2013-2014

STUDENT HANDBOOK

Mechanical Engineering
Aerospace Engineering
Environmental Engineering
Engineering Science
Welcome to the Mechanical and Aerospace Engineering Department!

Congratulations on being admitted to the Department of Mechanical and Aerospace Engineering (MAE) in the Jacobs School of Engineering. We are sure you have questions about what to do next. We hope that this handbook will help you get familiar with our departments policies and expectations. If there are questions or concerns that are not answered make sure to contact us.

MAE Undergraduate Academic Advising

The MAE advising staff assists students with their programs of study. The advising staff is available in EBU2, first floor for walk-in advising.

Walk-in Advising: Monday through Friday 9:00 AM—11:30 AM and 1:30 PM—3:30 PM

The MAE advising program runs parallel to the work of college advisors who assist students with the general-education requirements of each college. It is important that the scheduling of mathematics, physics, chemistry and engineering courses be done as suggested in the MAE curriculum table. If you have any questions about your major please refer to the MAE advisors.

Gerri Johnson- Phone: (858) 534-0114 Email: gljohnso@ucsd.edu
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MAE PROGRAM EDUCATIONAL OBJECTIVES

EDUCATIONAL OBJECTIVES:

- To provide our students with a strong technical education that will enable them to have successful careers as engineers, technology leaders and innovators.
- To prepare our students for rapid technological change with the core knowledge central to assuring that they are able to further develop their knowledge and skills across a range of disciplines throughout their professional careers and pursue advanced education.
- To prepare our students to communicate effectively and to deal knowledgeably and ethically with the impact of technology in our society and on global issues.

MISSION STATEMENT:

"Educate Tomorrow's Technology Leaders.  
Conduct Leading Edge Research and Drive Innovation. 
Transfer Discoveries for the Benefit of Society."

“To foster the best possible working and learning environment, our university strives to maintain a climate of fairness, cooperation, and professionalism, which is embodied in our campus Principles of Community. UC San Diego embraces diversity, equity, and inclusion as essential ingredients of academic excellence in higher education.”
OUTCOMES:

(ABET accredited programs)

AEROSPACE ENGINEERING STUDENT OUTCOMES:
(1a) an ability to apply knowledge of mathematics, science, and engineering
(2b) an ability to design and conduct experiments, as well as to analyze and interpret data
(3c) 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
(4d) an ability to function on multidisciplinary teams
(5e) an ability to identify, formulate, and solve engineering problems
(6f) an understanding of professional and ethical responsibility
(7g) an ability to communicate effectively
(8h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(9i) a recognition of the need for, and an ability to engage in lifelong learning
(10j) a knowledge of contemporary issues
(11k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

(AE12) Aeronautics (Primary): knowledge of aerodynamics, aerospace materials, structures, propulsion, flight mechanics, and stability and control
(AE13) Astronautics (Secondary): knowledge of attitude determination and control, space structures, orbital mechanics, and rocket propulsion
(AE14) Integration: an ability to integrate knowledge of the fundamental topics in the design of aerospace systems

MECHANICAL ENGINEERING STUDENT OUTCOMES:
(1a) Fundamentals: An ability to apply knowledge of mathematics (including multivariate calculus and differential equations), science, and engineering, to model and analyze physical systems, components or processes.
(2b) Experiment: An ability to design and conduct experiments, as well as to analyze and interpret data
(3c) Design: An ability to design and realize a physical system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(4d) Teams: An ability to function on multidisciplinary teams
(5e) Problem Solving: An ability to identify, formulate, and solve engineering problems
(6f) Ethics: An understanding of professional and ethical responsibility
(7g) Communication: An ability to communicate effectively
(8h) Broad Education: The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(9i) Life-Long Learning: A recognition of the need for, and an ability to engage in lifelong learning
(10j) Contemporary Issues: A knowledge of contemporary issues
(11k) Modern Skills/Tools: An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

(ME12) Mechanical Systems: An ability to work professionally in mechanical systems areas.
(ME13) Thermal Systems: An ability to work professionally in thermal systems areas.
WHAT IS ABET?

ABET is the Accreditation Board for Engineering and Technology

All majors at USCD are accredited by the Western Association of Schools and Colleges (WASC). ABET is responsible for the specialized accreditation of educational programs in applied science, computing, engineering, and technology.

ABET accreditation is assurance that a college or university program meets the quality standards established by the profession for which it prepares its students. For example, an accredited engineering program must meet the quality standards set by the engineering profession. An accredited computer science program must meet the quality standards set by the computing profession.

The quality standards must meet to be ABET-accredited, which is set by the ABET professions themselves. This is made possible by the collaborative efforts of many different professional and technical societies. These societies and their members work together through ABET to develop the standards, and they provide the professionals who evaluate the programs to make sure they meet those standards.
DURING THE FIRST YEAR:

By the end of the first year, all students must complete at least the following eight required courses. These courses can be taken at UCSD or transferred in from a different university or community college.

### One Intro Engineering Course
- MAE 3 (For ME Students)
- MAE 2 (For AE Students)

### Three Math Courses
- Math 20A
- Math 20B
- Math 20C

### Two Physics courses w/lab
- Phys 2A
- Phys 2B/BL

### One General Chemistry
- Chem 6A/AH

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**Average GPA, MSAT and TSAT Scores of Students Admitted Directly to MAE Majors (2013):**

<table>
<thead>
<tr>
<th>Major</th>
<th>M.SAT</th>
<th>SAT</th>
<th>GPA</th>
<th>Transfer GPA (2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerospace</td>
<td>773</td>
<td>2046</td>
<td>4.22</td>
<td>3.76</td>
</tr>
<tr>
<td>Mechanical</td>
<td>734</td>
<td>2110</td>
<td>4.26</td>
<td>3.75</td>
</tr>
<tr>
<td>Environmental</td>
<td>690</td>
<td>1945</td>
<td>4.08</td>
<td>3.62</td>
</tr>
</tbody>
</table>

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**MAJOR ACADEMIC ADVISING**

**MAE Undergraduate Advising Staff.**

The MAE advising staff assists students with their programs of study. The advising staff is available in EBU2, first floor for walk-in advising.

**Walk-in Advising: Monday through Friday 9:00 AM—11:30 AM and 1:30 PM—3:30 PM**

The MAE advising staff also assists students in preparing petitions to the Undergraduate Affairs Committee for any deviation from the standard programs of study. The MAE advising program runs parallel to the work of college advisors who assist students with the general-education requirements of each college. It is important that the scheduling of mathematics, physics, chemistry and engineering courses be done as suggested in the MAE curriculum table. If you have any questions about your major see an MAE advisor.

**Student Affairs Lobby.** The student lobby is a great resource for students. Here you'll also find a complete MAE course offering list for the 2013-2014 academic year, copies of all MAE majors four year plans, along with a complete list of technical electives for each major, student petitions, etc. The MAE Student Affairs lobby is located in EBU II, first floor. We suggest you come prior to the Fall quarter, to familiarize yourself with the lobby and the EBU II building itself.
GENERAL EDUCATION/COLLEGE REQUIREMENTS

For graduation each student must satisfy general-education course requirements determined by the student’s college as well as the major requirements determined by the department. The six colleges at UCSD require widely different general-education courses and the number of such courses differs from one college to another. Each student should choose his or her college carefully, considering the special nature of the college and the breadth of general education.

In practice, the overwhelming majority of students are happy with their college assignment, even if it was not their first choice originally, and few students apply to switch. Petitions to transfer between colleges are difficult to justify and approved only in exceptional cases. To qualify, you must complete your originally assigned college’s writing program, demonstrate that switching to a different college will substantially shorten your time to degree, and have a cumulative grade point average of at least 2.5 with a specified number of completed units.

Each MAE program allows for humanities and social science (HSS) courses so that students can fulfill their college requirements. In the ABET accredited programs, students must develop a program that includes a total of at least twenty-four units in the arts, humanities, and social sciences, not including subjects such as accounting, industrial management, finance, or personnel administration. It should be noted, however, that some colleges require more than the nine or ten HSS courses indicated in the curriculum tables. Accordingly, students in these colleges could take longer to graduate than the indicated four-year schedule. Students must consult with their college to determine which HSS courses to take.

| Number of College General Education Courses in addition to those met within MAE Major Programs: |
|-------------------------------------------------|------------------------------------------------|
| # of Courses | # of Units |
| Warren       | 10          | 40             |
| Marshall     | 10-11       | 40-44          |
| Muir         | 11          | 44             |
| Sixth        | 12-14       | 52-60          |
| ERC          | 10-15       | 44-64          |
| Revelle      | 12-16       | 52-68          |

Unit of GEs range between 4-6 units per course

MAE MAJOR PROGRAMS AND REQUIREMENTS

Specific course requirements for each major program are outlined in tables in this section of the handbook. In addition to the required technical courses specifically indicated, a suggested scheduling of humanities and social science courses (HSS) are distributed in the curricula for students to use to meet college general-education requirements. To graduate, students must maintain an overall GPA of at least 2.0, and the Department requires at least a C-grade in each course required for the major. A complete list of technical electives (TE) for each major is available in the MAE Student Affairs lobby (EBU II, first floor). In the accredited programs, TE courses are restricted to meet ABET standards. Students are encouraged to complete lower and upper-division courses as suggested in the curriculum tables in a timely fashion and in the sequences outlined. Deviation in scheduling of MAE upper-division courses is strongly discouraged.

Lower-division courses are offered more than once each year to permit students some flexibility in their program scheduling. However, many MAE upper-division courses are taught only once per year, and the courses are scheduled to be consistent with the curricula as shown in the tables. Students taking upper-division courses in a different order than that shown in the tables may experience conflicts as the schedules of different courses may overlap. A tentative schedule of course offerings is available from the department each spring for the following academic year. Prerequisite courses with a grade of D or F must be repeated before you can move on to the next course in the sequence. This includes the required math, physics and Chemistry courses. Prerequisites are strictly enforced by the department.
Impacted Majors

Please note: The departments in the Jacobs School of Engineering have requested that all engineering majors be declared impacted. This request is currently under review. Please check back for information on the status of this request, including effective dates. Remember that admission to the university and to a college does not guarantee acceptance to an impacted major.

Due to high demand, some engineering majors at the Jacobs School have been designated as oversubscribed. They are:

1. Mechanical Engineering (Effective Fall 2009 for freshmen. Effective Fall 2011 for transfers)
2. Aerospace Engineering (Effective Fall 2009 for freshmen. Effective Fall 2011 for transfers)

Acceptance into an Impacted Engineering Major
Acceptance into an oversubscribed engineering major is based on academic excellence demonstrated in high school, community college or other four year institutions.

Freshmen
Admitted freshmen that have applied to an oversubscribed major will be further evaluated by the Office of Admissions and Relations with Schools for admission to the major. Acceptance will be granted to the maximum number of students in each of these impacted major programs. Students who are not admitted to the oversubscribed major are placed into the alternate major they selected on the UC Undergraduate Application, provided the alternate is not oversubscribed.

We highly recommend that freshman applicants list a non-oversubscribed open major as their alternate choice on the UC Undergraduate Application. If a student lists an oversubscribed major as both the first and alternate choices on the UC application, and is not admitted to the first choice major, the Office of Admissions and Relations with Schools will place the student in the Undeclared major. The Undeclared major is not affiliated with the Jacobs School. However, students admitted as undeclared may later seek admission to an open engineering major.

Transfers
Admitted transfer students who choose impacted engineering major programs as their first choice major on their UC application are strongly encouraged to complete the major preparation classes. Acceptance to impacted majors may be limited to the best transfer applicants, e.g., those who have been admitted with the most complete lower-division preparation and the highest college grade-point averages. For impacted majors, a competitive UCSD transferable cumulative GPA of 3.20 and 3.40 in the major-preparation courses is recommended. Since acceptance is restricted to these majors, transfer students are encouraged to apply to more than one major degree program.

We highly recommend that transfer applicants who list an impacted engineering major as their first major, choose a non-impacted engineering major or non-engineering major as their alternate choice. If a student lists an oversubscribed major as both the first and alternate choices on the UC application, and is not admitted to the first choice major, the Office of Admissions and Relations with Schools will place the student in the Undeclared major. The Undeclared major is not affiliated with the Jacobs School. However, students admitted as undeclared may later seek admission to an open engineering major.

It is strongly recommended that transfers complete the following preparation for all engineering majors.

- Calculus I—for Science and Engineering (Math 20A)
- Calculus II—for Science and Engineering (Math 20B)
- Calculus and Analytic Geometry (Math 20C)
- Differential Equations (Math 20D)
- Linear Algebra (Math 20F)
- Complete calculus-based physics series with lab experience (Physics 2A, B, and C)
- Chemistry 6A
- Highest level of introductory computer programming language course offerings at the community college
Aerospace engineering is a four-year curriculum that begins with fundamental engineering courses in mechanics, thermodynamics, materials, solid mechanics, fluid mechanics, and heat transfer. Additional courses are required in aerospace structures, aerodynamics, flight mechanics, propulsion, controls, and aerospace design. Graduates of this program normally enter the aerospace industry to develop aircraft and spacecraft, but also find employment in other areas that use similar technologies, such as mechanical and energy-related fields. Examples include automobile, naval, and sporting equipment manufacturing. This program received ABET accreditation in 2002.

Recommended Course Sequence of Required Courses for Fall 2013 Students:

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math 20A*</td>
<td>Math 20B*</td>
<td>Math 20C*</td>
</tr>
<tr>
<td>MAE 2- Intro to Aerospace</td>
<td>Phys 2A*</td>
<td>Phys 2B* and 2BL</td>
</tr>
<tr>
<td>Chem 6A</td>
<td>HSS</td>
<td>Structural Engineering (SE) 2</td>
</tr>
<tr>
<td>HSS (College Requirements)</td>
<td>HSS</td>
<td>HSS</td>
</tr>
<tr>
<td><strong>Year 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math 20D</td>
<td>Math 20F*</td>
<td>Math 20E</td>
</tr>
<tr>
<td>Phys 2C and 2CL</td>
<td>MAE 8- Intro to MatLab</td>
<td>MAE 131A- Solid Mechanics</td>
</tr>
<tr>
<td>MAE 3- Graphics and Design</td>
<td>MAE 130A*- Statics</td>
<td>MAE 130B- Dynamics</td>
</tr>
<tr>
<td>HSS</td>
<td>HSS</td>
<td>HSS</td>
</tr>
<tr>
<td><strong>Year 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAE 105*- Mathematical Physics</td>
<td>MAE 101A*- Intro to Fluids</td>
<td>MAE 101B*- Advance Fluids</td>
</tr>
<tr>
<td>MAE 110A- Thermodynamics</td>
<td>MAE 143A*- Signals and Systems</td>
<td>MAE 143B- Linear Control</td>
</tr>
<tr>
<td>MAE 140- Linear Circuits</td>
<td>MAE 130C- Vibrations</td>
<td>MAE 170- Experimental Technique</td>
</tr>
<tr>
<td>MAE 107- Computational Methods</td>
<td>SE 160A*</td>
<td>SE 160B</td>
</tr>
<tr>
<td><strong>Year 4</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAE 101C*- Heat Transfer</td>
<td>MAE 155A*- Aerospace Design</td>
<td>MAE 155B- Aeronautics Design</td>
</tr>
<tr>
<td>MAE 150*- Computer-Aid Design</td>
<td>MAE 175A- Engineering Lab</td>
<td>HSS</td>
</tr>
<tr>
<td>MAE 104*- Aerodynamics</td>
<td>MAE 142*- Dynamics and Controls</td>
<td>HSS</td>
</tr>
<tr>
<td>HSS</td>
<td>MAE 113*- Propulsion</td>
<td>TE</td>
</tr>
</tbody>
</table>

When scheduling classes, the MAE department follows this curriculum grid. If you choose to deviate from it, you will extend your time to graduation.

(continued on next page...)
AEROSPACE ENGINEERING:

In fulfilling the Humanities and Social Science (HSS) requirements, students must take at least 24 units in the arts, humanities, and social sciences, not including subjects such as accounting, industrial management, finance, or personnel administration. Ten HSS courses are listed here; individual college requirements may be higher or lower.

Technical Elective (TE) courses must be upper-division or graduate courses in the engineering sciences, natural sciences or mathematics and must be selected with prior approval of the Department. See the MAE Student Affairs Office for a complete list of approved Technical Electives.

*COURSES MARKED WITH AN ASTERISK ARE PREREQUISITES TO COURSES LISTED IN THE IMMEDIATELY SUCCEEDING OR CONCURRENT QUARTER.

Photos courtesy of the MAE 2 course of 2008

First-year aerospace engineering students work in teams to design, build, and fly multi-disciplinary payload experiments on balloon satellites to near-space. Students gain real-world engineering experience developing and assembling sub-systems on space flight critical systems.
The Environmental Engineering program resembles the Chemical Engineering program for the first two years. In the third and fourth year, the programs diverge: an environmental engineering sequence is offered, as well as further specialization in fluid mechanics, and a wide choice of Technical Elective (TE) courses, both from within MAE and in other departments. The newly founded Environmental Engineering program within the Department of Mechanical and Aerospace Engineering (MAE) at UCSD is a modern interpretation of this rapidly changing field. Unlike the classical environmental engineering topics (e.g. water sanitation, brownfield remediation) many new environmental engineering and sustainability challenges require strong quantitative skills. Renewable energy technologies require skills in material science and physics, climate change research requires individuals trained in fluid mechanics and environmental transport and sustainable building design requires deep knowledge of heat and mass transfer in complex geometries.

Proposed Course Sequence of Required Courses for Fall 2013 Students. Proposed Changes noted with **. All changes pending approval:

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>** Year 1 **</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math 20A</td>
<td>Math 20B</td>
<td>Math 20C</td>
</tr>
<tr>
<td>Chem 6A</td>
<td>Phys 2A</td>
<td>Phys 2B and 2BL</td>
</tr>
<tr>
<td>HSS</td>
<td>Chem 6B</td>
<td>Chem 6C/6BL</td>
</tr>
<tr>
<td>HSS</td>
<td>HSS</td>
<td>HSS</td>
</tr>
<tr>
<td>** Year 2 **</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math 20D</td>
<td>Math 20F</td>
<td>Math 20E</td>
</tr>
<tr>
<td>Phys 2C/2CL</td>
<td>MAE 8 Intro to MatLab</td>
<td>** MAE 3- Graphics and Design</td>
</tr>
<tr>
<td>ESYS 101- Environmental Bio</td>
<td>**MAE 130A- Statics</td>
<td>** MAE 130B- Dynamics</td>
</tr>
<tr>
<td>HSS</td>
<td>HSS</td>
<td>MAE 108 – Statistics and Probability for Engineering</td>
</tr>
<tr>
<td>** Year 3 **</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAE 105*- Mathematical Physics</td>
<td>MAE 101A*- Intro to Fluids</td>
<td>MAE 101B*- Advance Fluids</td>
</tr>
<tr>
<td>MAE 107- Computational Methods</td>
<td>MAE 119- Renewable Energy</td>
<td>MAE 170*- Experimental Technique</td>
</tr>
<tr>
<td>CENG 100- Modeling and Computations</td>
<td>** MAE 110A- Thermodynamics</td>
<td>TE</td>
</tr>
<tr>
<td>** Chem 171- Environmental Chemistry I</td>
<td>HSS</td>
<td>HSS</td>
</tr>
<tr>
<td>** Year 4 **</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAE 101C*- Heat Transfer</td>
<td>MAE 126A*- Environmental Engineering Lab</td>
<td>MAE 126B- Environmental Engineering Lab</td>
</tr>
<tr>
<td>MAE 122- Environmental Transport</td>
<td>MAE 123- Groundwater Remediation</td>
<td>TE</td>
</tr>
<tr>
<td>TE</td>
<td>TE</td>
<td>HSS</td>
</tr>
<tr>
<td>HSS</td>
<td>HSS</td>
<td>HSS</td>
</tr>
</tbody>
</table>

When scheduling classes, the MAE department follows this curriculum grid. If you choose to deviate from it, you will extend your time to graduation.
ENVIRONMENTAL ENGINEERING

In fulfilling the Humanities and Social Science (HSS) requirements, students must take at least 24 units in the arts, humanities, and social sciences, not including subjects such as accounting, industrial management, finance, or personnel administration. Eleven HSS courses are listed here; individual college requirements may be higher or lower.

Five Technical Elective (TE) courses are required to receive a degree in Environmental Engineering: at least 1 must be upper division courses selected from the MAE Department and at least 2 must be courses selected from outside the MAE Department. See the MAE Student Affairs Office for a complete list of approved Technical Electives.

**Proposed changes to the Environmental Engineering major are currently pending approval. For a current four-year plan, please see the MAE advisors.

*COURSES MARKED WITH AN ASTERISK ARE PREREQUISITES TO COURSES IN THE IMMEDIATELY SUCCEEDING OR CONCURRENT QUARTER.*

This experiment consists of a plume produced by a source of salt water at the top of a tank of fresh water. The flow to the plume is controlled by a peristaltic pump, which pumps salt water from the beaker to the plume nozzle. The density of the plume is determined by a conductivity probe that measures the resistance of the solution that is, in turn, a function of the salt concentration. The probe measures the salinity of water drawn in through the tip by the second peristaltic pump. The location of the probe is controlled in the Labview VI.
The Mechanical Engineering Program has a traditional ABET accredited four-year curriculum involving mechanics, vibrations, thermodynamics, fluid flow, heat transfer, materials, control theory and mechanical design. Graduates of this program find employment in the high-technology electromechanical industry as well as in the mechanical and aerospace industry.

**Recommended Course Sequence of Required Courses for Fall 2010 Students:**

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math 20A*</td>
<td>Math 20B*</td>
<td>Math 20C*</td>
</tr>
<tr>
<td>Chem. 6A*</td>
<td>Phys 2A*</td>
<td>Phys 2B* and 2BL</td>
</tr>
<tr>
<td>HSS</td>
<td>Chem 6B</td>
<td>MAE 3- Graphics and Design</td>
</tr>
<tr>
<td>HSS</td>
<td>HSS</td>
<td>HSS</td>
</tr>
<tr>
<td>Year 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math 20D</td>
<td>Math 20F*</td>
<td>Math 20E</td>
</tr>
<tr>
<td>Phys. 2C and 2CL</td>
<td>MAE 130A* - Statics</td>
<td>MAE 131A- Solid Mechanics</td>
</tr>
<tr>
<td>MAE 20- Materials Science</td>
<td>MAE 8- Intro to MatLab</td>
<td>MAE 130B- Dynamics</td>
</tr>
<tr>
<td>HSS</td>
<td>HSS</td>
<td>MAE 108 – Statistics and Probability for Engineering</td>
</tr>
<tr>
<td>Year 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAE 105*- Mathematical Physics</td>
<td>MAE 101A*- Intro to Fluids</td>
<td>MAE 101B*- Advance Fluids</td>
</tr>
<tr>
<td>MAE 110A- Thermodynamics</td>
<td>MAE 143A*- Signals and Systems</td>
<td>MAE 143B- Linear Control</td>
</tr>
<tr>
<td>MAE 140- Linear Circuits</td>
<td>MAE 130C- Vibration s</td>
<td>MAE 170- Experimental Technique</td>
</tr>
<tr>
<td>MAE 107- Computational Methods</td>
<td>MAE 160 or MAE 131B Behavior of Materials/Solids</td>
<td>HSS</td>
</tr>
<tr>
<td>Year 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAE 101C*- Heat Transfer</td>
<td>MAE 156A*- Design Lab I</td>
<td>MAE 156B- Design Lab II</td>
</tr>
<tr>
<td>MAE 150*- Computer-Aid Design</td>
<td>MAE 171A - Engineering Lab I</td>
<td>TE</td>
</tr>
<tr>
<td>TE</td>
<td>TE</td>
<td>TE</td>
</tr>
<tr>
<td>HSS</td>
<td>HSS</td>
<td>HSS</td>
</tr>
</tbody>
</table>

*WHEN SCHEDULING CLASSES, THE MAE DEPARTMENT FOLLOWS THIS CURRICULUM GRID. IF YOU CHOOSE TO DEVIATE FROM IT, YOU WILL EXTEND YOUR TIME TO GRADUATION.*
MECHANICAL ENGINEERING:

In fulfilling the Humanities and Social Science (HSS) requirements, students must take at least 24 units in the arts, humanities, and social sciences, not including subjects such as accounting, industrial management, finance, or personnel administration. Ten HSS courses are listed here; individual college requirements may be higher or lower.

Technical Elective (TE) courses must be upper-division or graduate courses in the engineering sciences, natural sciences or mathematics and must be selected with prior approval of the Department. See the MAE Student Affairs Office for a complete list of approved Technical Electives.

*COURSES MARKED WITH AN ASTERISK ARE PREREQUISITES TO COURSES LISTED IN THE IMMEDIATELY SUCCEEDING OR CONCURRENT QUARTER.

Example of an MAE 3 Project

This course introduces the fundamentals of engineering graphics and the design. Emphasis is placed on applying engineering tools to design and fabrication of working machines. Course material will be centered around two projects:

- Model Clock Project (2.5 weeks): Students will use AutoCAD to design an escapement wheel and pendulum for a model clock, and make the model using shop tools.
- Robot Design Project (7.5 weeks): Teams of students will design and build a machine for a competition using DC motors, solenoids, and fabrication tools.
# ENGINEERING SCIENCE

This major has been discontinued as of Fall 2011. All current Engineering Science major students will be able to finish their degree in Engineering Science.

The Engineering Science program resembles the Mechanical Engineering program, except that the course load of mechanical design is reduced, and control theory is not required. In addition to core courses in dynamics, vibrations structures, fluid mechanics, thermodynamics, heat transfer, and laboratory experimentation, a large number of technical electives are scheduled. Students intending to pursue postgraduate professional careers in non-technical fields such as business administration, law, or medicine may develop an appropriate sequence of courses. Although a sequence in the non-sciences may be permitted, the faculty adviser may insist on a substantial number of MAE or other science courses as Technical Electives. Students must consult their advisors to develop a balanced course of study to fulfill the Technical Elective requirements. This curriculum allows the highest number of Humanities and Social Science (HSS) courses to meet college general-education requirements.

## Recommended Course Sequence of Required Courses for Fall 2010 Students:

<table>
<thead>
<tr>
<th>FALL QUARTER</th>
<th>WINTER QUARTER</th>
<th>SPRING QUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Math 20A*</td>
<td>Math 20B*</td>
<td>Math 20C*</td>
</tr>
<tr>
<td>Chem 6A*</td>
<td>Phys 2A*</td>
<td>Phys 2B* and 2BL</td>
</tr>
<tr>
<td>HSS (College Requirements)</td>
<td>Chem 6B</td>
<td>MAE 3*- Graphics and Design</td>
</tr>
<tr>
<td>HSS</td>
<td>HSS</td>
<td>HSS</td>
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<tr>
<td><strong>Year 2</strong></td>
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<tr>
<td>Math 20D</td>
<td>Math 20F</td>
<td>Math 20E</td>
</tr>
<tr>
<td>Phys. 2C and 2CL</td>
<td>MAE 130A - Statics</td>
<td>MAE 131A- Solid Mechanics</td>
</tr>
<tr>
<td>MAE 20- Materials Science</td>
<td>MAE 8 Intro to MatLab</td>
<td>MAE 130B- Dynamics</td>
</tr>
<tr>
<td>HSS</td>
<td>HSS</td>
<td>MAE 108 – Statistics and Probability for Engineering</td>
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<tr>
<td><strong>Year 3</strong></td>
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</tr>
<tr>
<td>MAE 105*- Mathematical Physics</td>
<td>MAE 101A*- Intro to Fluids</td>
<td>MAE 101B*- Advance Fluids</td>
</tr>
<tr>
<td>MAE 107- Computational Methods</td>
<td>MAE 130C- Vibrations</td>
<td>MAE 170- Experimental Technique</td>
</tr>
<tr>
<td>MAE 110A- Thermodynamics</td>
<td>MAE 143A*- Signals and Systems</td>
<td>MAE 143B- Linear Control</td>
</tr>
<tr>
<td>MAE 140- Linear Circuits</td>
<td>MAE 160 or MAE 131B Behavior of Materials/ Solids HSS</td>
<td>HSS</td>
</tr>
<tr>
<td><strong>Year 4</strong></td>
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<tr>
<td>MAE 101C*- Heat Transfer</td>
<td>MAE 171A*- Engineering Lab</td>
<td>TE</td>
</tr>
<tr>
<td>MAE 150*- Computer-Aid Design</td>
<td>TE</td>
<td>TE</td>
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<tr>
<td>TE</td>
<td>HSS</td>
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<td>HSS</td>
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<td>HSS</td>
</tr>
</tbody>
</table>
ENGINEERING SCIENCE:

In fulfilling the Humanities and Social Sciences (HSS) requirements, students must take at least 24 units in the arts, humanities and social sciences, not including subjects such as accounting, industrial management, finance or personal administration. Twelve HSS courses are listed here; individual college requirements may be higher or lower.

Technical Elective (TE) courses must be upper-division or graduate courses in the engineering sciences, natural sciences or mathematics and must be selected with prior approval of the department. A sequence of non-science courses may also be selected with prior approval (see program description). See the MAE Student Affairs Office for a complete list of approved Technical Electives.

*COURSES MARKED WITH AN ASTERISK ARE PREREQUISITES TO COURSES IN THE IMMEDIATELY SUCCEEDING OR CONCURRENT*
ACADEMIC ENRICHMENT

A number of additional educational opportunities, not formally required in the curriculum, are available to undergraduates interested in exploring facets of engineering in more detail. These opportunities include participation in research, industrial internships, student societies, course instruction, and seminars.

Academic Internships: Special Study (MAE 197)

The UCSD Academic Internship Program coordinates work experiences for undergraduates with industry, governmental offices, and hospitals. Students work under the supervision of either a faculty member or an industrial supervisor. The position may or may not be salaried. Students may receive up to 12 units of academic credit by registering for MAE 197 Engineering Internship and completing a research paper or technical laboratory report on their internship work. The typical student time commitment to the internship is ten hours per week for every four units of academic credit. However, students may not receive upper division technical elective credit for such internships.

Undergraduate Research and Independent Study (MAE 199)

Undergraduates may participate in engineering research at UCSD through a number of informal and formal mechanisms. Many students first become familiar with research by participating 5-10 hours per week during the academic year or 10-20 hours per week in the summer on a volunteer basis. Other students are involved in research through the more formal programs described below.

Independent Study for Undergraduates. MAE 199 courses offer qualified and motivated students the opportunity to work closely with faculty and graduate students and gain first hand experience in conducting research. MAE students may take MAE 199, Independent Study for Undergraduates, under the guidance of an MAE faculty member. Typically, this course is taken as an elective on a P/NP basis. Under the following restrictive conditions, however, it may be used to satisfy upper-division technical elective course requirements for the major:

- The students must be in the major and have a GPA of 3.0 or better at the beginning of the MAE 199 project.
- The project must cover two consecutive quarters of work and the performance must be equivalent to A or B work, as determined by the 199 project advisor and the Undergraduate Affairs Committee. If the performance is not of A or B quality after the first quarter, the advisor can cancel the "contract" and the student may not attempt additional MAE 199 units.
- The student must declare his intention to seek technical elective credit by filing with the department a special studies form (each quarter) and an MAE 199 Contract (first quarter). These forms must be completed, approved, and processed by the beginning of the quarter in which the course is to be taken. Please keep in mind that the Registrars Office does not recognize enrollment in a 199 until they receive the approved Special Studies form for each quarter of the 199.

The initial "contract" should be in the form of a brief single page proposal outlining the proposed research objectives; the course background the student has had or will be taking as preparation to accomplish the research, and the student's current GPA. The student, his/her MAE 199 advisor and the department chairperson must sign the contract. At the end of the first quarter, a progress report must be submitted to the advisor. The advisor may cancel the contract for less than B performance, assigning a grade of P or NP, as appropriate. These units will not count toward technical elective credits. At the end of the second quarter, the advisor will assign an internal letter grade based on the final written report and discussions with the student during the previous quarter. If the grade is less than B, a grade of P or NP, as appropriate will be reported for the second quarter and no technical elective credit will be given. Otherwise, the final report must be submitted to the Undergraduate Affairs Committee at the end of the second quarter to determine what technical elective credit the student will receive. It is the students’ responsibility to make sure that his/her 199 advisor gets the report turned in on time to the Undergraduate Affairs Committee. Late reports may be denied. It should be noted that MAE 199 may not replace ABET approved courses.
Opportunities Abroad

Engineering is already a global field offering jobs throughout the world. You can prepare yourself for these opportunities with an exciting study or internship experience abroad. Through the Programs Abroad Office, students may receive credit for international study through a variety of programs. For information on EAP and OAP programs, first contact the Programs Abroad Office (858-534-1123, pao@ucsd.edu, or http://infopath.ucsd.edu/icenter/pao/main.html) or visit the International Center on Library Walk.

Freshman Seminar Series

Informal seminars (MAE 87) are offered every quarter to new freshmen to provide them with the opportunity to explore an intellectual topic with a faculty member in a small seminar setting. Topics vary quarter by quarter.

Teams in Engineering Service (TIES) – For more information contact Mandy Bratton

Phone : (858)822-4164 Email: mbratton@soe.ucsd.edu

Teams in Engineering Service are an innovative service-learning academic program putting UCSD undergraduates and their technical and creative skills to work for San Diego non-profit organizations. Multi-disciplinary teams of UCSD students design, build, and deploy projects that solve technology-based problems for community partners.

TIES projects can range from working with orthopedists and physical therapists to developing and building mechanical tools or prosthetics for the developmentally disabled and to working with agriculture to develop new irrigation solutions for local farming communities.

The benefits for students’ involvement in TIES are numerous, and include improved communication, organizational, and leadership skills, start-to-finish design experience, multi-disciplinary teamwork, experience in project and resource management, ethics training and responsibility, as well as customer and community awareness. Finally, TIES provides demonstrable and measurable outcomes of undergraduate engineering theoretical knowledge, technical skills, teamwork, communication, ethical responsibility and value for professional development. Mechanical, Engineering Science, and Environmental majors students are eligible to receive 4 units of technical elective. *Note: The Aerospace major does not currently offer technical elective credit for either ENG100 or ENG100L. For more information about TIES as a technical elective, please see an MAE Undergraduate advisor.

TIES Project - Middle School Environmental Education

TIES Project - The Free Clinic Project: Electronic Medical Records
Team Internship Program (TIP) - For more information contact Erica Kosa

Phone: (858) 822-6772 Email: ekosa@eng.ucsd.edu

Today’s employers are looking for engineers who have both technical skills and the ability to collaborate and function as a team. Summer Team Internships are part of the Jacobs School’s effort to enhance our students’ education through real-world engineering experiences in a team setting. Students work on-site with local, domestic, and international industry partners as a multi-disciplinary team of 2-5 students, focused on a clearly defined and significant project. TIP is a 10-12 week, full time, paid internship program during the summer.

Undergraduate and graduate student of all levels in all engineering departments are eligible to apply. All application and resumes are screened by the TIP Office and candidates who best meet the criteria are forwarded to companies for review.

TIP also offers resume guidance and professional development training to all applicants. This is designed to help students make the best impression at their interviews. TIP, in collaboration with the Corporate Affiliates Program (CAP), works with some of the top engineering companies. About 50% of TIP students are offered full time employment upon finishing their internship.

Participating Companies

The Moxie Center
Phone: (858) 246-1178 Email: MoxieCenter@ucsd.edu

The Center's primary program, the "Moxie Incubator," fosters the incubation/acceleration of student ideas. Projects accepted to the Incubator will generally be technology-based products or services that are potentially commercializable via licensing or startup paths.

The Incubator provides desks, lounge and meeting spaces for use by program participants. The Moxie Center facilities has workspaces, tools and equipment for prototyping a range of electronic and mechanical products. Incubator residents have access to certain other facilities in the Jacobs School and other campus locations, for use of larger-scale tools or specialized equipment. These uses are scheduled through Center staff, and will depend on availability, cost, and required safety and usage training certification.

Incubator residents, in addition to building their product/service prototypes, will develop commercialization plans including customer & market analysis, business models, financial plans and IP strategies. Mentoring on engineering and commercialization issues is provided by Moxie Center staff; the von Liebig Center staff and advisors; affiliated faculty from Jacobs School, the Rady School of Management, other parts of the UC San Diego campus; and advisors from the business community.
The Jacobs School of Engineering supports several programs that promote academic and professional development for undergraduate students across all engineering departments. These programs include:

- Engineering Student Organizations
- Engineering Student Employment Opportunities
- Internship Program
- Tutoring

Students are encouraged to contact these programs through electronic mail (ess@soe.ucsd.edu), by phone (858) 534-6105, or personally at Room 1400, Jacobs Hall.

### Student Societies and Organizations

The **Undergraduate Student Advisory Committee (USAC)** is a group of undergraduate students consisting of representatives from Aerospace and Mechanical Engineering. The representatives are selected/appointed by the students each year. The group meets with the Undergraduate Affairs Committee (UAC) Chair on a semi-annual basis. The group discusses all aspects of student life with a focus on the undergraduate programs in MAE. The concerns and suggestions communicated by USAC are presented to the faculty and administration for consideration. USAC also provides a link to the student professional and honor societies that are active in JSOE. These societies include AIAA, ASME, AIChE, SAE, SWE, and Tau Beta Pi.

The Student Organization and Leadership Opportunities (SOLO) office coordinates the formation of student clubs that are run by and for students. All of these groups are represented at the Fall Festival on the Green (FFOG), usually held in mid-October. Call 534-0501 for further information.

MAE undergraduate students participate in student chapters of the American Institute of Aeronautics and Astronautics (AIAA), American Society of Civil Engineers (ASCE), and American Society of Mechanical Engineers (ASME). These student chapters invite external speakers, organize trips to local companies, visit local projects and participate in regional and national design competitions.

A number of other engineering societies are active at UCSD. The Society of Women Engineers (SWE) encourages and supports women in engineering. They sponsor talks, provide workshops, and distribute information about opportunities for women in engineering. The Society of Hispanic Professional Engineers (SHPE) promotes the development of Hispanics in engineering, science, and math to achieve educational excellence, economic opportunity, and social equity. The National Society of Black Engineers (NSBE) provides a forum of support for African-American engineers. Each year, NSBE sponsors a Night of Industry, designed to inform undergraduate minority engineers of industrial opportunities. Tau Beta Pi (TBP) at UCSD is a member of the National TBP engineering honor society. Engineering students who rank in the top 1/8 of juniors and the top 1/5 of seniors are contacted by TBP for possible membership. These students are eligible for membership in TBP if they complete an interview process as well as a community service project. Throughout the year, TBP invites speakers to club meetings, organizes tours of companies, and provides a tutoring service.

### Engineering Student Employment Opportunities

In a coordinated effort, Engineering Student Services assists Career Services, the Academic Internship Program, interested companies, faculty and staff in disseminating information about job opportunities for engineering students. These opportunities include permanent employment, part-time employment during the academic year,
summer employment and contract work. This information is currently posted near Room 1400 of Engineering Building, Unit 1, and will be made available electronically to those with campus computer access. If you have additional questions about this service, you may contact the coordinator through electronic mail (ess@soe.ucsd.edu), or by phone (858) 534-6105.

**Internship Program.**

The Jacobs School is located at the heart of San Diego’s thriving technology and life sciences industry, and career opportunities abound for our students. Engineering students make connections with prospective employers through the following resources:

- **Internships/Student Jobs Bulletin:** Visit the Engineering Student Services’ bulletin for a current listing of employment opportunities for Jacobs School students. Most companies who advertise are local and the jobs range from part-time internships to full-time engineering jobs.
- **CAP Resume Database:** Students gain an insider advantage by posting their resumes to the (Corporate Affiliates Program) CAP Resume Database. Our 50+ industry partners can access student resumes on-line via this members-only searchable database.
- **Day@Jacobs:** CAP member companies also recruit on-campus via Day@Jacobs School events, where they come to meet our students for recruitment and networking opportunities, share their new technologies or host informational seminars.
- **Career Services Center:** The Center is a one-stop shop for career exploration, resume development, grad school preparation, career fairs, and Port Triton Job Postings. Students seeking internships or full-time jobs can sign-up for interviews on-campus with selected employers.
- **Student Organization Career Networking:** Our student organizations invite companies to campus for recruitment and networking activities geared towards specific engineering disciplines. The Triton Engineering Student Council’s (TESC) annual Disciplines of Engineering Career Fair (DECaF) draws more than 70 companies and 1,500 attendees.
- **Team Engineering:** Engineering students can build their resume and develop their technical, leadership, project management, and communication skills via our signature community and corporate team engineering programs. Students can get technical elective credit and experience via the TIES service-learning program or can apply to be selected for a paid full-time Team Internship during the summer.
- **Academic Internship Program (AIP):** Students can earn academic credit for internships through the UCSD AIP program. Internships are available locally, nationally, and via specific programs in New York City (NY), Washington (D.C.), Sacramento (CA), London (England), and Sydney (Australia).

**IDEA Study Lab:**

Tau Beta Pi and Eta Kappa Nu, Engineering Honor Societies, offer FREE tutoring sessions at the IDEA Study Lab undergraduate engineering students! The IDEA Study Lab is located at Jacobs Hall 4600. Check the calendar below for the weekly tutoring schedule. Fill out the tutoring room if you'd like to request a specific class or time. Please note that individual tutoring is done on a first-come, first-served basis.
The Office of Academic Support and Instructional Services (OASIS) provides a variety of services to maximize student performance and retention at the University of California, San Diego. OASIS provides activities that support and contribute to the improvement of teaching and learning. Programs range from services to help students overcome past academic efficiencies to programs to help them excel in a subject matter or skill. All students in any of the six colleges are eligible for OASIS programs. Classes are non-credit and may be repeated. Course titles and schedules are printed in the Schedule of Classes and campus media. Student services are available in six locations: the Underground, the Second Story, the Third Place, the Warren Academic Services Center, Muir Residence Halls, and the OASIS Main Office. The Third Place provides services to all Marshall College and EOP/SAA students. Professional and peer counselors assist in all areas with adjustment to university life. In addition, there are tutors in writing, study skills, lower-division math, physics, chemistry, economics, biology, and computer science. The Warren Academic Services Center, operated jointly with Warren College academic advising, offers tutoring and peer counseling, as well as selected workshops and study groups.

Tutorial Program.
OASIS provides free tutoring in lower-division biology, chemistry, physics, mathematics, economics, and computer science. Tutors are available on a drop-in basis to help the student become an independent learner. Tutors often arrange to hold group sessions in various locations throughout campus. Center Hall, 3rd Floor, Tel. 534-3760.

OPPORTUNITIES FOR UNDERREPRESENTED STUDENTS

The UCSD Academic Enrichment Office manages several programs to help under-represented undergraduate students prepare for graduate school and careers in research and college teaching. These activities complement the OASIS Academic Transition Program and Student Support Services in the School of Engineering.

The McNair Workshop Program serves low-income, first-generation college students and under-represented minorities who are interested in pursuing a Ph.D. It is a one-year rigorous program of scholarly activities that includes participation in the Faculty Mentor Program and the Summer Research Program. In addition, participants receive training in how to write and present a scholarly paper, preparation for the GRE, and assistance with the graduate school application process. All participants have the opportunity to present a paper at a minimum of two research conferences.

The Summer Research Program offers full-time research experience to underrepresented students (i.e., minorities, women, and low-income, first generation college students) who are interested in preparing for careers in research or university teaching. As research assistants, students work on their faculty mentor’s project for at least 30 hours per week. Students are trained in research skills, how to write and present a research proposal or paper, and how to prepare for the GRE. At the conclusion of the program, students present their papers at the UCSD Summer Research Conference. Students who participate in this intensive 8-week program receive free on-campus housing, 4 units of MAE 199 (Independent Study) credit, and a $2,400 fellowship. Funding is provided by the McNair and NSF grants. Eligible students are juniors and seniors who have a 3.0 GPA or above and plan to attend graduate school.

The UCSD Undergraduate Research Conference is an annual event where more than 100 students who have written outstanding research papers are invited to present their research. Invitation is by faculty nomination. Students present their papers at small round table discussions led by a faculty preside. Conference participants receive a certificate as a research scholar.

The Faculty-Student-Staff Interaction Program (FSSI) is a student organization that was initiated and is supported by Academic Enrichment Programs. Students invite faculty and staff to attend luncheons and other informal gatherings.
ETHICAL STANDARDS OF THE ENGINEERING STUDENT

The UCSD Policy on Integrity of Scholarship states the general rules for student integrity.

Instructors’ Responsibility

At the beginning of the term the instructor shall state in writing (e.g., in the syllabus, information sheets, or website) what graded assignments and exams will be required of students. If there are any course-specific rules required by the instructor for maintaining academic integrity, the instructor shall also inform students in writing what kinds of aid and collaboration, if any, are permitted on graded assignments and exams.

Students’ Responsibility

Students are expected to complete the course in compliance with the instructor’s standards. No student shall engage in an activity that involves attempting to receive a grade by means other than honest effort; for example:

- No student shall knowingly procure, provide, or accept any unauthorized material that contains questions or answers to any examination or assignment to be given at a subsequent time. THIS INCLUDES SOLUTIONS MANUALS.
- No student shall complete, in part or in total, any examination or assignment for another person.
- No student shall knowingly allow any examination or assignment to be completed, in part or in whole, for himself or herself by another person.
- No student shall plagiarize or copy the work of another person and submit it as his or her own work.
- No student shall employ aids excluded by the instructor in undertaking course work or in completing any exam or assignment. THIS INCLUDES SOLUTIONS MANUALS.
- No student shall alter graded class assignments or examinations and then resubmit them for re-grading.
- No student shall submit substantially the same material in more than one course without prior authorization.

Students are expected to notify their instructor or appropriate officials, such as their college Dean, about any incident of dishonesty they observed.

Jacobs School Student Honor Code

We, the members of the Jacobs School of Engineering, have a responsibility as students, faculty and staff to ensure the highest level of integrity in our academic and social practices.

As Jacobs School engineering students, we are creating the foundation for our futures as engineers. We must look to pursue knowledge justly, fairly, and honestly. The value of our education is in understanding that learning is a lifelong commitment. The experiences that we share and the skills that we learn are all the more valuable if we hold ourselves to high ethical and moral standards.

The Jacobs School must promote leadership, honesty and integrity. The Jacobs School community must work together to ensure that these qualities are valued. We must also make a conscious effort to provide our students...
with the instruction that will prepare them for a professional career. Instructors will honor their teaching responsibilities, and in turn students will reflect this commitment by pursuing leadership, honesty and integrity in their own academic endeavors.

This is a personal and professional commitment that we all share as members of the Jacobs School of Engineering. We pledge ourselves to these ideals and promise to be honest in our hearts, minds and our actions.

- Triton Engineering Student Council, 2003

PROFESSIONAL ENGINEERING LICENSE

Whether you design power plants, consumer goods, buildings, or aerospace vehicles, whether you work in private industry, for the U.S. government, or for the public and whether your efforts are theoretical or practical, you (as an engineer) have a significant responsibility.

Engineers of all types perform exciting and rewarding work, often stretching new technologies to their limits. But those limits are often incomprehensible to non-engineers. As the ambient level of technological sophistication increases, the public depends increasingly and unhesitatingly on engineers. That is where professional licensing and the National Society of Professional Engineers (NSPE) become important.

NSPE, the leading organization for licensed engineering professionals, is dedicated to serving the engineering profession by supporting such activities as continuing educational programs for its members, lobbying and legislative efforts on local and national levels and promoting guidelines for ethical service. From local, community-based projects that encourage top-scoring high school students to choose engineering as a career, to hard-hitting lobbying efforts in the nation's capital to satisfy the needs of all engineers, NSPE is committed to you and your profession.

Engineering licensing is a two-way street: it benefits you while it benefits the public and the profession. For you, licensing offers a variety of advantages, ranging from peer recognition to greater advancement and career opportunities. If you wish to become an independent engineering consultant, it is required by law that you are registered. Some states require registration as a Professional Engineer if you wish to use the title engineer. A court of law generally will not recognize an individual as an engineer unless he/she is registered, thus one cannot testify as an expert witness or try to collect engineering fees unless one is registered. For the profession, licensing establishes a common credential by which engineers can be compared. For the public, a professional engineering license is an assurance of a recognizable standard of competence.

The requirements for professional engineering registration prevailing in most of the states are as follows:

1) Graduation from an ABET accredited school, plus four years of engineering experience acceptable to the board, plus passage of a 16-hour written examination, or

2) Eight years of engineering experience acceptable to the board, plus passage of a 16-hour written examination.

The 16-hour written examination is divided into two equal parts: the first is generally known as the "Fundamental Examination" (sometimes referred to as the "Engineering-in-Training" exam or the EIT) and the second, as the "Professional Examination," (sometimes referred to as the PE exam or the "Principles and Practices" exam). Persons who successfully pass these examinations are entitled to use the title "Professional Engineer" and to place the initials "P.E." after their names. It is illegal for unregistered persons to use the title.

Nearly all states have made provisions for an EIT status and will allow persons to take the first eight-hour (EIT or "Fundamentals") portion of the written examination immediately before or immediately after graduation from an ABET accredited school. EIT status conveys no legal privileges and is offered primarily as a convenience to new graduates so that they can take the examination in fundamentals at a time when the material is still fresh in their minds. Almost all of the states use a uniform national EIT examination, administrated through the National Council Engineering Examiners (NCEE) and a great majority uses a uniform national examination for the "Professional" portion.
The 8-hour EIT exam, which is generally offered twice a year (April, October), is a closed-book exam (calculators allowed) that consists of two four-hour sessions separated by a one-hour lunch. The morning session has 140 multiple choice questions covering such topics as: chemistry, electric circuits, mathematics, statistics, dynamics, mechanics, material science, thermodynamics, engineering economics, fluid mechanics. Since all 140 morning problems must be worked to get full credit, it is important that you know all subject areas and have strategy that involves fast recall (memorize formulas, solution procedures, important data) and stamina. The afternoon session consists of 70 questions in 5 topics: engineering mechanics, applied mathematics, electrical circuits, and engineering economics and thermo/fluid mechanics. No material of any kind will be allowed. A reference handbook will be furnished at the exam site and will be collected at the conclusion of the examination.

For application and further information regarding the California EIT and PE examinations contact: the State Board of Registration for Professional Engineers and Land Surveyors, 2535 Capitol Oaks Drive, Suite 300, Sacramento, California 95833-2944 or call (866) 780-5370, or visit their website: http://www.dca.ca.gov/pels/. For more information regarding Professional Engineering membership, write to the National Society of Professional Engineers, Information Center, 1420 King Street, Alexandria, VA 22314, or call (703) 684-2800 or visit their website: http://www.nspe.org.

**DEGREES REQUIRED**

A bachelor’s degree in engineering is generally required for entry-level engineering jobs. Engineering degrees from one area may be able to work in related areas. For example, many aerospace engineers have training in mechanical engineering. This flexibility allows engineers to shift in fields. Graduate training is essential for engineering faculty positions but is not required for the majority of entry-level engineering jobs. Many engineers obtain graduate degrees to learn new technology, broaden their education, and enhance their promotional opportunities.

It is important for engineers to continue their education throughout their careers because much of their value to their employer relies on their knowledge of current technologies.

*Source: Bureau of Labor Statistics*

**PREPARATION FOR GRADUATE STUDIES**

Many engineers, after receiving their Bachelor’s degrees choose to continue their education and training by enrolling in graduate programs leading to the Master of Science (M.S.) or Doctor of Philosophy (Ph.D.) degrees in Engineering. At the present time, about 45% of engineers obtain an MS degree and 10% a Ph.D. degree. A Ph.D. degree is required for research and teaching at the college and university level.

General information on graduate schools can be obtained from the MAE graduate advisor and through the Professional and Graduate School Advising Office of the Career Services Center (career.ucsd.edu). The Career Center has the current edition of *Peterson's Guide to Graduate Schools*, which contains information on Graduate Engineering Programs. Also, the Career Center has information on the Graduate Record Examinations (GRE), typically taken in the Spring of the Junior year or the Fall of the Senior year. In addition, the Career Center coordinates the distribution of letters of recommendation to graduate schools.

Admission to graduate schools of engineering is typically based on undergraduate GPA (a minimum of 3.0 is typically required), GRE scores, letters of recommendation from faculty, reputation of undergraduate institution and additional research or professional activities of the applicant. Applications are typically due at the end of December or the beginning of January for admission to the Fall quarter or semester.

The most common form of financial aid for academic doctoral study is a departmental assistantship (teaching or research), in addition to some form of tuition remission or waiver (partial or full) by the institution or department. Most research university doctoral programs attempt to fund students throughout their Ph.D. programs. External fellowships (e.g., NSF Fellowship, Ford Foundation Fellowship) or other competitive awards sometimes augment institutional aid. Funding for academic masters programs generally varies from none to partial to full funding; however, many masters students must fund all or part of their graduate education.
<table>
<thead>
<tr>
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<td>Energy / Solid Mechanics and Materials Science</td>
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<td>Beg, Farhat</td>
<td>858-822-1266</td>
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<tr>
<td>Bewley, Tom</td>
<td>858-534-4287</td>
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<td>Design/ Dynamic Systems &amp; Control</td>
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Advising

Q) What is the difference between college and department advising?

A) Each undergraduate student at UC San Diego has academic advisors in their academic department as well as in their college.

MAE Academic Advisors
The MAE Academic Advisors helps students with major curriculum planning, petitions, regulations, degree checks, etc. Department advising staff can also refer students to faculty for advice on engineering specializations, technical electives and career options.

College Advising
College Advisors helps students with four-year curriculum planning and college-specific general education courses.

Q) How do I make an appointment to meet with an MAE Academic Advisor?

A) The MAE Undergraduate Student Advising office is open Monday-Friday from 9-11:30am & 1:30-3:30pm for walk-in advising ONLY.

Q) What are the HSS courses on my four-year plan?

A) The HSS courses listed on your major curriculum are simply there to help you plan your college general education courses accordingly. Please see you college advisor for more information regarding your required GE courses.

Q) Can I switch from my current college to another college?

A) Yes, but only after you have completed your college's writing program and if you can demonstrate that switching to a different college will allow you to graduate in fewer academic quarters. In practice, the overwhelming majority of students are happy with their college assignment, even if it was not their first choice originally, and few students apply to switch. For more information, please contact your college.

Academic History

Q) If I got AP credit for a lower division math or science course required for my major, do I have to retake the course?

A) No. If you have received AP credit for a course, such as Math 20A or Physics 2A, you do not have to take the class over. We advise that you continue with the series as prescribed in your curriculum. Please double check and make sure that you know what you have been exempt from. Credit for Math 10A or Physics 1A is not the same as Math 20A or Physics 2A. Credit for Math 10A DOES NOT exempt you from Math 20A.

Q) How do I find out if my major department has received my transcripts/ AP scores?

A) Your major department does not handle, receive or evaluate your transcripts. If you have questions about your transcripts or AP scores, please contact the Admissions Office. Otherwise, please keep checking to make sure that all courses you have taken at your previous community college/university have transferred in by checking your "Academic History" via TritonLink.
Q) How will I know what courses have transferred to UCSD?

A) The website, Assist.org, is a useful tool that may help in determining equivalent courses. You can also check what transferred in by checking your "Academic History" or "Degree Audit" via Triton Link.

Q) I took a course at my college/university that is similar to a course at UCSD but it’s not articulated on my Academic History. What do I do?

A) Some engineering courses from a community college/University do not transfer. We cannot process petitions for courses that are NOT listed on your academic history.

Course Equivalencies:

Lower/Upper division course work:

- Check with Assist.org to see if a course equivalency already exists for your course work. If so, you will not need to petition, just let the advisors know.
- Submit the petition including the UCSD course number for which you think your course work is equivalent
- Provide documentation of course work: a detailed syllabus, title of textbook, lecture notes, and exams

Your completed petition will be reviewed by an MAE faculty member for equivalencies. If it is determined to be equivalent, you will be notified via your UCSD email account and your Degree Audit will be updated to reflect equivalency. However, you WILL still encounter registration problems as the computer registration system may not recognize the articulation, even after your Degree Audit has been updated. If your equivalent course is a prerequisite, please come to the MAE Student Affairs Office to be cleared in the registration system a few days BEFORE your registration time. DON’T WAIT UNTIL YOUR REGISTRATION DATE AS YOU MAY END UP ON A WAITLIST!

Undergraduate Petitions can be found here: http://registrar.ucsd.edu/forms/UNstudentpetition.pdf

Q) My transfer academic history is incorrect on my Triton Link. Who should I speak to about correcting my academic information?

A) Sometimes, transferable course numbers are listed incorrectly in the Academic History section in Triton Link. You will most likely run into this problem if you completed a series, such as the Physics series, at two or more community colleges.

An MAE Major Advisor can ONLY fix MAE transferable courses when you let us know that a course is listed incorrectly.

For math and science course corrections, please see that specific department. (i.e. for a Math course see the Math department). An error like this will keep you from enrolling into other MAE courses.

Enrollment

Q) When can I enroll in classes? How do I enroll in my classes?

A) Your enrollment time and date will be posted on your UCSD student portal. If you need help finding your registration time or need help with enrollment, please review the WebReg tutorial at: http://registrar.ucsd.edu/studentlink/WebRegTriton.pdf
Q) What is two-pass enrollment?

A) The campus has a two-pass enrollment process for all undergraduate students which allows you to "pass" through the enrollment process twice before enrolling in your full course load for any given quarter.

How the two-pass enrollment system works: All students are assigned TWO enrollment times and dates appointments. Please check TritonLink for your enrollment times and dates.

FIRST PASS (48 hour window):

• You may ENROLL in up to 11.5 units.
• You will be UNABLE TO WAITLIST in courses during the first pass.
• You will have 48 HOURS to complete your enrollment during the 1st pass.
• Students who do not enroll during their 1st pass appointment must WAIT UNTIL THE 2ND PASS to enroll.

SECOND PASS

• You may ENROLL IN UP TO 19.5 units.
• You may WAITLIST for courses during the 2nd pass.
• Once your 2nd pass enrollment has started you can add classes until Week 2 of the quarter.

Q) How do I prioritize my enrollment?

A) Many students are unsure which courses to enroll in on their initial pass. The following information is intended to offer some general guidance. During your first enrollment pass it is recommended you prioritize your enrollment based on the following criteria:

• Courses required for your major.
• Courses that are prerequisites for courses you intend to take in subsequent quarters.
• Infrequently offered courses, such as those offered only once a year or in alternate academic years.
• Small courses with limited seats, such as labs, i.e., MAE 3, MAE 170...

How to prepare for your enrollment appointment.

1. Determine which courses you want to enroll in prior to your enrollment appointment.
2. Check to see that you have satisfied the necessary prerequisites to enroll.
3. Have back-up options in the event the course you want to enroll in is full.
4. Speak with your Department and College advisor prior to your enrollment time and date for further assistance.
5. If petitioned an MAE course, and it is a prerequisite, please come to the MAE Student Affairs Office to be cleared in the registration system a few days BEFORE your registration time. Don't wait until your registration date as you may end up on a wait list!

Q) What if the class I want to add is full?

A) If a class you hope to add is full, add yourself to the wait list during your second-pass enrollment period. Please note that you cannot wait list for any course during you first-pass. The wait list sequence is first-come, first-served. Be sure to enroll during your appointment time! An automated computer program will move eligible students off the wait lists and into classes as seats become available. It will run nightly through the end of the second week of the quarter.

Keep in mind that classes fill up fast during the initial registration period. During the first week of the quarter, students will start to drop courses, as they readjust their schedules, opening spaces in the courses. Once space is available, students will automatically be enrolled in the course.
Q) Are all MAE courses offered every quarter?

A) No. Some courses are only offered once a year. If you miss taking that course in the quarter it's offered, you will have to wait a year to take it. A complete schedule of courses offered for this year is located both in the MAE lobby and on the MAE website at maeweb.ucsd.edu.

Q) Triton Link won't let me enroll in a class. It says I don't meet the prerequisites. What do I do?

A) Contact the MAE Student Affairs office if you're trying to enroll in an MAE course. If you have already fulfilled the prerequisites to the course but are still getting an error, we can rectify the situation. The MAE department has a very strict prerequisite policy. A 3.0 GPA minimum will be required for all petitions requesting to enroll in a course without successfully completing its prerequisite/s with a grade of C- or better. Keep in mind that not all courses will allow you to enroll without a prerequisite so not every course can be petitioned.

Courses with “Consent of Instructor” override:

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Taking a prerequisite concurrently does not mean you have successfully completed the prerequisite.

No requests to add senior classes without completing all prerequisites with a grade of "C-" or better will be considered, except under extraordinary personal circumstances (e.g. hospitalization), which prevented the student from adding or passing the corresponding prerequisites.

If you are trying to add a course in a different department, please see that specific department. (i.e. for a course in Computer Science Engineering please contact the CSE department).

Impacted Major

Q) What if I want to switch majors?

A) You can switch your major on your student portal on TritonLink. **If you plan to switch to an impacted major, please contact the department for more information.** Once you changed your major you must wait 3 weeks before you can change your major again. It is advised to contact the department you wish to switch to prior to switching.

Q) What is an Impacted Major?

A) An impacted major is one that is limiting enrollment. Beginning Fall 2009, Mechanical and Aerospace Engineering will be impacted majors. This means that student will have to apply to declare these majors.

Q) What if I want to switch into Mechanical or Aerospace Engineering?

A) Currently, continuing UCSD students who wish to change into an impacted major (mechanical engineering and aerospace engineering) must submit an application to the department. Applications are accepted twice a year **providing that there is space available in either of our impacted majors.**
Continuing students who wish to be considered must submit an application to the MAE department during the application period and must meet the following minimum requirements:

1. completed at least one year/three quarters in residence at UCSD; (Freshmen can apply their Spring Quarter)
2. complete all lower-division requirements for the requested major.
3. have a minimum 2.5 GPA

Applications will be ranked by their UCSD GPA on the date of the application. Admission is based on available space and meeting these requirements does not guarantee admission. Students should be aware that applications will be evaluated based on academic excellence. Students who apply later than the final day of their sixth academic quarter at UCSD will not be considered.

It is not advised that any student follow any impacted major curriculum. Deviation in ANY engineering major can delay your graduation by a year or more. Keep in mind that admission is based on available space. We cannot guarantee that there will be an application period in which you are eligible to apply.

Other

Q) What computer/laptop should I buy?

A) Computer choice for students is a moving target, with the rapid changes in technology. The university provides computers in the labs and libraries. But many students find benefits in having their own computers. I have seen that many students like the portability and long battery life of notebooks. These lower cost computers can run some engineering software such as Matlab, but they typically will not run Autodesk Inventor and ProE, which MAE students do use. One solution is to have both a notebook and a higher powered laptop or desktop at home. One can use an Apple computer, but with a partition to run Windows programs, such as Inventor, ProE, and Labview. The computer requirements for Autodesk Inventor can be found at: http://students.autodesk.com

Q) What engineering organizations can I get involved in as an engineering student?

A) Our engineering student organizations help students develop their leadership skills and connect with the Jacobs School community. Activities range from professional development and career networking to project teams, design competitions and K-12 outreach. For a list of engineering student organizations that you can be involved in please visit here: http://www.jacobsschool.ucsd.edu/student/student_org/
MAE 02. Introduction to Aerospace Engineering (4)
An introduction to topics in aeronautical and astronautical engineering including aerodynamics, propulsion, flight mechanics, structures, materials, orbital mechanics, design, mission planning, and environments. General topics include historical background, career opportunities, engineering ethics, and professionalism. Must be taken for a letter grade. **Prerequisites:** none.

MAE 03. Introduction to Engineering Graphics and Design (4)
Introduction to design process through a hands-on design project performed in teams. Topics include problem identification, concept generation, project management, risk reduction. Engineering graphics and communication skills are introduced in the areas of Computer-Aided Design (CAD), hand sketching, and technical communication. **Prerequisites:** grade of C– or better in Physics 2A or 4A (or concurrent enrollment). Priority enrollment given to engineering majors.

MAE 05. Quantitative Computer Skills (4)
Introductory course for nonengineering majors. Use of computers in solving problems; applications from life sciences, physical sciences, and engineering. Students run existing computer programs and complete some programming in BASIC. **Prerequisites:** none.

MAE 08. Matlab Programming for Engineering Analysis (4)
Computer programming in Matlab with elementary numerical analysis of engineering problems. Arithmetic and logical operations, arrays, graphical presentation of computations, symbolic mathematics, solutions of equations, and introduction to data structures. **Prerequisites:** Math 20A, B or consent of instructor.

MAE 20. Elements of Materials Science (4)
The structure of materials: metals, ceramics, glasses, semiconductors, superconductors, and polymers to produce desired, useful properties. Atomic structures. Defects in materials, phase diagrams, microstructural control. Mechanical and electrical properties are discussed. Time temperature transformation diagrams. Diffusion. **Prerequisites:** Phys 2A or 4A, Chem 6A or Chem 6AH, Math 20C.

MAE 87. Freshman Seminar (1)
The Freshman Seminar program is designed to provide new students with the opportunity to explore an intellectual topic with a faculty member in a small seminar setting. Freshman seminars are offered in all campus departments and undergraduate colleges. Topics vary from quarter to quarter. Enrollment is limited to fifteen to twenty students, with preference given to entering freshmen. **Prerequisites:** none.

MAE 92A. Design Competition—Design, Build, and Fly Aircraft (1)
(Cross-listed with SE 10A.) Student teams design, build, and fly unmanned aircraft for a national student competition. Students concentrate on vehicle system design including aerodynamics, structures, propulsion, and performance. Teams engineer, fabricate the aircraft, submit a design report, and prep aircraft for competition. **Prerequisites:** consent of instructor.

MAE 93. Design Competition—Design, Build, and Test Race Car (1)
Student teams design, build, and test a formula-style racing car for an international student competition. Students concentrate on vehicle system analysis and design, manufacturability, and performance. Teams engineer, fabricate car, submit a design report, and prep car for competition. **Prerequisites:** department stamp.

MAE 99H. Independent Study (1)
Independent study or research under direction of a member of the faculty. **Prerequisites:** student must be of first-year standing and a Regent’s Scholar; approved Special Studies form.

Upper Division

MAE 101A. Introductory Fluid Mechanics (4)
Fluid statics; fluid kinematics; integral and differential forms of the conservation laws for mass, momentum and energy; Bernoulli equation; potential flows; dimensional analysis and similitude. **Prerequisites:** admission to an engineering major and grades of C– or better in Phys 2A, Math 20D, 20E, or consent of instructor.

MAE 101B. Advanced Fluid Mechanics (4)
Laminar and turbulent flow. Pipe flow including friction factor, Boundary layers, separation, drag, and lift. Compressible flow including shock waves. **Prerequisites:** grade of C– or better in MAE 101A or CENG 101A, and MAE 110A or CENG 102 or consent of instructor.
MAE 101C. Heat Transfer (4)
Extension of fluid mechanics in MAE 101A–B to viscous, heat-conducting flows. Application of the energy conservation equation to heat transfer in ducts and external boundary layers. Heat conduction and radiation transfer. Heat transfer coefficients in forced and free convection. Design applications. Prerequisites: MAE 101A or CENG 101A, MAE 101B, and MAE 105, or consent of instructor.

MAE 104. Aerodynamics (4)
Basic relations describing flow field around wings and bodies at subsonic and supersonic speed. Thin-wing theory. Slender-body theory. Formulation of theories for evaluating forces and moments on airplane geometries. Application to the design of high-speed airplanes. Prerequisites: open to MC 25, MC 27, MC 28 and SE 27 only and grade of C– or better in MAE 101A–B, or consent of the instructor.

MAE 105. Introduction to Mathematical Physics (4)
Fourier series, Sturm Liouville theory, elementary partial differential equations, integral transforms with applications to problems in vibration, wave motion, and heat conduction. Prerequisites: admission to engineering major or and grades of C– or better in Math 2A–B and Math 20D or Math 21D.

MAE 107. Computational Methods in Engineering (4)
Introduction to scientific computing and algorithms; iterative methods, systems of linear equations with applications; nonlinear algebraic equations; function interpolation and differentiation and optimal procedures; data fitting and least-squares; numerical solution of ordinary differential equations. Prerequisites: engineering majors only and grades of C– or better in MAE 9 or MAE 10 and Math 20F.

MAE 108. Probability and Statistical Methods for Mechanical and Environmental Engineering (4)
Probability theory, conditional probability, Bayes theorem, random variables, densities, expected values, characteristic functions, central limit theorem. Engineering reliability; elements of estimation, random sampling, sampling distributions, hypothesis testing, confidence intervals. Curve fitting and data analysis. Prerequisites: Math 20F.

MAE 110A. Thermodynamics (4)
Fundamentals of engineering thermodynamics: energy, work, heat, properties of pure substances, first and second laws for closed systems and control volumes, gas mixtures. Application to engineering systems, power and refrigeration cycles, combustion. Prerequisites: grades of C– or better in Phys 2C and Chem 6A. Enrollment restricted to engineering majors only.

MAE 110B. Thermodynamic Systems (4)
Thermodynamic analysis of power cycles with application to combustion driven engines: internal combustion, diesel, and gas turbines. Thermodynamics of mixtures and chemical and phase equilibrium. Computational methods for calculating chemical equilibrium. Prerequisites: grade of C– or better in MAE 110A.

MAE 113. Fundamentals of Propulsion (4)
Compressible flow, thermodynamics, and combustion relevant to aircraft and space vehicle propulsion. Analysis and design of components for gas turbines, including turbines, inlets, combustion chambers and nozzles. Fundamentals of rocket propulsion. Prerequisites: engineering majors MC 25, MC 27 and MC 28 only and grades of C– or better in MAE 110 A or CENG 102 and MAE 101 A–B or CENG 101 A and 101 C (or CENG 103A–B).

MAE 117A. Elementary Plasma Physics (4)
(Cross-listed with Physics 151.) Particle motions, plasmas as fluids, waves, diffusion, equilibrium and stability, nonlinear effects, controlled fusion. Prerequisites: Math 21D or consent of instructor. Phys 100B–C or ECE 107 are recommended.

MAE 117B. Industrial Plasma Applications (4)
Charged particle motion in DC and RF electromagnetic; atomic processes in plasmas; ionization, excitation, dissociation, rate constants, electron energy balance electric breakdown of the gases; debye length, plasmas quasi-neutrality, sheath; DC, capacitive, inductive, and wave- heated discharges; etching, deposition, and implantation. Prerequisites: Math 20D or 21D, or consent of instructor.

MAE 117L. Elements of Experimental Plasma Physics (4)
Measurements of electron density and temperature with the lenguierre probes, emission spectroscopy measurements of neutrals and ions in plasmas; electric breakdown of the gases; plasmas etching of materials. Prerequisites: none.

MAE 118. Introduction to Energy Systems (4)
Overview of present day primary energy sources and availability; fossil fuel, renewable, and nuclear; heat engines; energy conservation, transportation, air pollution, and climate change. Students may not receive credit for both MAE 118 and MAE 118A. Prerequisites: MAE 101A or CENG 101A, or consent of instructor.

MAE 119. Introduction to Renewable Energy: Solar and Wind (4)
Basic principles of solar radiation—diffuse and direct radiation; elementary solar energy engineering—solar thermal and solar photovoltaic; basic principles of wind dynamics—hydrodynamic laws, wind intermittency, Betz’s law; elementary wind energy engineering; solar and wind energy perspectives; operating the California power grid with 33 percent renewable energy sources. Students may not receive credit for both MAE 118B and MAE 119. Prerequisites: MAE 101A or CENG 101A, or consent of instructor.

MAE 120. Introduction to Nuclear Energy (4)
Overview of basic fission and fusion processes. Elementary fission reactor physics and engineering; environmental and waste disposal issues. Survey of fusion technology issues and perspectives. May not receive credit for both MAE 118C and MAE 120. Prerequisites: MAE 101A or CENG 101A, or consent of instructor.
MAE 121. Air Pollution Transport and Dispersion Modeling (4)

MAE 122. Flow and Transport in the Environment (4)
Introduction to the air and aquatic environments. Buoyancy, stratification, and rotation. Earth surface energy balance. Introduction to the atmospheric boundary layer. Advection and diffusion. Turbulent diffusion and dispersion in rivers and in the atmospheric boundary layer. Surface waves and internal gravity waves. Prerequisites: MAE 101A, or CENG 101A, or consent of instructor.

MAE 123. Introduction to Transport in Porous Media (4)

MAE 124. Environmental Challenges: Science and Solutions (4)
Cross-listed with ESYS 103.) This course explores the impacts of human social, economic, and industrial activity on the environment. It highlights the central roles in ensuring sustainable development played by market forces, technological innovation and governmental regulation on local, national, and global scales. Prerequisites: grade of C– or better in Math 20B or Math 10A–C, or consent of instructor.

MAE 126A. Environmental Engineering Laboratory I (4)
Design and analysis of experiments in environmental engineering. Experiments in wind tunnel, water tunnel, and other equipment. Use of instrumentation. Laboratory report writing; error analysis; engineering ethics. Prerequisites: MAE 101A or CENG 101A; MAE 125A.

MAE 126B. Environmental Engineering Laboratory II (4)
Design and analysis of original studies in environmental engineering. Students work on environmental projects and use computational and laboratory facilities. Students propose and design studies, collect and analyze data, and prepare a major report. Prerequisites: grade of C– or better in MAE 126A.

MAE 127. Statistical Methods for Environmental Sciences and Engineering (4)
Methods for evaluating environmental data including probability distributions, confidence intervals, functional fitting, spectral analysis, and programming methods for data analysis. Prerequisites: grade of C– or better in Math 20C.

MAE 130A. Mechanics I: Statics (4)
(Cross-listed with SE 101A.) Statics of particles and rigid bodies in two and three dimensions. Free body diagrams. Internal forces. Static analysis of trusses, frames, and machines. Shear force and bending moment diagrams in beams. Equilibrium problems with friction. Prerequisites: Math 20C and Phys 2A with grades of C– or better. Students cannot also receive credit for SE 101A.

MAE 130B. Mechanics II: Dynamics (4)
(Cross-listed with SE 101B.) Kinematics and kinetics of particles in 2-D and 3-D motion. Newton’s equations of motion. Energy and momentum methods. Impulsive motion and impact. Systems of particles. Kinematics and kinetics of rigid bodies in 2-D. Introduction to 3-D dynamics of rigid bodies. Prerequisites: Grade of C–or better in MAE 130A or SE 101A.

MAE 130C. Mechanics III: Vibrations (4)
(Cross-listed with SE 101C.) Free and forced vibrations of undamped and damped single degree of freedom systems. Harmonically excited vibrations. Vibrations under general loading conditions. Vibrating systems with multiple degrees of freedom. Modal analysis with application to realistic engineering problems. Vibration of continuous systems. Prerequisites: grades of C– or better in Math 20F and MAE 130B or SE 101B.

MAE 131A. Solid Mechanics I (4)

MAE 131B. Fundamentals of Solid Mechanics II (4)
Continuous mechanics of solids and its application to the mechanical response of machine and structural elements. Stress and strain in indicial notation; field equations and constitutive relations. Linear elastic stress analysis in torsion, plane stress and plane strain; stress concentrations; fracture mechanics. Extremum principles and structural stability. Viscoelasticity, plasticity, and failure criteria. Theorems of plastic limit analysis. Prerequisites: grades of C– or better in MAE 131A and MAE 105 (or concurrent) and admission to engineering major.
MAE 131C. Solid Mechanics III (4)
Small deflection of plate bending. Solutions for rectangular and circular plates. Buckling of plates. Membrane and bending stresses in cylindrical shells. Pressure vessels. Energy methods and finite element analysis. Prerequisites: grade of C– or better in MAE 131A or SE 110A.

MAE 132. Intermediate Dynamics (4)
Kinematics and kinetics of 3-D rigid body motion. Angular momentum and its rate of change. Euler's and general equations of motion. Rotation about a fixed axis and a fixed point. Gyroscopic motion. Dynamic reactions. Lagrange's equations of motion with applications. Prerequisites: grade of C– or better in MAE 130B or SE 101B.

MAE 133. Finite Element Methods in Mechanical and Aerospace Engineering (4)
Development of stiffness and mass matrices based upon variational principles and application to static, dynamic, and stability design problems in structural and solid mechanics. Architecture of computer codes for linear and nonlinear finite element analysis and basic computer implementation. The use of general purpose finite element structural analysis code. Prerequisites: grade of C– or better in MAE 131A or SE 110A.

MAE 140. Linear Circuits (4)

MAE 142. Dynamics and Control of Aerospace Vehicles (4)
The dynamics of vehicles in space or air are derived for analysis of the stability properties of spacecraft and aircraft. The theory of flight, lift, drag, dutch roll and phugoid modes of aircraft are discussed. Optimal state space control theory for the design of analog and digital controllers (autopilots). Prerequisites: admission to the engineering major and grades of C– or better in MAE 104 and MAE 143B or ECE 171A, or consent of instructor.

MAE 143A. Signals and Systems (4)

MAE 143B. Linear Control (4)

MAE 143C. Digital Control Systems (4)
Discrete time systems: sampling, aliasing, stability, Z-transform, discrete time signals, state space models; state equations, canonical forms, observability, controllability. Pole placement design, observer design, output feedback, linear quadratic regulator design. Implementation: digital approximation, computational and numerical issues. Prerequisites: grade of C– or better in MAE 143B.

MAE 149. Sensor Networks (4)
(Cross-listed with ECE 156 and SIO 238.) Characteristics of chemical, biological, seismic and other physical sensors; signal processing techniques supporting distributed detection of salient events; wireless communication and networking protocols supporting formation of robust sensor fabrics; current experience with low power, low-cost sensor deployments. Prerequisites: upper-division standing and consent of instructor, or graduate student in science or engineering.

MAE 150. Computer-Aided Design (4)
Computer-aided analysis and design. Design methodology, tolerance analysis, Monte Carlo analysis, kinematics and computer-aided design of linkages, numerical calculations of moments of inertia, design of cams and cam dynamics; finite element analysis, design using Pro-E, Mechanica Motion and Mechanica Structures. Prerequisites: grade of C– or better in MAE 130A or SE 101A or BENG 110, MAE 107 or SE 121, and MAE 3, senior standing in engineering major, or consent of instructor.

MAE 154. Product Design & Entrepreneurship (4)
This course will teach teams of students how to develop product concepts and business plans in the design of new and innovative products. Emphasis will be placed on identifying user needs, concept generation, and prototype fabrication. Prerequisites: Junior or Senior standing and Permission of Instructor.

MAE 155A. Aerospace Engineering Design I (4)
Fundamental principles of aerospace vehicle design including the conceptual, preliminary, and detailed design phases. Aeronautical or astronautical design project that integrates all appropriate engineering disciplines as well as issues associated with optimization, teamwork, manufacturability, reporting, and professionalism. Prerequisites: grade of C– or better in MAE 2, 104, 113, 130C, 142, 150, SE 2 and SE 160B or consent of instructor. Students may enroll concurrently with MAE 113, 142, and 150.
MAE 155B. Aerospace Engineering Design II (4)
Fundamental principles of aerospace vehicle design including the conceptual, preliminary, and detailed design phases. Aeronautical or astronautical design project that integrates all appropriate engineering disciplines as well as issues associated with optimization, teamwork, manufacturability, reporting, and professionalism. Prerequisites: grade of C– or better in MAE 113, 142, 150, 155A or consent of instructor.

MAE 156A. Fundamental Principles of Mechanical Design I (4)
Fundamental principles of mechanical design and the design process. Application of engineering science to the design and analysis of mechanical components. Initiation of team design projects that culminate in MAE 156B with a working prototype designed for a real engineering application. Professional ethics discussed. Course material fee may apply. Prerequisites: grades of C– or better in MAE 3, MAE 130B, MAE 131A, MAE 143B, MAE 150 and MAE 170 or consent of instructor.

MAE 156B. Fundamental Principles of Mechanical Design II (4)
Fundamental principles of mechanical design and the design process. Culmination of a team design project initiated in MAE 156A which results in a working prototype designed for a real engineering application. Prerequisites: grade of C– or better in 156A in the immediately preceding quarter, MAE 101C, MAE 150, MAE 160, and MAE 130C or consent of instructor.

MAE 160. Mechanical Behavior of Materials (4)
Elasticity and anelasticity, dislocations and plasticity of crystals, creep, and strengthening mechanisms. Mechanical behavior of ceramics, composites, and polymers. Fracture: mechanical and microstructural. Fatigue. Laboratory demonstrations of selected topics. Prerequisites: grade of C– or better in MAE 20, MAE 130A (or SE 101A) and MAE 131A, or consent of instructor.

MAE 161. Electronic, Magnetic, and Photonic Materials (4)
Introduction to the worlds of electronic, magnetic/photonic materials, the unique properties of advance engineering materials in relation to processing, fabrication, and microstructure. Semiconductors, metals, alloys, ceramics, polymers, and composite materials and their practical applications. Prerequisites: consent of instructor. Not offered every year.

MAE 165. Fatigue and Failure Analysis of Engineering Components (4)

MAE 166. Nanomaterials (4)
Basic principles of synthesis techniques, processing, microstructural control and unique physical properties of materials in nano-dimensions. Nanowires, quantum dots, thin films, electrical transport, optical behavior, mechanical behavior, and technical applications of nanomaterials. Prerequisites: consent of instructor. Not offered every year.

MAE 167. Wave Dynamics in Materials (4)
Pressure and shear waves in infinite solids. Reflection and diffraction. Rayleigh and Love waves in a semi-infinite space. Impulse load on a half space. Waveguides and group velocity. Prerequisites: consent of instructor. Not offered every year.

MAE 168. MEME Materials, Fabrication, and Applications (4)
The principles of micro-electro-mechanical systems (MEMS) fabrication, materials involved, actuation principles utilized, and the fundamentals of MEMS operation in relation to stresses and deformation. Novel device applications, future trends, and nano-electro-mechanical (NEMS) systems. Prerequisites: consent of instructor. Not offered every year.

MAE 170. Experimental Techniques (4)
Principles and practice of measurement and control and the design and conduct of experiments. Technical report writing. Lectures relate to dimensional analysis, error analysis, signal-to-noise problems, filtering, data acquisition and data reduction, as well as background of experiments and statistical analysis. Experiments relate to the use of electronic devices and sensors. Prerequisites: Grade of C– or better in Phys 2CL and admission to any engineering major.

MAE 171A. Mechanical Engineering Laboratory I (4)
Design and analysis of experiments in fluid mechanics, solid mechanics, and control engineering. Experiments in wind tunnel, water tunnel, vibration table and material testing machines, and refined electromechanical systems. Laboratory report writing; error analysis; engineering ethics. Prerequisites: MAE 101C or CENG 101B; MAE 143B or CENG 120; MAE 160 or MAE 131B or SE 110B; MAE 130C or SE 101C; MAE 140; MAE 170.

MAE 171B. Mechanical Engineering Laboratory II (4)
Design and analysis of original experiments in mechanical engineering. Students research projects using experimental facilities in undergraduate laboratories: wind tunnel, water channel, vibration table, and testing machine and control systems. Students propose and design experiments, obtain data, complete engineering analysis and write a major report. Prerequisites: requires a grade of C– or better in MAE 171A.
MAE 175A. Aerospace Engineering Laboratory I (4) Analysis of aerospace engineering systems using experimental facilities in undergraduate laboratories: wind tunnel, water channel, vibration table, and testing machine. Students operate facilities, obtain data, complete engineering analysis and write major reports. Prerequisites: MAE 101C or CENG 101C; MAE 143B, and MAE 170 or consent of instructor.


MAE 192. Senior Seminar in Aerospace, Environmental or Mechanical Engineering (1) The Senior Seminar Program is designed to allow senior undergraduates to meet with faculty members in a small group setting to explore an intellectual topic in aerospace, environmental or mechanical engineering (at the upper-division level). Topics will vary from quarter to quarter. Senior seminars may be taken for credit up to four times, with a change in topic and permission from the department. Enrollment is limited to twenty students, with preference given to seniors. Prerequisites: department stamp or consent of instructor.

MAE 197. Engineering Internship (1–4) Students work in local industry or hospitals under faculty supervision. Units may not be applied toward graduation requirements. Salaried or unsalaried. Number of units determined by enrollment frequency. First quarter up to four units. Subsequent quarters cannot exceed one unit. Prerequisites: consent of instructor and department stamp, 2.50 overall GPA minimum, at least ninety units.

MAE 198. Directed Group Study (1–4) Directed group study on a topic or in a field not included in the regular department curriculum, by special arrangement with a faculty member. May be taken P/NP only. Prerequisites: consent of instructor.

MAE 199. Independent Study for Undergraduates (4) Independent reading or research on a problem by special arrangement with a faculty member. P/NP grades only. Prerequisites: consent of instructor.
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