AME 101 – Introduction to Mechanical Engineering - Fall 2024

Course Description: Gateway to the Bachelor of Science degree in Mechanical Engineering. Introduction to mechanical engineering disciplines including Statics, Strength of Materials, Fluid Mechanics, and Energy and Thermal Systems; basic electrical circuits; computer-aided drafting and structural analysis, manipulation of USCS and SI units, dimensional analysis, and working in teams on engineering projects.

Lecture: Tuesdays and Thursdays 8:00 - 9:20 am, LVL 16
OR Tuesdays and Thursdays 9:30 - 10:50 am, LVL 16

Labs: Mondays 11:00 – 1:50 pm, SAL 109
OR Tuesdays 11:00 – 1:50 pm, SAL 126
OR Thursdays 11:00 – 1:50 pm, SAL 127
Note: all 3 sections of the SolidWorks labs (see schedule) nominally cover the same material. Due to capacity limitations, please attend your assigned section, however, if you miss a section or know in advance that you'll miss one, you may attend another section - if space is available.
Lab sessions in BHE 301 (see schedule) will end at 1:30 pm, not 1:50 pm.

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

Piazza page (for discussions): https://piazza.com/usc/fall2024/ame101

Instructor: Paul Ronney
Office: Olin Hall 400B
Phone: 213-740-0490
Email: ronney@usc.edu
Office hours: 1:00 – 4:00 pm Thursdays. In person (OHE 406) or via Zoom: https://usc.zoom.us/j/95904778918

Teaching Assistants (TA) and Course Producers (CP)

Name	Email (add "@usc.edu")	Office hours	Location
Shih-Yao (Bob) Huang (TA)	shihyaoh@usc.edu	12:00 – 3:00 pm Wednesdays	VHE 202
Alberto Rigo (TA)	rigo@usc.edu	10:00 am – 1 pm Fridays	VHE 202
Veronica Roberson (CP)	vroberso@usc.edu	N/A	N/A
Kurian Joseph (CP)	kurianjo@usc.edu	N/A	N/A
Joy Uehara (CP)	juehara@usc.edu	N/A	N/A

- TAs have office hours every week; CPs can offer *ad hoc* group discussions by request
- Students can attend any TA's office hours or any CP's group discussions
- TAs and CPs can answer questions about any part of the course (lectures, labs, projects)

Texts:

- Lecture notes (posted on Brightspace and Piazza)
- (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).

USC technology support links for students:

- Zoom information: https://keepteaching.usc.edu/students/student-toolkit/classroom/zoom/
- Brightspace help: https://www.brightspacehelp.usc.edu
- Software available to USC Campus: https://software.usc.edu/

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.

- **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 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. **If you wish to request an extended deadline for an assignment, you must do so at least 24 hours before the deadline. Also, the grade for the 5th lab assignment, which counts twice as much as the others, cannot be dropped!**
- The deadline for disputing grading of homework or exams is **two weeks from the day the graded material is returned with solutions.** To dispute a homework grade, do so via Gradescope's "request for regrade" 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 PDR, not the graders.
- **Homework and midterm solutions will not be posted online**, but paper copies will be distributed in class and during office hours.
- **No extra credit assignments will be offered.** 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 3.3/4.0, perhaps a bit higher if I decide 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 and thus losing 20% of their grade. Viterbi students as a group are extremely competitive in the sense that the standard deviation of scores is small, so losing 20% of your total score would typically move one from the A range to the C range.

Classroom policies:

- Etiquette-related
  - **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…)
- Requests for rescheduling deadlines and exams
  - Multi-student Recognized Student Organizations (RSO) events, for example conferences, contests, *etc.*, and varsity athletic competitions which conflict with the posted course schedule must be discussed with instructor at the beginning of the semester.
  - RSOs requesting accommodations need to have their **RSO President** send event dates and a participating student list to instructors **prior to Week 3** of the semester to review scheduling and potential resolutions.

Tutoring:

- Free peer tutoring for AME 101 is offered through the Viterbi Learning Program (VLP) (https://viterbiundergrad.usc.edu/viterbilearningprogram/).

"Production" aspects of the class

- The 8:00 am and 9:30 am lectures will cover the same material. (The biggest problem with having 8:00 am and 9:30 am sections back-to-back is that with the second lecture, sometimes I can't remember if I said something to both sections already or just the 8:00 am class.)
- Policy on Zoom recordings
  - **Lectures and lab sections will NOT be available via Zoom or recorded, but PDR office hours will be.** (Since office hours are not an officially scheduled part of the class, there's no way we'll find a time where everyone can meet, hence recording office hours is the remedy.)
  - One lab section during the weeks of September 2 and November 11 will be recorded, since students in the Monday section will not have an opportunity to attend in person (Labor Day and Veterans Day), but students in the Monday section can attend the Tuesday or Thursday lab section if space is available.

Tentative schedule

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

	Week of	Lecture subject	Lab subject / Location	Tues. lecture	Thurs. lecture	Assignment due
1	8/26	Introduction, units	Introduction, safety training / BHE	PDR	PDR	
2	9/2	Units	Sketching 1 / SAL	PDR	PDR	
3	9/9	Engineering scrutiny	Arduinos 1 /BHE	PDR	PDR	
4	9/16	Statics	Sketching 2 / SAL	PDR	PDR	L1
5	9/23	Statics	Arduinos 2 /BHE	PDR	PDR	G1
6	9/30	Materials & stresses	Design project 1 build time / BHE	PDR	PDR	L2
7	10/7	Materials & stresses	Design project 1 build time / BHE	PDR	XXX	
8	10/14	N/A	Features 1 / SAL	P1	Q1	L3
9	10/21	Fluid flows	Technical report writing, Assemblies 1 / SAL	PDR	PDR	G2
10	10/28	Fluid flows	Assemblies 2 / SAL	PDR	PDR	R1
11	11/4	Fluid flows	Finite element analysis / SAL	PDR	PDR	G3
12	11/11	Thermodynamics	Drafting 1 / SAL	PDR	PDR	L4
13	11/18	Thermodynamics	Project 2 help / SAL	PDR	Q2	G4
14	11/25	Thermodynamics	Lab tours / EEP CAD project help / SAL	PDR	XXX	
15	12/2	Heat transfer	CAD project help / SAL	PDR	PDR	GP
16	12/9	XXX		P2	Final*	L5
17	12/16	XXX				R2

Legend for schedule

PDR; SL	PDR lectures; Substitute Lecturer
Qn	Midterm exam n
Ln	Lecture homework n due
Gn; GP	Lab homework n due; Lab project due
Pn	Design project n contest (both 8:30 – 10:30 am in EEP)
Rn	Design project n report due
XXX	Break / holiday / end of semester
BHE; SAL	BHE 310 laboratory; SAL 109, 126, or 127 computer laboratory
EEP	Epstein Engineering Plaza fountain

* - Final for 8:00 am class: Tues. 12/17, 4:30 – 6:30 pm; 9:30 am class: Thurs. 12/12, 11 am – 1 pm

Lecture homework topics

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

Lab homework topics

1. Sketching
2. Features
3. Assemblies
4. Drawings

Design projects

1. King of the Hill – week 8
2. 3D Printed Bridge – week 16

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.

Computer Aided Design Lab

This lab will introduce you to a powerful Computer Aided Design (CAD) tool, Solidworks, which is widely used in industry today. This is a hands-on, learn-by-doing class and all instruction will require active use of software, Solidworks 2024. This software will be installed on the computers in SAL 109, 126, and 127. Remote access to these computers is available via a Virtual Desktop Interface, but long experience with the VDI has shown it to be unreliable. Instructions will be provided for students to "check out" Solidworks licenses for use on their own Windows-capable computers.

In lieu of a formal course textbook, a short presentation will be posted on Piazza each week before the class. Log on to Piazza using your USC account, navigate to the AME 101 course page, then navigate to "lab_section_notes". 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.

- Breakdown of laboratory grade - 5 assignments
    - First 4 assignments: each 20% of lab grade (lowest of the 4 grades will be dropped)
    - Fifth assignment: 40% of lab grade (this grade cannot be dropped!)
- Assignment submission
    - All files will be submitted **as one zip file** via Gradescope.
- A grading rubric will be provided with each assignment – **PLEASE READ THE RUBRIC!**

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 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), 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 Academic Integrity (see https://academicintegrity.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 Brightspace, 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

(Possibly) useful information and disclaimers

1. Be sure you understand the lectures. Ask questions inside and outside class!
2. If you choose to buy the optional textbook, 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 live 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 participate in class and read the notes, it will make the course SO much easier for you. Believe me.
3. **Come to office hours and get to know your faculty**. Don't come just for getting help on homework. Faculty members' office hours are the most underutilized resource on campus. You'll never have so much "free" access to so many experts in so many fields - take this opportunity to ask the appropriate faculty about any topic of interest to you.
4. **Read and review 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?
5. **Check your USC email often!** I send a number of "broadcast" emails during the semester via Piazza, 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.
6. **Tips for studying for and taking exams**
    a. 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?"
    b. Do the posted sample exams, homework and examples in lecture notes without looking at the answers. It's very easy to read the solutions and think you understand them, but quite another to answer the questions without looking at the solutions.
    c. Budget your time. Some students tend to spend too much time on the first problem and try to get it "just right" before moving on to the next one.
    d. 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.
    e. 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"
  - Embedded systems (Arduino) & very basic electrical circuitry
  - Approaches to problem-solving and teamwork
  - Writing technical reports
- Provide introductory knowledge of engineering topics
  - Forces and moments of force
  - Fluid flows
  - Materials and stresses
  - Thermal and energy systems
- Provide introductory knowledge of Computer Aided Design (laboratory section)
  - Sketching
  - Features
  - Assemblies
  - Drafting
  - Finite element analysis of stresses
- 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)
  - Statistics
  - Ethics (covered to some extent in WRIT 130 and 340)
  - Computer animation (covered in AME 308)
  - History of engineering
  - Philosophy of engineering
  - Oral presentations

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 these opportunities and not develop "early senioritis"

USC Viterbi School of Engineering mission statement

"The USC Viterbi School of Engineering is innovative, elite and internationally recognized for creating new models of education, research and commercialization that are firmly rooted in real world needs. The school's first priorities are the education of outstanding students and the pursuit and publication of new research. As the school's faculty and students extend the frontiers of engineering knowledge through their research, they also apply engineering and technology to address societal challenges. The school stimulates and encourages qualities of scholarship, leadership, ambition and character that mark the true academic and professional engineer - to serve California, the nation and the world. At USC Viterbi, we call this the enabling power of Engineering+."

Mission statement for the Department of Aerospace and Mechanical Engineering

The degree programs of the Department of Aerospace and Mechanical Engineering provide the educational foundation for success in all walks of life whether one's career path includes employment as a professional engineer, work in a field outside of engineering, or pursuit of further education.

Who's in charge here???

- The USC Board of Trustees has the ultimate say in what happens on campus. The Board has approximately 60 voting members. The Board is a self-perpetuating body which elects 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 or Chief Executive Officer of a corporation.
- Provost Andrew Guzman – the single person most responsible for making the vision of the President actually happen – role similar to that of "Chief Operating Officer" of a corporation.
- Dean of Engineering Yannis Yortsos – overall responsibility for the operation of the School of Engineering
    - Executive Vice Dean Gaurav Sukhatme – responsible for the overall Academic Affairs portfolio of the School, including Undergraduate and Graduate Programs, Faculty Affairs and Academic Programs
    - Vice Dean for Academic Affairs Erik Johnson
    - Senior Associate Dean for Admissions and Student Affairs Kelly Goulis
    - Many other Associate Deans – see http://viterbi.usc.edu/about/administration/
- Chair of Department of Aerospace and Mechanical Engineering (AME) Prof. Paul Ronney, – overall responsibility for the operation of AME
- AME faculty – 26 tenure-track + 10 teaching and (hopefully) growing
- AME students – ≈ 125 freshers per year + ≈ 25 transfers - In what ways are you in charge?

- Participate in aforementioned activities
- Teaching evaluations
- Directed research
- (Someday) alumni activities

AME student design teams

- SC Solar Car Team (advisor: Prof. Emma Singer) http://uscsolarcar.com
- Formula SAE internal combustion (advisor: Prof. Yann Staelens) https://www.uscformulasae.com
- Formula Electric (advisor: Prof. Yann Staelens) https://www.uscformulae.com
- Aero Design Team (advisor: Prof. Saakar Byahut) https://www.uscaerodesign.com
- Advanced Composites Design Team (advisor: Prof. Bocheng Jin) https://careers.usc.edu/organizations/advanced-composites-design-team/
- Recumbent Vehicle Design Team (advisor: Prof. Matt Gilpin) https://www.uscrvdt.com
- Advanced Spacecraft Propulsion and Energy Laboratory (ASPEN) (advisor: Prof. Matt Gilpin) https://www.uscaspen.com

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."

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.

Learning Objectives for AME 101:

Throughout the semester students will develop an understanding of, and demonstrate their proficiency in applications of the following concepts and principles pertaining to Mechanical Engineering:

1. Convert and manipulate the units of engineered systems
2. Use dimensional analysis to estimate the effects of scale in physical systems
3. Scrutinize a calculated or measured result for "obvious" mistakes
4. Work productively as part of an engineering team working toward a common objective
5. Create 3-D models of parts and assemblies using Computer-Aided Design software
6. Analyze the forces and torques on rigid objects
7. Know the properties of common engineered materials and calculate stresses in simple structures
8. Use Finite Element Analysis software to compute stresses in complex structures
9. Calculate fluid flow properties in simple systems and compute lift, drag, and pressure drop
10. Application of the principle of conservation of energy to very simple systems.

11. Know the three modes of heat transfer and be able to apply their basic equations to simple systems.
12. Design, test, and use simple electrical circuits
13. Interface electromechanical elements such as motors, position sensors, and accelerometers with microcontrollers such as Arduino-based systems.

ABET Program Educational Objectives

In addition to course-specific objectives and outcomes, ABET requires that the program being evaluated have a set of "Program Educational 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. Graduates of the undergraduate programs in Aerospace and Mechanical Engineering are expected to attain the following objectives within a few years after graduation:

- Work as professionals within engineering or a related area in both small- and large-scale businesses;
- Pursue further education through graduate school or professional development courses; and
- Become leaders within their chosen profession whether it be industry, academia, or service.

ABET Student Outcomes

ABET evaluation also requires a set of "Student Outcomes" which are narrower statements that describe what students are expected to know and be able to do by the time of graduation. Upon completion of an undergraduate program offered by the USC Department of Aerospace and Mechanical Engineering, students will have acquired:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

AME undergraduate curriculum – transition from 3-unit to 4-unit classes
Special note for the Class of 2028

Recently AME made the difficult and time-consuming choice to transition its undergraduate curriculum from primarily 3-unit to primarily 4-unit classes, starting with the incoming class in Fall 2023. This was done to be in sync with the rest of the university which is based primarily on 4-unit classes. With 3-unit classes and a requirement of a minimum of 16 units per semester on average to graduate in 4 years, students sometimes had to take 5 or even 6 classes in a semester. With the revised curriculum, students can graduate in 4 years by taking four 4-unit classes every semester, plus two 2-unit class (BSME majors) or three 2-unit classes (BSAE majors). In no semester does a student need to take more than 18 units which would trigger additional tuition charges.

This discussion pertains only to courses specifically required for the BSAE or BSME degree, not **any** electives including AME Core Electives. Currently AME electives are not affected, although many that are currently 3 units will eventually transition to 4 unit classes. Any unit-based requirement for electives can be met with any combination of 3-unit and 4-unit classes. For example, if a student needs 12 units of AME Core Electives, they could take four 3-unit courses or three 4-unit courses.

- Policies for students
  - All students must follow the curriculum in the catalog published in the year they first enrolled at USC or later. This policy includes both 4-year and transfer students. As a consequence:
    - All incoming first-year students starting in Fall 2023 or later must follow the new 4-unit curriculum. They may not follow the prior 3-unit curriculum.
    - All students who first enrolled at USC any time before Fall 2023 would normally follow the 3-unit curriculum but are not required to.
    - Students taking courses out-of-sequence must still follow these policies. For example, if a Fall 2024 freshman wishes to take AME 310 in AY 2024 - 2025, they must take it for 3 units even though if they took it in AY 2025 - 2026, they would get 4 units of credit.
    - In such cases, students will get a waiver of the extra unit of AME 310 (or other course) required, but their total unit requirement will not change. The additional unit requirement can be met with **any** free elective (*e.g.*, a 1-unit Physical Education course.)
- Policies for scheduling the revised courses
  - **General approach**
    - The revised 4-unit courses will have 4 contact hours (*e.g.*, 3 lecture hours + 1 discussion hour or 4 lecture hours, *etc.*), regardless of whether the course is being offered for 3 or 4 units of academic credit.
    - All revised courses listed as "(3, 4 units)" in the USC Catalog and/or the Schedule of Classes will only be offered for either 3 or 4 units; never both in the same academic year.
    - Once these "(3, 4 units)" courses have been offered for 4 units, they will always be 4-unit classes and the USC catalog will be revised to list them as "4 units" only.
  - **Starting in AY 2023 - 2024:** all revised courses that have been approved for "3, 4 units" will be offered only in the 3-unit versions in the Schedule of Classes. The 4-unit versions will not be available to students. The following exceptions apply:
    - AME 101 will be offered for 4 units only. (AME 105 was already 4 units so no change was needed.)
    - AME 208, the new course in the curriculum, will not be offered until AY 2024 - 2025 and will be offered for 4 units only.

    - AME 302ab (2 units each), the replacement for the current AME 302 (3 units), will not be offered until AY 2025 - 2026 when the incoming Fall 2023 students are juniors.
    - AME 431 (4 units; replacement for AME 331, 3 units) will not be offered until AY 2024 – 2025. Instead, AME 331 (3 units) will be offered for the last time in AY 2023-2024.
- **Starting in AY 2024 - 2025:** AME 201 and 204 will be listed from now on as "4.0 units." The 3-unit option will not be available to students.
    - AME 431 (4 units) will be offered instead of AME 331 (3 units), and AME 331 will be terminated. Students who need AME 331 will take AME 431 instead.
    - Note: AME 261 was already 4 units, so no change was needed.
- **Starting in AY 2025 - 2026:** AME 301, 308, 310, and 341ab will be listed from now on as "4.0 units." The 3-unit option will not be available to students.
    - AME 302ab (2 units each) will be added to the course offerings.
    - Note: AME 309 was already 4 units so no change was needed.
- **Starting in AY 2026 - 2027:** AME 436, 441ab, and 451 will be listed from now on as "4.0 units." The 3-unit option will not be available to students.