Society of Engineering Sciences
presents

Unofficial Guide to Engineering Sciences

2015-2016
http://ses.berkeley.edu

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Introduction

Welcome to Cal! We, the students of the College of Engineering, would like to congratulate you on your admission to one of the finest engineering institutions in the world. You are now a member of a very elite group of students who make up Cal's Engineering Science Program.

As former freshmen, we understand the feelings of confusion and the overwhelming amount of information you may be experiencing as you enter your college experience. It is a monumental task to sort through all of the new information and determine the path you will take here at Berkeley. You have to take the initiative to find out about classes and chart your own course. Within the couple of years, you will be making some important decisions that will undoubtedly affect your future. Drawing on our past experiences in Engineering Science and other related engineering disciplines, we hope that we will be able to give you a hand in making informed decisions and to help you avoid the pitfalls of the college system.

The Unofficial Guide to Engineering Sciences contains information concerning classes, majors, graduate schools, jobs, careers, and campus resources. We hope that this will become a first resource to you whenever you have any questions about the engineering program. This guide does not replace your faculty adviser, ESS adviser, or any of your peer advisers. However, we hope that the booklet will help answer most of your questions about your new major. Perhaps it will help you formulate your own path here at Berkeley. Welcome to the Cal Engineering family! Good luck and GO BEARS!

Energy Engineering

Energy Engineering (EnE) offers an interdisciplinary look at the challenges around the quickly-changing energy landscape. Energy Engineering majors take the same strong quantitative base that other Berkeley engineers take, including physics, linear algebra, single and multivariable calculus, as well as chemistry. It is currently a small major, but every year since its creation in 2012, the major has increased rapidly, some years even doubling in size.

In addition to these core quantitative classes, a huge variety of other perspectives shed light on the energy issue. Required classes come from departments all over the College of Engineering, as well as outside it. The required Civil Engineering classes generally take a bird's-eye view, focusing on fluid and energy flows at large scales, as well as the associated chemical reactions. From Mechanical Engineering, EnE pulls in a more rigorous mathematical approach to the physical and energetic interactions between and within systems. Electrical Engineering classes seem to split the difference, with EE 137 (Electric Power Systems) taking a high-level view of power systems and EE 134 (Photovoltaics) taking a detail-oriented view of semiconductors. Statistics, sustainability and economics courses also inform the study of energy. Each of these categories pulls a class from a set of possible classes listed on the degree worksheet. For example Stat 134, IEOR 172, or Math 55 can be used for the statistics requirement. Each brings a different perspective to the intersection of statistics and energy. All of these skills come together in a senior capstone project E 194, which allows students to synthesize and apply the knowledge they have gained to a current problem in energy engineering.

Due to the number of classes, an Energy Engineering program is a bit less flexible than other Engineering Science majors, but you can be assured that you are taking basically every energy-related class that Berkeley offers. This rigidity requires a bit of careful planning to make sure that you have all of the prerequisites at the right time. Certain classes are offered only fall or spring, so this is another consideration. The schedule is actually more flexible than it may seem at first because of the major's relative novelty. Energy Engineering is still in flux, so if

you see a class that piques your interest, speak up! You may be able to substitute it for one that feels less relevant. Faculty and departmental advisors can give helpful advice and will be important voices in developing your path through and after university. With this ability to tailor the major comes the responsibility of looking ahead and doing so thoughtfully.

Student groups are very important in determining what you want to do with your major, as well as for meeting people with similar interests. (For example, try SES!) BERCU attracts a variety of majors and puts on some really cool events, occasionally fueled by free pizza. Engineering project clubs such as Human Powered Vehicle and CalSol are also great ways to hone skills and meet people.

EnE's interdisciplinary nature allows the pursuit of a variety of different career paths including graduate school, mechanical engineering, solar photovoltaics at either the system level or the semiconductor level, and more. The Career Center sends out newsletters about research or internship opportunities, and signing up for BOTH engineering and environmental newsletters will allow you to see a large range of possibilities. (For more information, see https://career.berkeley.edu/MailList/MailList.) Because there are no "Energy Engineering" career fairs (yet!), you tend to make your own way by attending a variety of career events.

Examples of relevant challenges include improving energy efficiency in buildings, transportation, and industrial sectors; reducing emissions of carbon dioxide and other environmental impacts associated with fuel combustion in power plants and engines; designing and managing smart energy grids; developing non-fossil energy systems including wind, solar, geothermal, and nuclear power; and developing and improving production, storage, and distribution infrastructure needed for electric vehicles, hydrogen fuel cells, and biofuels.

Final Note: Many EnEs recommend taking Thermodynamics early (to account for scheduling), and to avoid taking both CE 107 and ERG 100 (the content is quite similar). Also, take anything Nazaroff teaches! For a list of FAQs about the major and other information, visit http://engineeringscience.berkeley.edu/energy-engineering.

Engineering Math and Statistics

This major is a combination of math and engineering. Due to the breadth of this program, it is especially suited for those who plan to enter graduate school. If you are unsure of engineering but still love math and science, Engineering Math and Statistics (EMS) is still for you. Additional engineering or science deficiencies for graduate work that you may have can be made up early in graduate school, and your broad background can offer some creative sparks for research. If it turns out that engineering is not right for you, you still will have important knowledge of it that can help you in other fields. This is an excellent program for additional math coursework and a stepping-stone to graduate work in math or science education. Alternatively, you may develop a pre-actuarial plan with technical courses in math, statistics, operations research, and engineering economics, and with social science courses in economics, business, and law.

It is important to emphasize that lower division math classes are very different from upper division classes. Upper division classes are more theoretical and have little emphasis on computation. For additional guidance, you may want to contact the mathematics department. The department office is located in 970 Evans. Also, the Mathematics Undergraduate Student Association (MUSA) can be very helpful. They may be contacted by e-mailing musa@math.berkeley.edu.

You can find many potential clusters of engineering courses that will give you some concentration. One way is to look at the courses required or recommended for other engineering majors and their various options. The College of Engineering Undergraduate Guide (http://coe.berkeley.edu/guide) is a good source to look at classes required for other majors. Of all the engineering departments, the Industrial Engineering and Operations Research (IEOR) department is closest to EMS. Look at the IEOR 160 series.

Your upper division math/stat classes require Math 128A (a class in numerical analysis for which prior exposure to a high level programming language is recommended), Math 110 (linear algebra, a course very similar to Math 54), Stat 134 or IEOR 172, 3 electives in math or

statistics from an approved list, and, most importantly, one of the following two-course sequences:

1. Math 104, Introduction to Analysis, and Math 105 (Integration), Second Course in Analysis.
2. Math 104 and 185, Introduction to Complex Analysis.

Note that Math 104 is a rite of passage where you basically prove calculus. However, be aware that it is NOT an easy course. To quote the Math Department's Undergraduate Announcement, "students are advised that this [Math 104] is a very difficult course, and is best taken following another upper division mathematics course."

If you are more interested in applied mathematics more than pure math, then the math electives that may be of interest are:

123 Ordinary Differential Equations
126 Intro to Partial Differential Equations
128B 2nd Course in Numerical Analysis (may not count as an upper division technical elective)
170 Mathematical Methods for Optimization

The four basic core courses for the math major in L&S are Math 104, 185, 110, and 113 (Abstract Algebra). Thus, if you are really interested in math, you might want to choose 113 as an elective. L&S math majors also need to take one course from each of two of the following subject areas: Computing (which you automatically satisfy because of Math 128A); Geometry (Math 140, 141, 142); Logic and Foundations (Math 125A, 135). These courses are possibilities for the three-course elective. If you are interested in statistics, then you should consider completing the full Stat 134-135 sequence to have a more complete background in Probability (Stat 134) and Statistics (Stat 135), even though there are statistics courses satisfying the elective requirement which require only 134. Just for reference, L&S statistics majors are recommended to take Math 104, 105, 113, 126, 128A, and 185. If you can, give the honors sections a try when you take Math 104, 185, 110, and 113, especially 104. These are rigorous and difficult sections, but they are worth the work if you really love and appreciate the beauty of mathematics.

Although it is not required, you may want to take Math 55 (or CS 70) on discrete mathematics. This class introduces proof methods and techniques, and it helps you adjust to upper division math classes, which tend to be far more theoretical than lower division classes. Discrete mathematics also places a lot of emphasis on structures (such as sets, graphs, relations) and less on computation, so it exposes students to sides of math they haven't seen before. You get a chance to write clear, concise proofs, and get a "flavor" of upper division mathematics. (This counts a lower-division elective!)

Within computer science, the 150 series are computer architecture courses; the 160 series, software; the 170 series, computer theory; and the 180 series, computer applications.

The requirement for a computer science minor is CS 61ABC, CS 70, and three upper division courses in computer science (also including EE 122). Unfortunately, only one upper division CS course can overlap for the CS minor, but at least you can have the EQUIVALENT of a CS minor, which is still something for the resume. Another feasible minor is chemical engineering provided completion of either the Chem 1 or Chem 4 series.

If you are interested in the physics side of applied mathematics, you may also want to consider concentrating on physics courses such as fluid dynamics or quantum mechanics. Of course, talk with your faculty adviser when planning your technical electives.

Because any two EMS students can potentially have drastically different programs, it is very important that you glean as much as you can out of your faculty adviser and talk to people in the many fields in which you are interested. Ask your faculty adviser and your professors for people that can give you more information. If they refer you to another professor, do not be afraid to go to his/her office hours even though you are not in his/her class.

Engineering Physics

As an Engineering Physics (EP) major, you can pick from a range of focuses – an engineering mindset with a fundamental background. You might be interested in semiconductors, but you would study more solid state physics than most electrical engineers. Or, you want to build things, but still work though Lagrangian and Hamiltonian methods of classical mechanics. Engineering Physics starts you off with more of a first-principles approach! If you're curious about the foundations of technology, these extra physics classes help quench that thirst.

Chief among the attractions of Engineering Physics is the ability to take diverse classes. Go wild! Still, it helps to emphasize a particular area of study. Choose your curriculum according to your interests at the time. If you keep thinking about how materials work, take E 45. If you are finding an interest in theory, try programming – a useful tool to run simulations. (Lecturer Reinsch in the physics department advocates that all physics undergraduates learn to program!)

Read the fine print in the General Catalog (guide.berkeley.edu) and know what the prerequisites are for a class. That way, you can take your requirements before taking upper division classes. Since some classes are offered in only the Fall or Spring semester, missing a prerequisite can become a hassle. Key survey classes that are important prerequisites for many interesting upper division classes are E 45, EE 16A/B, and ME C85/CEE C30.

Some of the required classes have a list of recommended – but not strictly required – classes. Ask the professor if the prerequisite is actually necessary. Many students agree that you will be best off if you use Advanced Placement credit for any math and chemistry classes you can. This should give you more time for the really interesting and important upper division classes. It could also help make your semester unit loads more bearable. Use the time to develop relationships with your peers in physics – many will take a few upper division classes with you. We strongly encourage taking the Physics Honors (H7) sequence. The added rigor and challenge will help you adjust to upper division physics and mathematics courses more easily.

In your first year, it is fairly standard to focus on lower division physics, math, chemistry, and miscellaneous breadths. You can make important decisions (such as what topic to focus on) in your sophomore year, so don't stress out just yet! If you do have open slots, be sure to explore intro classes, such as Astro 7A, CS 61A, EE 16A/B, or Math 55. These classes can help you decide your interests so you can plan out your courses over the next four years.

Depending on how you use your electives, this major is well-suited for graduate studies in physics, engineering, and materials science. Graduates regularly go to the best graduate departments in all of these areas. You will notice that your degree requirements allow you to choose either an engineering course or the equivalent physics course for a broad range of subjects. If your goal is physics graduate school, it is recommended that you take Physics 105 (Mechanics), 112 (Thermodynamics), 137A/B (Quantum Mechanics), and 110A/B (Electrodynamics) in order to be prepared for graduate studies. On the other hand, if your goal is to enter a specific industry (say, for instance, aerospace engineering), then choose engineering courses related to your future career path. **Working in a research group and at an internship are both enlightening experiences; if you can, try both.**

From the lab courses, Physics 111 is the most useful for basic engineering and physics research – it equips you to understand experimental technique and instrumentation, which is ubiquitous. EE 143 is also very useful (and is recommended by Professor Attwood), especially if you are interested in semiconductors and fabrication techniques. Both of these classes can help to make you a great undergraduate researcher.

For math electives, you have a choice between the 121 series and 104/185. Unless you are really interested in theory and abstract math, take the 121 series! The 104/185 sequence can be difficult and time-consuming, which may impact your understanding and performance in other classes. Alternatively, the 121 series prepares you for math you'll see in upper division physics courses (special functions, solving different differential equations, and Fourier math). Also, more of your peers will be in the 121 series, so you'll have a good study group and a more familiar curve. The 104/185 courses, however, more adequately

prepare an individual for graduate school in a theoretical field. In particular, Math 185 (Complex Analysis) is applied in both quantum mechanics and signal processing. Additionally, if you plan on taking many upper division physics courses, consider taking Physics 89, a mathematics course targeted for physics majors.

After you finish your lower division courses, there are a lot of opinions about which physics upper division courses you should take first. Some people say Physics 105 (Mechanics) is quite fundamental, but it's so time-consuming you should save it for the end. Physics 112 (Thermodynamics) can be easy or hard depending on your instructor, but little thermodynamics topics do show up in other classes like quantum mechanics and solid state physics. It's not necessary, but it is nice to have! You'll find that every course in upper division physics is slightly related to all of the other upper division physics courses.

Because you will have to make choices between engineering and physics courses, it may be helpful to have student descriptions of classes in addition to the General Catalog. (Don't know anyone who's taken that class? Ask SES!) Remember that the engineering courses tend to hone your numerical-spatial problem-solving skills, while physics courses will demand critical thinking with more equations and almost no numbers.

Remember to consult with your faculty adviser often, and talk about potential plans for graduate studies. Your advisers are on your side – make sure to take advantage of the guidance they can provide!

Environmental Engineering Science

Introduction: The Environmental Engineering Science (EES) major is a rigorous interdisciplinary program pairing engineering fundamentals with courses in the environmental and natural sciences. Although environmental engineering options may be found in the chemical, civil, mechanical, and material science engineering departments, the EES curriculum provides a broader foundation in the sciences. At the same time, it allows students to focus their study on environmental issues more than any other program option in the College of Engineering. As a student in this program, you will have many chances to direct your own curriculum. Thus, it is important that you plan ahead and research course prerequisites, units, and availability.

EES vs. CEE with Environmental Emphasis: Many lower division students with a strong interest in environmental engineering have trouble choosing between the EES track and the Civil Engineering with an environmental emphasis.

- For starters, your diploma will say B.S. Environmental Engineering Science or B.S. Civil and Environmental Engineering, depending on your decision.
- Civil Engineering requires a few more courses not environmental in nature (to be expected), including Civil Engineering Materials (CE 60), Mechanics of Structures (CE 130), and Engineering Data Analysis (CE 93). A Civil Engineering student is also required to take both a design elective as well as four core courses, not all of which are related to environmental engineering.
- In contrast, the EES program requires more breadth and applications to the earth sciences, architecture, or chemistry (depending on your choices; see Advanced Science Sequence section). For example, EPS 108 (Field Geology; includes field trips every week), EPS 50 (The Planet Earth), and Architecture 140 (Energy and the Environment) will count toward your major. Thermodynamics, hydrology, and math/stats/computing are also required in EES.

- Both majors require a number of upper division technical electives (EES with 12 units, CE with 15 units).
    - CE requires that these electives exist within the College of Engineering or Chemical Engineering, while EES electives may encompass technical courses in or out of engineering.
    - CE electives may be any combination of classes (so long as they are engineering-related), while EES has what are known as Clusters. Essentially, the electives must fall within a specific subject area, or Cluster. For each Cluster (Air Pollution and Climate Change, Biotechnology, Ecosystems and Ecological Engineering, Environmental Fluid Mechanics, Geoengineering, Water Quality), one should examine the specific lists of allowed classes. (Do note that these clusters can be flexible with adviser approval.) Look out for classes with prerequisites (e.g., in Electrical Engineering, Mechanical Engineering, MCB) not often taken by EES students.
- Unlike the Civil Engineering major, the EES program does not yield an ABET-accredited engineering degree. However, the flexibility of the EES program allows each student to specialize in what they are most interested in, while a Civil Engineering degree covers the breadth of civil engineering practice with some emphasis on environmental engineering.
- Visit these links to see the full requirements of each program:
    - http://engineering.berkeley.edu/academics/undergraduate-guide/academic-departments-programs/engineering-science/environmental
    - http://engineering.berkeley.edu/academics/undergraduate-guide/academic-departments-programs/civil-environmental-engineering

Lower Division Basic Science Electives: One key decision occurs during your sophomore year when you can choose three basic science electives from this list: Physics 7C, Bio 1A/1AL, 1B, Chem 1B, 3A, 3B, and EPS 50. Those who have taken AP, IB, or A-Level exams in Biology should check (link at http://admission.universityofcalifornia.edu/counselors/exam-credit) to see if they can fulfill two of these electives by passing out of Bio 1A/1AL and Bio 1B. For those possibly considering grad school, many programs, such as in the earth sciences, recommend or require one full year of chemistry, so Chem 1B may be a wise choice. The Chemistry 3 series is relevant to many aspects of environmental engineering, such as toxicology, biofuels, and soil chemistry. EPS 50 is helpful for the Geoengineering cluster. Those more physics-minded (for example, those interested in the Atmospheric Science Advanced Science Sequence) might find Physics 7C useful.

Clusters: Build cluster/sequences carefully. Make sure you have the necessary knowledge to get the job you want. Explore different possibilities. Remember that you can't knock out series and cluster course requirements with one class. Not all classes are offered every semester! Also, there are many classes not listed in the requirements that you can get approved into a cluster or sequence! Consult your faculty adviser for more information.

Advanced Science Sequence: In accordance with the program's goal of a broad science background, students are required to take at least 8 units in one of the following sequences: Atmospheric/Climate Science, Biochemistry/Microbiology, Ecosystems/Soils, Geology/Geodynamics, Organic Chemistry, or Physical Chemistry. For more information, consult the EES requirements.

Fluid Mechanics Elective: CE 100 is the most commonly taken fluid mechanics course by EES students. Unlike ME 106 and ChemE 150A (the other two options), CE 100 discusses open channel flow applicable to streams and rivers, an important aspect of environmental engineering. In addition, those considering the other two classes should look up and consider the respective prerequisites.

Thermodynamics Elective: ME 40 is the standard and likely the easiest option. Those with an eye toward chemistry should certainly consider ChemE 141 and E 115, the other two choices. Note that the Civil Engineering graduate program likes to see E 115 completed (since it is upper division).

Hydrology Elective: CE 103 covers the hydrological cycle, floods, runoff analysis, and watershed modeling, while CE 115 involves a significant amount of chemistry and covers topics such as pH, alkalinity, acid/base speciation, metal chemistry in aqueous systems, and redox chemistry.

Upper Division Math/Stats/Computing Elective: Lastly, you will be required to select an advanced mathematics course in your junior year. Perhaps the most practical are the two statistics options. In particular, Stat 133 (Computational Statistics) is very practical and teaches R (a programming language), but the class is in high demand. Some, including Math 128A and E 177, emphasize programming (using MATLAB). Others are pure math classes, including Math 104, 110, 126, and 185. Students are advised to read further on individual class descriptions to determine which is best for them.

Other Recommendations: Many EES students **highly, highly recommend** Professor Nazaroff's CE 111 (Environmental Engineering) and CE 107 (Climate Change Mitigation). Taking a class that has a big semester project (group or individual) can be a great experience (and really boost your résumé). Try classes outside your major or go for a minor (or double major)!

Minors and Double Majors: It can be fairly easy to minor in a related field or double major. In particular, look at Architecture, Earth & Planetary Science (EPS), Forestry, Molecular Environmental Biology (MEB), Sustainable Environmental Design (SED), and the College of Environmental Design (CED). You might find a graduate program is right for you in an outside department! For example, some EES graduates are completing a master's program in EPS.

Last Words: Talk to professors, but don't limit yourself to talking to professors just in the major. There are people in Architecture, EPS, Forestry, MEB, and Sustainable Design EVERYWHERE that can have interests similar to you and have opportunities for you. The Engineering Student Services (ESS) and departmental advisers are really friendly and accessible. Be sure to consult frequently with your faculty adviser, departmental adviser, AND the ESS office in 230 Bechtel for detailed information about courses/degree requirements.

Academic Resources

Center for Achieving Engineering Excellence
Counseling, tutoring, and workshops in math and science for College of Engineering students.
227 Bechtel Engineering Center, http://coe.berkeley.edu/caee

Counseling
We have a staff psychologist with office hours in Bechtel. If you feel like you're under a lot of stress or would like to talk in a confidential setting, contact Christine Zhou of University Health Services (UHS) at christinez@uhs.berkeley.edu or (510) 643-7850.

Eta Kappa Nu
Peer tutoring by EECS honors society students in lower division engineering prerequisites and upper division EECS classes. 290 Cory Hall 10 AM – 4 PM during the week.
http://www-hkn.eecs.berkeley.edu/student/tutoring.shtml

Student Learning Center
Tutoring in first year math, science, composition, and social science. Also provides study skills workshops.
140 Cesar Chavez Center, http://slc.berkeley.edu/

Tau Beta Pi (TBP)
Test bank, course surveys/syllabi, mock interview opportunities, and a general helpdesk.
https://tbp.berkeley.edu/students/

Unofficial Class Wiki
The brainchild of SES President Kunal Marwaha. Contains a database of notes for your engineering courses.
http://ocf.berkeley.edu/~kmarwaha/classwiki

In addition to the above resources, tutoring and academic assistance is available at all of the Residence Halls at the Academic Services Center.

Computing/Scheduling Resources

Internet access and email are integral to your educational experience. Most courses have web sites for class information, and professors often use email to communicate with their students. It is highly recommended that you obtain your own computer. But if this is not possible, don't worry, there are plenty of options.

On campus, there are several facilities (including libraries) with computers and printers that are available free of charge. For more info, check *Resource: A Reference Guide for New Berkeley Students*, which you will receive during your orientation. Some libraries (including Moffitt) have computers for short-term checkout. If you are enrolled in an EECS class, you will have access to the Cory and Soda workstations.

Open Computing Facility (OCF) accounts are available to all students free of charge. The lab (located in Hearst Gym) offers a limited amount of free printing, web hosting, and other services. See more at http://www.ocf.berkeley.edu. (Fun fact: OCF hosts our website.)

Software can be downloaded from http://software.berkeley.edu/ for academic and personal use. This includes Adobe Creative Suite 6 (CS6, which has Illustrator and Photoshop), Microsoft Office 2010, Windows 8, Mathematica, and MATLAB. If you're working with data, be sure to check out the Berkeley Institute for Data Science (bids.berkeley.edu) and the D-Lab (dlab.berkeley.edu).

Scheduling is always a nightmare, but there are important resources to help you out. Most important are ScheduleBuilder (schedulebuilder.berkeley.edu) and NinjaCourses (ninjacourses.com), which assist you with all of your scheduling needs. In addition, NinjaCourses also has course ratings submitted by other students so you can easily compare professors from the student perspective. Other resources, such as berkeleytime.com and telebearsoracle.com, help you decide which classes to Phase I by displaying enrollment data over the past semesters. Remember that you can always talk to your peers (including SES members), your ESS Adviser, your Departmental Adviser, or your Faculty Adviser for in-depth information about your courses.

Other Resources

College of Engineering

- Changing College: http://coe.berkeley.edu/coc
- Changing Major: http://engineering.berkeley.edu/academics/majors-minors/change-major
- Degree Worksheets: http://engineering.berkeley.edu/student-services/degree-requirements/degree-worksheets
- Humanities Requirements: http://coe.berkeley.edu/hss

Decals (Student-Taught Classes): http://www.decal.org

Engineering Organizations and Competition Teams:
http://engineering.berkeley.edu/student-life/teams-and-organizations

Engineering Science Requirements:
http://engineering.berkeley.edu/academics/undergraduate-guide/academic-departments-programs/engineering-science/

Freshman and Sophomore Seminars: Get a unique, small-group class experience with a faculty and other new students. http://fss.berkeley.edu/

Important Engineering Freshman Class: "Perspectives in Engineering", E 92, M 4 PM – 5 PM. Weekly 1-hour lectures about all relevant majors (all engineering departments plus physics). 1 unit, no HW, tests or assignments. Just attend! Find it at http://schedule.berkeley.edu/srchfall.html

Rose Hills Research Funding for Undergraduates:
http://surf.berkeley.edu/surf-rose-hills

Study Abroad: http://studyabroad.berkeley.edu

Undergraduate Conference Travel Grant Info:
http://iis.berkeley.edu/content/undergraduate-conference-travel-grant

Your Berkeley Portal: http://calcentral.berkeley.edu

Tip: Use Facebook with your @berkeley.edu address and you'll find Facebook groups for Berkeley organizations and majors. Join a few FB groups and pages related to your major and interests (e.g. Mechanical Engineering, BERC, Applied Mathematics, Computer Science) to stay updated and ask other questions! **We're at https://fb.com/berkeleyses and https://fb.com/groups/berkeleyses.**

Advising

When seeking answers to questions regarding courses or your degree, here is a list of some important resources. For more information, see http://coe.berkeley.edu/advising.

ESS Advising

Your ESS Adviser is located in 230 Bechtel and is available for advising Monday, Tuesday, Thursday and Friday, 9 AM – Noon and 1 PM – 4 PM. Have a quick question? Drop in on Wednesday from 9 AM – 11:30 AM and 1 PM – 3:30 PM. For a specific time allotted exclusively to you, you are strongly encouraged to make an appointment with your adviser, avoiding any excess waiting during the drop-in period. Schedule an appointment at http://coe.berkeley.edu/ESS.

Your adviser will suggest a reasonable curriculum for you to follow at Cal. This is the adviser you want to talk to concerning requirements for your major. They also answer such questions regarding breadth requirements, changing of majors, transfer/AP credit, and engineering-related paperwork. Especially if you are unsure of your major (or if you would like to double major), ESS advisers are there for you.

For further questions, feel free to call or email Engineering Student Services, (510) 642-7594, or email ess@coe.berkeley.edu.

Energy Engineering, Engineering Math and Statistics, and Environmental Engineering Science students should see Olivia Chan (oychan@berkeley.edu).

Engineering Physics students should see Bryan Jones (bkjones@berkeley.edu).

Undeclared Engineering students should see Sharon Mueller (smueller@berkeley.edu).

Departmental Advising

Engineering Science's departmental advisers answer registration questions, describe courses, interpret departmental policy, and make referrals to resources on campus. They are incredible people to get to know and work with. They are dedicated to supporting you both as an Engineering Science student and as a human.

Engineering Math and Statistics students and Engineering Physics students should see Mitzi Stevens. Mitzi holds drop-in student advising on Monday-Friday from 9 AM – Noon and 1 PM – 4 PM in 750 Davis Hall. To make an appointment or send an email inquiry, please email her at stevens3@berkeley.edu.

Energy Engineering students and Environmental Engineering Science students should see Joan Chamberlain. Joan holds drop-in student advising on Monday, Tuesday, and Thursday from 10 AM – Noon and 1 PM – 3 PM. Her cubicle is in the 705 wing in Davis Hall (on the 7th floor). To make an appointment, or send an email inquiry, please email her at joan@ce.berkeley.edu.

Faculty Advising

In addition to your ESS Adviser, every engineering student is assigned to one member of the faculty in his/her given field of study. The Student Affairs Office assigns your faculty adviser, and you will be notified of the name of your adviser shortly after your arrival at UC Berkeley. If you develop a good relationship with your faculty adviser, he or she can be an invaluable resource, providing insightful, experience-based knowledge to help guide you through your years at Cal. This is the adviser you approach with specific questions regarding courses and instructors. They have a better understanding of which courses are best and most pertinent to your studies and can also provide detailed descriptions of classes. They will also approve your schedule when enrollment begins (at our Pizza with Professors event every semester) and make sure that you are meeting all of your academic requirements while maintaining good academic standing in your department.

In addition, your faculty adviser can be a friend in your department who can recommend you for research and job opportunities, as well as serving as a good source of reference for graduate school. Your faculty adviser is usually available during his or her office hours, and sometimes by appointment.

Energy Engineering

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Other Advising

The College of Engineering runs a **Peer Adviser** program to assist ESS advising. The advisers are engineering upperclassmen and can help you find the right forms, answer quick questions, or chat about life. They are located in 230 Bechtel. More information at this link:

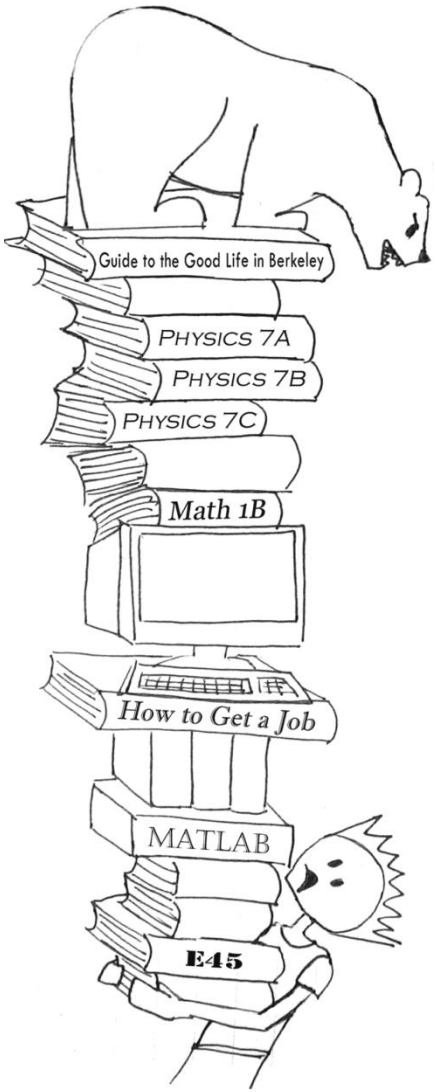
http://engineering.berkeley.edu/student-services/advising/peer-advising

The **Center for Access to Engineering Excellence (CAEE)** in 227 Bechtel Hall has two professional staff advisers and a learning support specialist available for all engineering undergraduates. There are new student programs, tutoring for introductory classes, and workshops throughout the school year. More information at this link:

http://engineering.berkeley.edu/student-services/tutoring-academic-support/center-access-engineering-excellence

Often, the most reliable information and opinions come from your peers. We encourage you to **get involved in clubs** like SES so that you can network with upperclassmen and seek their advice. Additionally, clubs are generally a great source of academic resources, including academic advising sessions and peer-counseling.

E 98



Engineering 98 is brought to you by

E98 Surviving Berkeley Engineering and Tau Beta Pi The Engineering Honor Society

Got questions?

What classes should I take, and with which professors?
How do I get a summer internship?
How can I study more effectively?
What's the right major for me?
Is it possible to have a life AND be an engineer?
What are some good places to eat around here?
How do I succeed as an engineer at Berkeley?

E 98 has answers.

Engineering 98 is a student-run class, designed specifically for new engineers by those who have been through it all.

This 1-unit P/NP DeCal covers:

- Study strategies and academic resources
- Interview tips and résumé development
- Tele-BEARS, professor, and course advice
- Internship and research information
- Student life and the best places to eat!

For more information:
visit: http://e98.berkeley.edu
e-mail: e98@tbp.berkeley.edu

Graduate School

How to Find a School

Start by meeting with your professor and/or faculty adviser during office hours to talk about suitable schools and graduate programs aligned with your interests.

To find a description of universities and their graduate programs, you may want *Peterson's Guide to Graduate Schools*. Another useful resource is *The Gourman Report*, which is a compilation of "Top 25" lists of graduate schools for many specific programs, including bioengineering and environmental engineering. Also, ask your professors or faculty adviser about which programs have good reputations in your particular field. Once you have a tentative list of schools, you could go to the Career and Graduate School Services on 2440 Bancroft Way and look at their catalogs. During the summer before your senior year, call or email the graduate schools for applications and a description of their graduate program. Most schools will first send you a catalog and an application later. If you plan to enter graduate school in the fall, application deadlines usually range from December to February. Graduate schools have either a bioengineering or a biomedical engineering graduate program depending on how closely associated the program is to its medical school. Most programs are for a Ph.D. degree and to a lesser extent the MS degree. Some schools also have MD/Ph.D. programs for the biomedical sciences/engineering that may also be worth looking into.

Letters of Recommendation

Most graduate school applications require at least three letters of recommendation. Students usually get letters of recommendations from professors, graduate students, or employers. Graduate schools are not only looking at your academic ability, but also at your ability to interact and work with other people. If you have worked for any professors or have had an internship in industry, make sure you ask your professor or supervisor to write you a letter of recommendation.

Graduate Record Examinations (GRE)
The GRE is a standardized test, the scores of which are accepted by most graduate schools across the US and also in many other countries as one of the criteria for consideration for admissions to graduate programs. Among the graduate programs that accept your scores in the GRE, engineering programs are the most lucrative. A combination of high scores in GRE, engineering degrees, and lots of hard work is the key to a successful career in the field of engineering!

Although most graduate schools have worked out various criteria for selecting the applicants who can be granted admissions, your performance in the GRE is one criterion that will be considered by most graduate schools. The weight given to your GRE scores may vary from school to school, but it is a well-known fact that competitive or good GRE scores will definitely tilt the scales in your favor if you are being compared with other applicants. While considering your scores in GRE, engineering colleges or graduate schools offering majors in engineering pay more emphasis on your Quantitative Reasoning score, which is the math score. As it is necessary for an engineering aspirant to be proficient in math, your Quantitative Reasoning score will provide an insight into your skill levels in math. Although your scores in the other two GRE sections are also important, you should aim for scoring very high in the Quantitative Reasoning test section of the GRE if you wish to graduate with a major in engineering subjects.

Medical School
You **can** apply for medical school even if you stick with Engineering Science.

Review medical school requirements **now** to see what classes you need to take before you apply. Remember that AP units are generally not accepted as credit for lower division classes. You must take the MCAT approximately 12-18 months before your expected entrance to medical school. Many helpful books and handouts can be found at Career and Graduate School Services on 2440 Bancroft Way. There are also several societies on campus that are support networks for pre-medical students. More information on the MCAT:
https://www.aamc.org/students/services/343550/mcat2015.html

Career/Internships

How to Get a Research Job
If you are interested in doing research within an engineering science group, you should talk to faculty advisers and talk to the professors directly. If you would like to work in another department, such as Mechanical Engineering, EECS, Molecular Cell Biology, or Chemical Engineering, obtain the departmental announcement which contains a detailed listing of professors and what they are currently working on. From this list you can call or email the professor to make an appointment. Prepare yourself when meeting the professor. Look professional and act interested. Ask questions to demonstrate that you have some knowledge of the professor's research. Have a résumé and a copy of your transcript ready. Consider beforehand whether or not you want to be paid (very often lab budgets don't initially allow for this) and how much time you want to put in. If the first interview doesn't work out, don't be discouraged. Just try again! The most important part of the process is starting. Once you start and get some contacts, eventually you will get a research job. Also, try looking at URO (Undergraduate Research Opportunities Program) through the College of Engineering or URAP (Undergraduate Research Apprenticeship Program) through the College of Letters and Sciences.

If You're Not Going to Graduate School
The majors in Engineering Science are geared towards graduate/medical studies. Thus, most of the curriculum focuses on the theoretical aspects of the various disciplines, leaving out some of the more practical engineering courses. This may put you at a disadvantage when competing for an industrial position against a mechanical or chemical engineer, who has a stronger practical-industrial background. On the other hand, holders of a Ph.D. degree usually take research and development positions. Nevertheless, there is no reason to despair. If your purpose and desire is to get a position in industry (and start earning good money in the process) with just a bachelor's degree, then these humble pointers might be of some help:

1) Decide your field; try to take as many related engineering courses as possible. This might seem something painful to do since this may imply giving up your “easy” electives for some “hardcore” engineering ones, but the payoff will be landing a good job once your weaknesses have become your strengths.

2) Get an engineering-related job before graduating. This is a must since this is what employers look for when they hire someone. Anything will work, i.e., part-time, full-time, paid, or volunteer.

3) Remember that experience is what counts. For job listings and references, go to the Career and Graduate School Services Center located at 2440 Bancroft Way. If it is too hard for you to work during the semester, try to get a summer job or take a semester off and get a CO-OP. Taking a CO-OP or an internship is the best way to get a permanent job. Always have your résumé ready. This is crucial. “Don’t leave home without it.” The handbook available at the Career Center has very valuable résumé advice and examples. You may even want to enroll in one of the many résumé -writing classes offered on campus.

Engineering Science programs are not ABET accredited, so consider taking the Fundamentals of Engineering (FE) exam before graduation!

Internships
An internship is a wonderful and effective way to connect your academic experience with the professional work arena. It allows you to gain valuable exposure to the workplace, provides the opportunity for skill development, and gives you a competitive edge in the job search.

Getting Started
Visit https://career.berkeley.edu/Internships/Internships.stm

- Internship Listings
- Frequently Asked Questions
- Meet with a Counselor
- Externships – Short term “job shadowing” opportunities
- Campus Opportunities – Campus-affiliated internships and experiential opportunities

Libraries/Department Offices

Bioscience and Natural Resources Library (2101 VLSB)	(510) 642-2531
Chemistry Library (100 Hildebrand Hall)	(510) 642-3753
Kresge Engineering Library (110 Bechtel)	(510) 642-3339
Main Stacks, Doe	(510) 643-4331
Math/Stat Library (100 Evans Hall)	(510) 642-3381
Physics/Astronomy Library (351 Le Conte Hall)	(510) 642-3122

College of Engineering, Dean’s Office
320 McLaughlin Hall
(510) 642-5771

Engineering Student Services
230 Bechtel Engineering Center
(510) 642-7594
ess@coe.berkeley.edu

Biochemistry and Molecular Biology
mcb.berkeley.edu

Bioengineering
bioeng.berkeley.edu

Cell and Developmental Biology
mcb.berkeley.edu

Chemical Engineering
cheme.berkeley.edu

Chemistry
chem.berkeley.edu

Civil and Environmental Engineering
ce.berkeley.edu

Computer Science
cs.berkeley.edu

Electrical Engineering and Computer Science
eecs.berkeley.edu

Engineering Science
engineeringscience.berkeley.edu

Genetics
mcb.berkeley.edu

Industrial Engineering and Operations Research
ieor.berkeley.edu

Immunology
mcb.berkeley.edu

Integrative Biology
ib.berkeley.edu

Materials Science and Engineering
mse.berkeley.edu

Mathematics
math.berkeley.edu

Mechanical Engineering
me.berkeley.edu

Molecular and Cell Biology
mcb.berkeley.edu

Neurobiology
mcb.berkeley.edu

Physics
physics.berkeley.edu

Society of Engineering Sciences

The professional and social club of Engineering Science – meet others in your major!

Mission Statement:
The Society of Engineering Sciences is dedicated to enhancing the lives of students within the Engineering Science department at University of California, Berkeley. The Society provides a node for Engineering Science majors to meet, interact with professors and faculty advisers, find research opportunities, and explore common goals. We support the diverse interests and needs related to the interdiscipline of Engineering Science and its scholars.

Founded in 1980, the Society of Engineering Sciences is comprised of students with interests in Energy Engineering, Engineering Math and Statistics, Engineering Physics, and Environmental Engineering Science. The primary purpose of this society is to give representation to and advance the interests of the Engineering Sciences. Additionally, SES seeks to provide resources, support, and activities to Engineering Undeclared students and to represent their interests in the college. Due to our multidisciplinary nature, all majors are welcome.

SES provides the opportunity for interaction of students with common interests. While SES represents a huge diversity of fields, it also serves to unite a group of largely interdisciplinary majors, which face unique goals and issues. Overall, SES is an extremely flexible and personal organization whose main goal is to continually adapt and serve the wide variety of member interests.

Anyone interested in becoming more involved is encouraged to contact one of the officers below. Please visit our website at ses.berkeley.edu. SES is an Engineering Student Council sponsored organization.

Fall 2015 SES Officers

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