge
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