
# STANFORD UNIVERSITY
# SCHOOL OF ENGINEERING

## HANDBOOK FOR UNDERGRADUATE ENGINEERING PROGRAMS

# 2009-2010

## UGHB.STANFORD.EDU

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# SCHOOL OF ENGINEERING

## HANDBOOK FOR UNDERGRADUATE ENGINEERING PROGRAMS

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This Handbook collects in one place information on undergraduate engineering programs at Stanford for 2009-2010. Here you will find details about school requirements and requirements for departments and programs, as well as instructions for declaring an engineering major, transferring engineering coursework from another school, petitioning for modifications of requirements, and the administrative steps to follow to graduate. You will also find descriptions of important opportunities and programs for engineering students, such as overseas studies, summer research fellowships, diversity programs, and career placement services.

There are always some changes from year to year and the Handbook is updated every summer before classes start in the fall. Since undergraduates come to the School of Engineering at different points in their Stanford careers, they may graduate using the requirements listed in any one Handbook that is published while they are undergraduates. All recent editions of the Handbook are available on the web at **http://ughb.stanford.edu.**

We hope that you will find the Handbook informative and useful, and we are interested in any suggestions you may have for improvements. If you have any questions about engineering degree requirements or about any of the information in the Handbook, please don't hesitate to contact your adviser or come see us in the School of Engineering's Office of Student Affairs, Terman 201. You are always welcome.

Professor Brad Osgood
Professor of Electrical Engineering
Senior Associate Dean, School of Engineering

# TABLE OF CONTENTS

# 1. FOR FRESHMEN AND SOPHOMORES

Just as it is for students at any university at the beginning of the year, your first weeks here will certainly be exciting, and may be overwhelming. For freshmen everything is new, and during orientation and as the school year begins you will be immersed in a constant stream of academic information together with many bits and pieces of Stanford culture. For sophomores, as you begin to move toward study that is more specialized, there will still be much for you to discover. This Handbook can help to inform your academic choices and provide some perspective on the School of Engineering within Stanford University.

## SOE EVENTS AND ANNOUNCEMENTS

There are some events and announcements every year that are of particular interest or importance to an engineering major such as reorientations for freshman or sophomores, job or internship opportunities, and key instructions for seniors on how to prepare to graduate. Please watch for and pay attention to emails coming from the staff of your major department or the Office of Student Affairs – email is the only effective method of general communication with SoE students.

## GETTING STARTED AT STANFORD

One of the great advantages of Stanford as an undergraduate institution is the tremendous breadth of excellence that the university offers. Some universities are strong in particular disciplines, while less so in others. The faculty and students we have been able to attract over the years have placed Stanford in the wonderful and exceptional position of being strong across the board. In engineering, as well as in the sciences, humanities, and social sciences, surveys conducted by the National Academies and other professional organizations that seek to assess the strength of academic programs all attest to the eminence of Stanford in education and research.

As an undergraduate, you should take the time to explore that wealth of academic excellence. Committing yourself prematurely to one discipline or coming in with too-firmly fixed ideas of exactly where you are going can take away from your chances to discover what Stanford has to offer, and to take advantage of all its diversity. Stanford encourages academic exploration by not requiring you to make a commitment up front; at many universities, students are asked to declare their intended major as part of the application process, particularly if they are interested in

engineering. Not so at Stanford. Here, you need not declare a major until the beginning of your junior year. You have the time to explore different possibilities before settling on a major.

At the same time, the flexibility that Stanford offers does not mean that you, as a prospective student of engineering, can afford to spend your first two years completely away from the techie side of things. Engineering majors typically require more courses and units than majors in other parts of the university. Technical courses, moreover, tend to be cumulative, in the sense that more advanced courses draw heavily on the material presented in the introductory courses that precede them. In engineering, you need to strike a balance between taking advantage of the freedom to explore and making sure that you are getting a reasonable start on an engineering curriculum.

## PLANNING YOUR FIRST (AND SECOND) YEAR

The best strategy is to avoid the extremes. A first-year schedule that includes *no* mathematics, science, or engineering will make it very difficult to complete an engineering major in four years. Conversely, it is surely a recipe for disaster to insist on packing your first year with three quarters each of calculus, physics, and chemistry along with the mandatory Introduction to the Humanities and Program in Writing and Rhetoric classes. There is too much work in each of those courses to take them all at the same time, particularly before you've had a chance to acclimate to Stanford's intensity and rapid pace. You should seek an appropriate balance for your studies.

## EXPLORING ENGINEERING

There are several ways for students to explore the various engineering majors. One is through the freshman/sophomore seminar program and departmental seminars, and another is through the "Engineering Fundamentals." The freshman/sophomore seminar program is described in detail in a separate publication from the Office of the Vice Provost for Undergraduate Education (VPUE), which you should receive as part of your orientation material. These seminars provide excellent opportunities for students to work with faculty in small settings, often on topics that aren't otherwise part of the curriculum for a particular major. You should *definitely* try to find a seminar that interests you, whether or not it's in engineering, and make that a part of your academic plans in your first or second year.

For 2009-2010, the seminars in engineering are listed in the table on the following page. For course descriptions, consult the Explore Courses web site at **http://explorecourses.stanford.edu/CourseSearch/.**

## FRESHMAN/SOPHOMORE SEMINARS 2009-2010

| Preference to Freshmen | Dept | Course |
|---|---|---|
| Structures: Why Things Don't (and Sometimes Do) Fall Down (Wtr) | AA | 113N |
| The Global Positioning System: Where on Earth are We, and What Time Is It? (Aut) | AA | 115N |
| Renewable Energy for a Sustainable World (Aut) | CHEME | 35N |
| Organizing Global Projects (Wtr) | CEE | 48N |
| The Art of Structural Engineering (Wtr) | CEE | 80N |
| Can Machines Know? Can Machines Feel? (Aut) | CS | 21N |
| Motion Planning for Robots, Digital Actors, and Other Moving Objects (Spr) | CS | 26N |
| Computers and the Open Society (Aut) | CS | 47N |
| Business on the Information Highways (Spr) | CS | 73N |
| Digital Dilemmas (Aut) | CS | 74N |
| Things About Stuff (Aut) | EE | 14N |
| Hacking Things (Aut) | EE | 20N |
| What is Nanotechnology? (Aut) | EE | 21N |
| Imaging: From the Atom to the Universe (Spr) | EE | 23N |
| Incentives for Promoting Good Social Behavior (Spr) | EE | 24N |
| Man versus Nature: Coping with Disasters Using Space Technology (Wtr) | EE/GEOPHYS | 60N |
| Building the Future: Invention and Innovation with Engineering Materials (Spr) | MATSCI | 70N |
| The Jet Engine (Aut) | ME | 12N |
| How Stuff if Made (Wtr) | ME | 14N |
| Global Warming and Climate Change: Fact or Fancy? (Wtr) | ME | 25N |
| Think Like a Designer (Aut) | ME | 26N |
| **Preference to Sophomores** | | |
| Medical Device Innovation (Spr) | BIOE | 70Q |
| Environmental Regulation and Policy (Aut) | CHEMENG | 60Q |
| Masters of Disaster (Aut) | CHEMENG | 70Q |
| Art, Chemistry, and Madness: The Science of Art Materials (Spr) | CHEMENG | 80Q |
| Accessing Architecture through Drawing (Wtr) | CEE | 31Q |
| Critical Thinking and Career Skills (Aut) | CEE | 44Q |
| Fail Your Way to Success (Spr) | CEE | 46Q |
| The Flaw of Averages (Aut) | MS&E | 22Q |
| International Environmental Policy (Wtr) | MS&E | 92Q |
| Nuclear Weapons, Energy, Proliferation, and Terrosism (Spr) | MS&E | 93Q |
| Japanese Companies and Japanese Society (Spr) | MATSCI/ENGR | 159Q |
| Creative Teams and Individual Development (Aut) | ME | 18Q |

In addition to the seminars listed above (check **http://ual.stanford.edu/OO/intro_seminars/IntroSemsCurrent.html** for most current information) that offer the opportunity to work closely with faculty, many programs within the School of Engineering offer less intense one-unit seminars that provide exposure to key issues and current research within their disciplines. Generally, these seminars feature invited speakers and meet once a week for an hour or an hour and a half. They often require attendance only or attendance and modest participation, such as asking questions or writing brief responses to presentations. Some seminars (such as CHEMENG 10 and EE 100) are specifically designed to introduce new students to the field, while others (such as CS 547) are designed for upper-level undergraduates or graduate students, but are generally accessible to the interested non-expert. These seminars can provide a low-key way to explore different majors and research areas, and we encourage you to check out the ones in areas of interest to you. The following table lists some of the more popular seminars that have been offered in the past, but offerings do change from year to year: be sure to look in Axess each quarter for other such seminars in departments of interest to you.

| **Course** | **Department** |
|---|---|
| The Chemical Engineering Profession | Chemical Engineering<br>CHEMENG 10, Autumn |
| Human-Computer Interaction Seminar | Computer Science<br>CS 547, Autumn, Winter, Spring<br>http://hci.stanford.edu/cs547/ |
| The Electrical Engineering Profession | Electrical Engineering<br>EE 100, Autumn |
| Entrepreneurial Thought Leaders Seminar | Management Science & Engineering<br>MS&E 472, Autumn, Winter, Spring |

The "Engineering Fundamentals" courses are an integral part of the undergraduate engineering curriculum and play a different role than the seminars. There are sixteen such courses and each serves as an introduction to one of the various engineering disciplines, endeavoring to build a foundation for more advanced work. Each major requires a minimum of three fundamentals chosen from the list, one goal being to ensure that our students obtain some breadth in engineering outside of their major. Details on the Fundamentals are provided later in this handbook. If, as a freshman, you are fairly certain which field of engineering you want to pursue, you might consider taking one of the Fundamentals in that area.

# MATHEMATICS COURSES

As a general rule, students interested in an engineering major should take a calculus sequence in their first year. Choosing which calculus sequence to take, however, requires careful thought and the assistance of your advisor. Stanford offers several different entry points into the study of calculus:

- MATH 41 and 42 present single variable calculus, with an emphasis on differential calculus in the first quarter and integral calculus in the second.
- MATH 19, 20, and 21 cover the same material as MATH 41 and 42, but do so in three quarters instead of two.
- MATH 51, 52, and 53 are taken by students who enter Stanford with 10 units of AP credit, or who have completed either Math 42 or Math 21. The 50 series covers differential and integral calculus in several variables, linear algebra, and ordinary differential equations. These courses are taught in an integrated fashion, with differential calculus of several variables and linear algebra being taught in MATH 51, integral calculus with linear algebra in MATH 52, and differential equations, including matrix methods for solving systems, in MATH 53. Students who are unsure of their mathematics preparation should consult with an advisor in the mathematics department before registering for this sequence.
- MATH 51H, 52H, and 53H cover the same material as in 51, 52, and 53, but with more emphasis on theory and rigor. These courses are designed for students who have a strong interest in majoring in mathematics with an inclination toward pure mathematics.
- CME 100, 102, and 104 or 106 (same as ENGR 154, 155A, 155B, and 155C) cover material that is similar to that in the MATH 51, 52, 53 series, but do so in a different order and with a more explicit engineering focus. The Computational and Mathematical Engineering (CME) courses were developed for undergraduates interested in Engineering. CME 100 presents multivariable calculus with engineering applications. It also introduces MATLAB, a computer program that integrates mathematical computing and visualization, providing a deeper, more visual understanding of the basic principles of multivariable calculus (for those taking the 50 series, MATH 51M, a one-unit course given in autumn quarter, offers an introduction to MATLAB). CME 100 can replace the material in MATH 51 and 52 in an engineering undergraduate's course requirements. Students can continue on with the CME 102/104/106 sequence, which covers the rest of the introductory mathematics curriculum with an emphasis on engineering applications. CME 102/104 and 106 require either MATH 51 *and* 52 or CME 100 as prerequisites.

## PHYSICS COURSES

The decision of whether to take a physics course in your first year is not nearly as simple as your decision about mathematics. Given the fact that you will also be taking required courses in writing and the humanities, taking both mathematics and physics in your first year pretty much fills your schedule, leaving little room for seminars or other courses that spark your interest. Furthermore, although all engineering majors require physics, it is often unnecessary to take physics so early in your undergraduate program. For students interested in engineering majors that depend heavily on physics, such as Mechanical Engineering and Electrical Engineering, taking physics in your first year makes a great deal of sense because physics is a prerequisite for many of the advanced courses. For most other engineering majors, however, it probably makes sense to delay physics until your sophomore year, giving you more flexibility in your course schedule.

As with mathematics, there are several possible sequences that are appropriate for first-year students:

- **PHYSICS 41, 43, and 45** constitute the standard introductory sequence in physics and cover mechanics, electricity and magnetism, and light and heat, respectively. These courses are calculus-based and are generally far more intensive than typical high-school offerings, even at the advanced placement level. Even students who have taken AP physics—and therefore do not in fact need the credits for these courses—find them challenging. Because the Stanford courses cover so much more material and do so with greater depth and rigor, it often makes sense to give up the advanced placement credits and take these courses. Talk with your advisor for guidance in this area.
- **PHYSICS 61, 63, and 65** offer a more advanced sequence designed for prospective physics majors and those interested in a more rigorous introduction to the field.
- **PHYSICS 21, 23, and 25** provide a lower-level introduction to basic physics primarily intended for premedical students. Most departments in the School of Engineering do not accept these courses and require students to take the 40 series or a more advanced offering. However, if you are intending to major in a discipline that *allows* students to take these courses, such as Computer Science or many of the degree options in Management Science and Engineering, these courses may represent an attractive option.

## CHEMISTRY COURSES

For some engineering majors, such as Chemical Engineering and the Individually Designed Majors associated with the Department of Bioengineering, taking a chemistry course in your first year is far more important than taking physics largely because Stanford requires students to take a

year of introductory chemistry before enrolling in biology. In order to get any advanced biology courses into a four-year degree, it is critical to begin the chemistry sequence early.

The Chemistry Department has recently revised its undergraduate offerings, starting with the freshman year. The following information has been provided by the department. Returning students will recognize the changes from previous years, and freshmen will receive additional information through their advisors.

The two-quarter sequence Chemistry 31A and 31B is offered in the autumn and winter quarters respectively, and the one-quarter accelerated course, Chemistry 31X, is offered in the autumn quarter only. Additionally, students with a score of 5 on the Chemistry Advanced Placement Exam may continue to start in Chemistry 33, which is offered winter and spring quarters, but see the last paragraph in this section, below, about consequences for those preparing to apply to medical school.

Chemistry 31A and Chemistry 31B cover all the essential topics in general chemistry that are required to prepare students for the subsequent courses in the curriculum. Only the more advanced portions of these same topics are covered in Chemistry 31X. Both tracks use the same textbook and will arrive at the same endpoint. Thus, Chemistry 31X is an accelerated course for students with a strong background in high school chemistry. Chemistry 31A and 31B is for students with moderate or no background in high school chemistry. Chemistry 31A is a prerequisite for taking Chemistry 31B. Students must decide before autumn quarter whether or not they will take the two-quarter track because it will not be offered again until the following year.

In addition to the courses offered by the Chemistry Department, the School of Engineering offers the course ENGR 31, “Chemical Principles with Application to Nanoscale Science and Technology.” ENGR 31, offered autumn quarter only, provides a one-quarter freshman-level chemistry option that emphasizes topics and approaches that are of interest to engineers. The course will provide preparation in chemistry that is equivalent in rigor and scope to Chemistry 31 A&B, or Chemistry 31X. The applications of chemistry in materials technology will be discussed, including: relationships among the optical properties and electronic structures of molecules and solids; thermodynamics governing the reduction of oxide ores to produce high purity metals; kinetics of the chemical vapor deposition of silicon; the analogy between the pH of an aqueous solution and the Fermi Energy of electrons in a solid.

The chemistry placement exam is required for students who are interested in taking Chemistry 31X in autumn quarter 2009 but who do not have a 5 on the AP exam. Students with a limited background in chemistry should sign up for Chemistry 31A, autumn quarter, and may continue with 31B during winter quarter (there is no need for this latter group to take the placement exam). New students will take the test on Wednesday morning of Orientation week. Returning students have an opportunity to take the placement test on Sunday evening.

Chemistry 33 is the next course in the chemistry sequence after Chemistry 31A and 31B, Chemistry 31X, or ENGR 31. It is offered in winter and spring quarters. Students in Chemistry 31 A and B should plan to take Chemistry 33 in spring quarter. The laboratory course Chemistry 36 can be taken in the spring quarter with Chemistry 33 as a pre- or co-requisite. The laboratory course Chemistry 130 can be taken in the autumn quarter of a student's second year with Chemistry 36 as a pre-requisite and Chemistry 35 as a pre- or co-requisite.

Students with AP credit in chemistry forfeit this credit if they complete Chemistry 31X or Chemistry 31A and Chemistry 31B. Students who are planning to apply to medical school should be forewarned that not all medical schools accept AP credit. Therefore, it is recommended that pre-med students with a 5 on the Chemistry AP exam enroll in Chemistry 31X and not proceed directly to Chemistry 33. Questions concerning pre-med requirements should be directed to the Undergraduate Advising Programs office in Sweet Hall.

## SUMMING UP

Here is some general advice that comes from the collective experience of the SoE advisors:

- *Get to know your advisor.* Every entering student at Stanford is assigned an advisor, usually in a discipline in which the student has expressed an interest. Many advisors are faculty, while some others are members of the staff or recent graduates. All advisors certainly have a good general sense of Stanford and its resources. Even if your advisor doesn't know the answer to one of your questions, it is almost certain that the advisor knows where to find that answer. Your job is to make sure that you establish a good relationship with your advisor so that you can draw on that wealth of knowledge and experience.
- *Take a course that provides real engineering experience.* Too many students spend their entire first year taking nothing beyond mathematics, physics, and the required writing and humanities courses. Such schedules make it hard to feel the excitement that comes from the quintessentially engineering activity of making something work. There are many courses—particularly in the Freshman Seminar program—that will give you an opportunity to engage in problem solving within an engineering domain.
- *Maintain flexibility.* Each year, some of you arrive at Stanford absolutely convinced about your major and career plans; many more of you, however, will not be quite so certain by the end of your first year. Rather than commit early to a particular major or course of study, it makes sense to explore more broadly and to keep an open mind about the possibilities.
- *Get help when you need it.* As at most universities, many students who start out with an interest in engineering end up leaving the field after running into problems in their introductory courses. For some, this decision is presumably the right one. Almost all of you, however, have what it takes to succeed in engineering. The same talent and drive that got you into Stanford should enable you to pursue your passion for engineering and go out into the world with a solid foundation in your chosen discipline. But you might need a little help along the way. Make sure you get that assistance when you need it, and not when it seems too late.
- *Plan ahead for an Overseas Program.* With careful planning, many engineering students can fit study at one of Stanford's overseas centers into their academic plans. Talk to your advisor as early as freshman year about planning for one or more quarters abroad (see "Engineers and Overseas Studies" section in Chapter 8).
- *Plan ahead for Coterm Degrees.* In the School of Engineering, all graduate programs allow students to study for a master's degree while completing their bachelor's degree. Because admission requirements and optimal application times vary, students are encouraged to talk early to the department in which they are interested (as early as end of sophomore year) to understand options, deadlines, etc. See chapter on "Other Degree Programs" or the *Bulletin* for more information.
- Have a wonderful year, and a successful time at Stanford.

# 2. TYPES OF ENGINEERING MAJORS & ACCREDITATION

Undergraduate programs in engineering fall into two categories:

- Departmental Majors
- School of Engineering Majors

These categories are described in the sections that follow.

## DEPARTMENTAL MAJORS

A Departmental Major leads to the Bachelor of Science degree[1] in:

- Chemical Engineering
- Civil Engineering
- Computer Science
- Environmental Engineering
- Electrical Engineering
- Management Science and Engineering
- Materials Science and Engineering
- Mechanical Engineering.

Unlike undergraduate programs at Stanford outside of the School of Engineering, these majors share a common curricular structure and are subject to school-wide requirements:

- 36 units (minimum) to 45 units (maximum) of Mathematics and Science, **combined**. (Departments may place individual minimums for both Mathematics and Science.)
- 1 course in "Technology in Society" (3 units minimum)

[1] Although it has "Engineering" in its title, Petroleum Engineering is offered by the Department of Energy Resources Engineering rather than the School of Engineering. For details on Petroleum Engineering, please see the *Stanford Bulletin*.

- 3 courses in "Engineering Fundamentals," at least one of which is left up to the student to choose
- "Engineering Depth" coursework within the particular engineering department such that the total units for Engineering Fundamentals and Engineering Depth coursework is at least 60 and no more than 72 units.

The total number of quarter units required ranges from 100 to 119. The specific total will depend on a particular department's Mathematics, Science and Depth requirements. For all departmental majors other than Computer Science, Management Science and Engineering, and Materials Science and Engineering, these units must include 8 units of "Experimentation" coursework.

**Detailed program requirements for each of these Departmental Majors, and lists of courses that have been approved for each category of the requirements, appear in later sections of this Handbook.**

## SCHOOL OF ENGINEERING MAJORS

The School of Engineering offers the option of a Bachelor of Science in an Individually Designed Major in Engineering (described in the next section), and several interdisciplinary programs leading to the Bachelor of Science degree in Engineering. At present, there are nine such pre-approved sub-plans:

- Aeronautics and Astronautics
- Architectural Design
- Atmosphere/Energy
- Bioengineering
- Biomechanical Engineering
- Biomedical Computation
- Computer Systems Engineering
- Engineering Physics
- Product Design

Detailed program and declaration requirements for these pre-approved School of Engineering sub-plans appear in Chapter 5, along with the requirements for departmental majors.

# INDIVIDUALLY DESIGNED MAJORS

Individually Designed Majors in Engineering (IDMENs) are intended for undergraduates interested in studying engineering in areas not covered by departmental majors or the pre-approved School of Engineering sub-plans. Each IDMEN curriculum is designed by the student in consultation with at least two faculty advisors. Each student's primary academic advisor must be a member of the Stanford Academic Council, which means that Lecturers and Visiting Professors cannot fill this role. Students must also have a secondary advisor; this faculty member can be a member of a Stanford School other than Engineering and need not necessarily be a member of the Stanford Academic Council. The purpose of requiring a second advisor is to ensure that the student receives sufficient guidance about aspects of the proposed course of study that may lie outside the field of expertise of the primary advisor. The IDMEN degree is designated as a "Bachelor of Science in an Individually Designed Major in Engineering: *Approved Title*." This degree program is not accredited by ABET (see later section on Accreditation for more information).

To pursue an IDMEN, a student must submit a written proposal to the IDMEN Subcommittee of the Undergraduate Council detailing her or his proposed course of study; you may bring your proposal to 201 Terman. IDMEN programs must meet the general minimum requirements established for School of Engineering majors:

- 21 units of mathematics
- 17 units of science
- One course on Technology in Society
- 40 units of School of Engineering courses, at least three of which must be Engineering Fundamentals courses
- Additional courses to bring the total to at least 90 but not more than 107 units

Each proposal must contain the following four elements:

1. **Rationale.** The proposal should begin with a carefully crafted statement that describes the major, characterizes the proposer's motivation for pursuing it, justifies it intellectually, indicates the proposer's ultimate goal and how the major relates to it, shows how the courses comprising its curriculum make sense given its purpose, and tells why this plan of study cannot be pursued in any existing School of Engineering major. A proposed title for the major, the accepted version of which will be shown on the student's diploma and transcript, should be included. Sample proposals are available for review in the Office of Student Affairs, Terman 201.

2. **Individually Designed Major program sheet.** This form, available in this handbook (see the forms section) and accessible as an Excel spreadsheet on the web at `http://ughb.stanford.edu`, should be filled out completely including an indication of which course the student intends to take to fulfill the university's Writing in the Major (WIM) requirement. The bottom of the second page of the IDMEN program sheet must be signed by two faculty members: the student's primary advisor, who **must** be an Academic Council member of the School of Engineering faculty, and a secondary advisor. These signatures certify that the advisors endorse the major as described in the proposal and agree to serve as the student's permanent advisors.
3. **Four-year plan.** This form is also available in the "Forms" section of this handbook and on the web at `http://ughb.stanford.edu`. The courses listed as part of the plan should comprise a well-coordinated sequence that fosters mastery of the important principles and techniques in a well-defined field.
4. **Letter of support.** A letter of support from the student's primary advisor appraising the academic value and viability of the proposed major and the student's ability to successfully complete it must accompany the Proposal.

Students proposing to pursue an IDMEN must have at least four quarters of undergraduate work remaining at Stanford after the quarter in which their proposals are submitted. Any changes in a previously approved major must be endorsed by the faculty advisors and reapproved by the IDMEN Subcommittee of the Undergraduate Council. Proposals are reviewed and acted upon once per quarter by the IDMEN subcommittee. Proposals should be submitted to Darlene Lazar in the Office of Student Affairs, Terman 201. Deadlines for proposal submission this year are:

**Autumn Quarter: October 23, 2009**

**Winter Quarter: February 5, 2010**

**Spring Quarter: April 30, 2010**

Once the proposal has been accepted by the IDMEN subcommittee, the School of Engineering will notify the registrar to add the approved major to your information in Axess.

Further information and assistance in preparing proposals are available from the Office of Student Affairs, Terman 201. **Students are strongly encouraged to read "School of Engineering/Individually Designed Majors," a handout prepared by the Undergraduate Council for students interested in the IDMEN alternative. This handout is available from the Office of Student Affairs.**

# INSTRUCTIONS FOR DECLARING AN INDIVIDUALLY DESIGNED MAJOR

1. Investigate existing majors to determine whether your goals can be met by pursuing a pre-defined major. It is important to gather information about the majors and their options by talking to students and professors.
2. If you decide to pursue an individually designed major, talk to faculty members to get their advice. Identify two Stanford faculty members who can serve as advisors, and select one as your "primary" advisor.
    a. The primary advisory must be within the School of Engineering and must be a member of the Stanford Academic Council, which means that Lecturers and Visiting Professors cannot fill this role.
    b. The secondary advisor need not be a member of the Academic Council, and may be outside of the School of Engineering.
3. Work with your advisors to design a proposal (as described in the previous section of this handbook), including the following materials:
    a. A rationale statement describing the proposed major
    b. An Individually Designed Major program sheet
    c. A four-year plan listing the courses you intend to take
    d. A letter of support from your advisor
4. Submit the proposal package to Darlene Lazar in the SoE Student Affairs Office, Terman 201. See previous section for quarterly deadlines.
5. If and when your major is approved, the SoE Student Affairs Office will notify you. You must then go into Axess and declare IDMEN as your major plan. Once you have done this, email Darlene at **dlazar@stanford.edu** so that she can notify the Registrar's Office. They will add your approved major title in Axess.

# ACCREDITATION

The Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET), an organization formed by the major engineering professional societies, accredits university engineering programs on a nationwide basis. An accredited program of study is usually the first step toward a professional engineering license. Advanced study in engineering at a graduate school sometimes presupposes completion of an accredited undergraduate program.

The accredited engineering programs at Stanford are Chemical Engineering, Civil Engineering, Electrical Engineering, Environmental Engineering, and Mechanical Engineering, all at the Bachelor of Science level. Computer Science, Management Science and Engineering, and Materials Science and Engineering are not accredited programs by choice of the departments and the School; lack of ABET accreditation is no reflection on the quality of the department or program. Note that programs are accredited, not students or student programs. Program accreditation, however, is based, in part, on student records, which means that all students in these five programs must meet all accreditation criteria to graduate. Accreditation depends on whether a program meets a clearly defined set of objectives, which are in turn judged by whether students achieve a particular set of outcomes. The objectives and outcomes for each accredited program are included along with the description of that program.

The School of Engineering at Stanford has broken down the units assigned to each engineering course to show how much of that course falls into each of the following categories: engineering science, engineering design, and experimentation. The program sheets for the ABET-accredited programs include columns for these categories to ensure that all students have sufficient exposure to each of these cornerstones of engineering education.

In Accordance with ABET, the professional component must include:

- one year of a combination of college-level mathematics and basic sciences (some with experimental experience) appropriate to the discipline;
- one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study; and
- a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

# 3. COURSES APPROVED FOR SCHOOL OF ENGINEERING REQUIREMENTS

Nearly all engineering majors share similar requirements in Mathematics, Science, Technology in Society, and Engineering Fundamentals. The Undergraduate Council of the School of Engineering is responsible for establishing lists of courses certified as satisfying these requirements, which appear in the tables included in this section. Other appropriate courses—such as more advanced courses—may be used to satisfy these requirements, but their use must be approved by petition. Petition forms can be found in the "Forms" section of this handbook and are also on the Undergraduate Handbook website (`http://ughb.stanford.edu`). All petitions should be submitted to the Office of Student Affairs, Terman 201. **A student must obtain petition approval prior to enrolling in any course she or he wishes to use in satisfying one of these requirements.** Further information is available on pages 28-30 of this Handbook or in the Office of Student Affairs.

## THE MATHEMATICS REQUIREMENT

The mathematics requirements for departmental and School of Engineering majors are delineated by major in the detailed "Program Requirements" section in this Handbook. In general, each program requires a number of specific and elective courses from the list of approved courses shown in Figure 3-1 on the next page. All engineering students should check the "Program Requirements" pages for their major to see which mathematics courses are recommended or required.

**FIGURE 3-1. COURSES APPROVED FOR THE MATHEMATICS REQUIREMENT**

| Course | Title | Units |
|---|---|---|
| MATH 19, 20, 21 | Calculus of a Single Variable | 3, 3, 4 |
| MATH 41, 42 | Calculus of a Single Variable | 5, 5 |
| MATH 51, 52, 53 | Linear Algebra and Differential Calculus of Several Variables | 5, 5, 5 |
| MATH 51H, 52H, 53H | Honors Calculus | 5, 5, 5 |
| MATH 104 | Applied Matrix Theory | 3 |
| MATH 106 | Functions of a Complex Variable | 3 |
| MATH 109 | Applied Group Theory | 3 |
| MATH 113 | Linear Algebra and Matrix Theory | 3 |
| MATH 115 | Functions of a Real Variable | 3 |
| MATH 120, 121 | Modern Algebra I, II | 3, 3 |
| MATH 131P, 132 | Partial Differential Equations I, II | 3, 3 |
| or more advanced Mathematics courses. | | |
| STATS 60/160 | Introduction to Statistical Methods: Precalculus | 5 |
| STATS 110 | Statistical Methods in Engineering and the Physical Sciences | 4-5 |
| STATS 116 | Theory of Probability | 3-5 |
| or more advanced Statistics courses numbered over 100. | | |
| CEE 101D | Computations in CEE | 3 |
| CEE 203 | Probabilistic Models in Civil Engineering | 4 |
| CME 100 (same as E 154) | Vector Calculus for Engineers | 5 |
| CME 102 (same as E 155A) | Ordinary Differential Equations for Engineers | 5 |
| CME 104 (same as E 155B) | Linear Algebra and Partial Differential Equations for Engineers | 5 |
| CME 106 (same as E 155C) | Introduction to Probability and Statistics for Engineers | 3-4 |
| CME 108 | Introduction to Scientific Computing | 3-4 |
| EE 178 | Introduction to Probabilistic Systems Analysis | 3 |
| ENGR 62 (same as MS&E 111) | Introduction to Optimization | 4 |
| ENGR 154 (same as CME 100) | Vector Calculus for Engineers | 5 |
| ENGR 155A (same as CME 102) | Ordinary Differential Equations for Engineers | 5 |
| ENGR 155B (same as CME 104) | Linear Algebra and Partial Differential Equations for Engineers | 5 |
| ENGR 155C (same as CME 106) | Introduction to Probability and Statistics for Engineers | 3-4 |
| GES 160 | Introduction to Statistical Methods for Earth and Environmental Sciences | 3 |
| MS&E 120 | Probabilistic Analysis | 5 |
| MS&E 121 | Intro to Stochastic Modeling | 4 |

# THE SCIENCE REQUIREMENT

The science requirements for departmental and School of Engineering majors are delineated in the detailed "Program Requirements" section in Chapter 5. In general, each program requires a number of specific and elective courses from the list of approved courses shown in Figure 3-2. Individually Designed Majors must include at least 17 units from the list. All engineering students should check the "Program Requirements" pages for their major to see which science courses are recommended or required.

**FIGURE 3-2. COURSES APPROVED FOR THE SCIENCE REQUIREMENT**

| Course | Title | Expr. Units | Total Units |
|---|---|---|---|
| BIO 41 (A) | Genetics, Biochemistry, and Molecular Biology | – | 5 |
| BIO 42 (W) | Cell Biology and Animal Physiology | – | 5 |
| BIO 43 (S) | Plant Biology, Evolution, and Ecology. | – | 5 |
| CEE 63 (A) | Weather and Storms | – | 3 |
| CEE 64 (W) | Air Pollution: From Urban Smog to Global Change | – | 3 |
| CEE 70 (S) | Environmental Science and Technology | - | 3 |
| CHEM 31A, B (A,Sum;W,Sum) | Chemical Principles I, II | – | 4, 4 |
| CHEM 31X (A) | Chemical Principles | – | 4 |
| CHEM 33 (W,S,Sum) | Structure and Reactivity | – | 4 |
| CHEM 35 (A,S) | Organic Monofunctional Compounds | – | 4 |
| CHEM 36(A,S,Sum) | Organic Chemistry Lab I | 2 | 3 |
| CHEM 131(A,W) | Organic Poly Compounds | - | 3 |
| CHEM 135 (A) | Physical Chemical Principles | – | 3 |
| EARTHSYS 10 (A) | Introduction to Earth Systems | 1 | 4 |
| ENGR 31 (A) | Chemical Principles with Application to Nanoscale Science | – | 4 |
| GES 1A (A) * | Introduction to Geology: The Physical Science of the Earth | 1 | 5 |
| GES 1B (W)* | Introduction to Geology: California Desert Field Geology | 1 | 4 |
| GES 1C (S) * | Introduction to Geology: Dynamic Earth | 1 | 4 |
| PHYSICS 21,23,25 (A,W,S) | Basic Physics (allowed for AD, CS and MS&E majors | – | 3,3,3 |
| PHYSICS 41 (W) | Mechanics | – | 4 |
| PHYSICS 43 (S) | Electricity, Magnetism | – | 4 |
| PHYSICS 45 (A) | Light and Heat | – | 4 |
| PHYSICS 44, 46 (S,A) | Physics Labs | 1,1 | 1,1 |
| PHYSICS 61–65 (A,W,S) | Advanced Freshman Physics and labs | 3 | 15 |

** A maximum of 5 units of coursework from these courses may be counted toward the Science Requirement.*

# THE TECHNOLOGY IN SOCIETY REQUIREMENT

It is important for the student to obtain a broad understanding of engineering as a social activity. To foster this aspect of intellectual and professional development, all engineering majors must take one course devoted to exploring issues arising from the interplay of engineering, technology,

and society. Individual courses approved for the Technology in Society Requirement are listed in Figure 3-3. Note that some of the approved courses are limited-enrollment offerings, which means that you need to take this into account when creating your course schedule. Petitions to use other courses to fulfill the Technology in Society Requirement will be considered strictly on their merits and will not be approved simply because the student has left the fulfillment of this requirement until her or his last quarter at Stanford.

**FIGURE 3-3. COURSES APPROVED FOR THE TECHNOLOGY IN SOCIETY REQUIREMENT**
Note: CE, EnvE, ME, and MS&E majors must choose from among the courses marked "X" in the appropriate columns. Students in other engineering majors may choose from any of the following courses, although only BMC majors may use HUMBIO 174.

| Course | Title | Qtr | Units | CEE | ME | MS&E |
|---|---|---|---|---|---|---|
| STS 101/201 (ENGR 130) | Science, Technology, and Contemporary Society | A | 4-5 | X | X | X |
| STS 101Q (Soph Sem) | Technology in Contemporary Society | A | 4 | | | |
| STS 110 (MS&E 197) | Ethics and Public Policy | W | 5 | X | X | X |
| STS 112 | Ten Things: An Archaeology of Design | W | 3-5 | | | |
| STS 180 | Imagining the Computer, Wiring the World | S | 4 | | | |
| COMM 120 | Digital Media in Society | S | 5 | | | |
| COMM 169 | Computers and Interfaces: Psychological and Social Issues | W | 5 | X | | X |
| CS 181 | Computers, Ethics and Public Policy | S | 3-4 | X | X | X |
| ENGR 145 | Intro to High-Technology Entrepreneurship | A,W | 4 | | | |
| HUMBIO 174 | Foundations of Bioethics (for BMC Majors only) | W | 3 | -- | -- | -- |
| MS&E 181 | Issues of Technology and Work in a Post-Industrial Economy | A | 3 | X | | X |
| MS&E 193 | Technology in National Security | A | 3 | | | X |
| PUBPOL 194 | Technology Policy | W | 5 | | | |

In addition to the courses shown in Figure 3-3, students can also fulfill the Technology in Society Requirement by taking part in the Stanford Center for Technology and Innovation (SCTI) program, which is offered by Overseas Studies at the Kyoto campus. NOTE: This option is not open to CE, EnvE, or ME majors, who must who must satisfy their TIS by taking one of the courses indicated in the designated CEE or ME columns above.

# THE ENGINEERING FUNDAMENTALS REQUIREMENT

The Engineering Fundamentals requirement is satisfied by a set of technically rigorous introductory courses chosen from the various engineering disciplines, as shown in Figure 3-4. These courses serve several purposes. First, they provide a breadth of knowledge about some of the major fields within engineering. Second, they furnish students with an opportunity to explore a number of engineering topics before embarking on a specific engineering major. Third, the individual classes each offer a reasonably deep insight into a contemporary technological subject for the interested non-engineer.

**FIGURE 3-4. COURSES APPROVED FOR THE ENGINEERING FUNDAMENTALS REQUIREMENT**

| Course | Title | Qtr | Engr Science | Engr. Design | Expr. Units | Total Units |
|---|---|---|---|---|---|---|
| ENGR 10 | Introduction to Engineering Analysis | Sum | 4 | – | – | 4 |
| ENGR 14 | Applied Mechanics: Statics | A, S | 2 | 1 | - | 3 |
| ENGR 15 | Dynamics | A, S | 2 | 1 | – | 3 |
| ENGR 20/CHEME 20 | Introduction to Chemical Engineering | S | 2 | 1 | – | 3 |
| ENGR 25/CHEME 25 | Biotechnology | S | 2 | 1 | – | 3 |
| ENGR 30 | Engineering Thermodynamics | A, W | 3 | – | – | 3 |
| ENGR 40 | Introductory Electronics | A, S | 3 | 2 | 2 | 5 |
| ENGR 50* | Intro to Materials Science, Nanotechnology Emphasis | W, S | 4 | – | – | 4 |
| ENGR 50M* | Intro to Materials Science, Biomaterials Emphasis | A | 4 | – | – | 4 |
| ENGR 60 | Engineering Economy | A, W | 3 | – | – | 3 |
| ENGR 62/MS&E 111 | Introduction to Optimization | A, S | 4 | – | – | 4 |
| ENGR 70A/CS 106A** | Programming Methodology | A, W, S, Sum | 3 | 2 | – | |
| ENGR 70B/CS 106B<br>*or*<br>ENGR 70X/CS 106X ** | Programming Abstractions<br>Programming Abstractions (Accelerated) | A,W, S, Sum<br>A | 3<br>3 | 2<br>2 | –<br>– | 5<br>5 |
| ENGR 80 | Introduction to Bioengineering | S | | | | 3 |

Note:

* Only one of the ENGR 50 courses may be applied toward the Engineering Fundamentals requirement.

** Only one of the ENGR 70/CS 106 courses may be counted toward the Engineering Fundamentals requirement. Refer to your department's major requirements in Chapter 5.

Engineering majors must complete a minimum of three Engineering Fundamentals courses, at least one of which is left up to the student to choose.

# THE EXPERIMENTATION REQUIREMENT

The departmental majors in Chemical, Civil, Electrical, Environmental, and Mechanical Engineering require 8 units of Experimentation, which is normally included within the units taken for Science, Engineering Fundamentals, and Engineering Depth. Thus, with careful planning of the courses taken in those portions of the curriculum, the Experimentation requirement should not involve additional coursework.

The experimentation content of undergraduate engineering and science courses is shown, in units, in Figure 3-5 on the following page. Students may also petition to receive experimentation units for work performed in other courses (including individual research projects) or even for appropriate summer work, with the approval of their Academic Advisor.

**FIGURE 3-5. COURSES APPROVED FOR THE EXPERIMENTATION REQUIREMENT**

| Course | Title | Expr. Units |
|---|---|---|
| BIOSCI 44 | Core Experimental Laboratory | 3 |
| CEE 100 | Managing Sustainable Building Projects | 1 |
| CEE 101A | Mechanics of Materials | 1 |
| CEE 101C | Geotechnical Engineering | 1 |
| CEE 110 | Building Information Modeling | 1 |
| CEE 111 | Multidisciplinary Modeling & Analysis | 1 |
| CEE 147 | Cases in Personality, Leadership, and Negotiation | 1 |
| CEE 160 | Mechanics of Fluids Laboratory | 2 |
| CEE 161A | Rivers, Streams, and Canals (for 4 units) | 1 |
| CEE 176A,B | Energy Efficient Buildings, Electric Power: Renewables and Efficiency | 1, 1 |
| CEE 178 | Intro to Human Exposure Analysis | 1 |
| CEE 179A | Water Chemistry Lab | 3 |
| CEE 182 | Design of Reinforced Concrete Structures | 1 |
| CEE 195A,B | Structural Geology | 1 |
| CHEM 36 | Chemical Separations | 2 |
| CHEM 130 | Organic Chemistry Lab II | 4 |
| CHEM 131 | Organic Polyfunctional Compounds | 1 |
| CHEMENG 185A | Chemical Engineering Laboratory – A | 4 |
| CHEMENG 185B | Chemical Engineering Laboratory – B | 4 |
| CS 48N | The Science of Art | 3 |
| EE 41 | Physics of Electrical Engineering | 2 |
| EE 101A,B | Circuits | 1, 1 |
| EE 102A,B | Signal Processing and Linear Systems | 1, 1 |
| EE 108A,B | Digital Systems | 1, 1 |
| EE 109 | Digital Systems Design Laboratory | 4 |
| EE 122 | Analog Circuits Laboratory | 3 |
| EE 133 | Analog Communications Design Laboratory | 2 |
| EE 134 | Introduction to Photonics | 3 |
| EE 144 | Wireless Electromagnetic Design Laboratory | 1.5 |
| EE 265 | Digital Signal Processing Lab | 3 |
| ENGR 40 | Introductory Electronics | 2 |
| GES 1A | Introduction to Geology: The Physical Science of the Earth | 1 |
| GES 1B | Introduction to Geology: California Desert Field Geology | 1 |
| GES 1C | Introduction to Geology: Dynamic Earth | 1 |
| MATSCI 161,162,163 | Experimental Methods in Materials Science | 4, 4, 4 |
| ME 70 | Introductory Fluids Engineering | 1 |
| ME 80 | Strength of Materials | 1 |
| ME 131A | Heat Transfer | 2 |
| ME 131B | Fluid Mechanics | 1 |
| ME 140 | Advanced Thermal Systems | 2 |
| ME 210 | Introduction to Mechatronics | 3 |
| ME 220 | Introduction to Sensors | 1 |
| ME 227 | Vehicle Dynamics | 1 |
| ME 281 | Biomechanics of Movement | 1.5 |
| ME 203 | Manufacturing and Design | 1 |
| MS&E 180 | Organizations: Theory and Management | 1 |
| MS&E 265 | Supply Chain Logistics | 2 |
| MS&E 277 | Creativity and Innovation | 1 |
| PHYSICS 46 | Light & Heats Lab | 1 |

# THE ENGINEERING SCIENCE AND ENGINEERING DESIGN REQUIREMENT

In order to satisfy ABET (Accreditation Board for Engineering and Technology) requirements, a student majoring in Chemical, Civil, Electrical, Environmental, or Mechanical Engineering must complete one and a half years of Engineering Science and Engineering Design, also called engineering topics, in order to graduate. This requires a minimum of 68 units of Engineering Science and Design appropriate to the student's field of study. In most cases, students meet this requirement by completing the major program core and elective requirements in Fundamentals and Depth. For example, ENGR 40 is a 5-unit course; 3 of these 5 units are assigned to Engineering Science and the remaining 2 units are assigned to Engineering Design. A student may need to take additional courses in Depth in order to fulfill the minimum requirement.

The engineering science and design units assigned to each major's depth courses are listed in tables within the applicable major program descriptions in Chapter 5 and online at **`http://ughb.stanford.edu`**. See Chapter 2 on *Accreditation* for more information.

# 4. POLICIES AND PROCEDURES

## POLICY ON ACADEMIC PERFORMANCE

The Undergraduate Council of the School of Engineering has established the following standards of academic performance for all engineering majors.

### Credit/No Credit Option

All courses taken in fulfillment of the requirements for an engineering major **must be taken for a letter grade** if the instructor offers that option.

### Grade Point Average

Engineering majors must achieve a Grade Point Average (GPA) of at least 2.00 for all courses taken in fulfillment of the Engineering Fundamentals and Engineering Depth requirements. A student's GPA is a weighted average of numerical grade points. The calculation is based on a 4-point system, with + and – modifiers counting as 1/3 of a grade point (e.g., a C+ is counted as 2.33). The grade for each course taken to satisfy the Engineering Fundamentals and Engineering Depth requirements is weighted by the unit value of the course and an average is then obtained. Thus, courses in which a grade higher than a C is earned offset courses in which less than a C is earned. Details of the University GPA calculation can be found at **http://www.stanford.edu/dept/registrar/academic/grades.html#GPA.** The GPA calculation does not include courses taken to satisfy the Math, Science, or Technology in Society requirements.

## DEVIATION PETITIONS AND SUBSTITUTIONS

Students have the right to petition for deviations from curricular requirements. If the action requested involves a requirement imposed by the University itself, such as the General Education or Foreign Language Requirements, the petition process is handled through the Student Services Center, located in the 2nd floor of Tresidder Union or online at **studentservicescenter.stanford.edu**.

Departmental Depth: If the petition involves a Departmental Depth requirement, the major department handles the request. Each department has its own procedures, and the student is advised to consult with his or her student services staff within the major department for guidance (see the list of room numbers on the inside front cover of this Handbook), and then with the advisor. **A deviation from an Engineering Depth requirement must be initialed and dated in ink by the advisor on the student's final Program Sheet that is submitted before graduation.**

Math, Science, Technology in Society, or Engineering Fundamentals: If the action requested involves one of the School of Engineering requirements, the student must submit a Program Deviation petition to the Office of Student Affairs in Terman 201. The petition must be submitted on the School's official petition form, a copy of which is in the "Forms" section of this Handbook, and which may also be downloaded from the UGHB website at **`http://ughb.stanford.edu`**. **The petition must be signed by your departmental student services contact and advisor, and accompanied by an up-to-date copy of your Program Sheet, preferably the one on file with your department**. Completed SoE petitions should be submitted to Darlene Lazar in the Office of Student Affairs, Terman 201.

Be sure to submit your petition to alter graduation requirements, to transfer credit, or for course substitutions at least two quarters prior to your expected date of graduation. For example, all petitions should be filed by end of fall quarter 2008 if you plan to graduate in June 2009. This will allow you time to make arrangements to take the original course or to petition for another course if your petition is denied.

## TRANSFER CREDIT

Many students elect to take some of their coursework at another institution. In addition, each year a small number of engineering students enter Stanford after completing one or two years at another institution. In either case, these transfer credits are subject to the guidelines below.

**Step One: Registrar's Office**

All units of transfer credit that are to be applied toward the University graduation requirement of 180 units must be approved by the Registrar's Office. Students must petition the University for approval; go to **`http://www.stanford.edu/dept/registrar/students/academics/xfer_credit.htm`** for instructions. Transfer courses may satisfy general University requirements or School of Engineering requirements. Such credits require specific, case-by-case approval. Those credits that

meet general University requirements will be so noted in a letter from the Registrar's Office to the student when the units are transferred to Stanford. Only courses graded "C" or above are transferable. To receive credit for courses used for your engineering major, go to Step Two after completing Step One.

**Step Two: Petition to SoE Dean's Office (SoE Requirements) OR to Department (Depth)**
Transfer credits that you want to use to meet engineering requirements must have School of Engineering approval prior to your final quarter. University approval is necessary, but not sufficient. You must petition to transfer credit(s) in the areas of:

- **Math**, **Science**, **Technology in Society** and **Engineering Fundamentals (SoE requirements)**

  These courses require approval by the SoE Dean's Office. Submit your petition and accompanying documents (see list below) in 201 Terman.

- **Depth**

  Depth coursework requires approval by your major or departmental advisor. Departments have considerable latitude in deciding whether to approve transfer requests. Departments may require that certain courses be taken at Stanford and may establish limits on the total number of transfer courses. For example, transfer students in Computer Science and Computer Systems Engineering may apply only three courses of transfer credit toward their depth requirements.

**Petition Forms and Documents**: To have transfer credits evaluated for use in your major, take the following forms and documents to either the Dean's office (SoE requirements) or the departmental advisor (depth courses):

- A completed Petition of Transfer Credit form, found in the "Forms" section of this handbook or on the web at **`http://ughb.stanford.edu`** (this Web form may be downloaded and filled out electronically). Indicate on the form which Stanford course or courses are considered equivalent; if the equivalence is uncertain, a faculty member from the field in question should be consulted. Include all courses, grades, and units taken for your major.
- Your current Program Sheet (the original on file with your major department, if you have already declared). The course you want to transfer should be listed on your Program Sheet by its equivalent Stanford course number, followed by its title, followed by the course number at the other school, followed by a check mark in the **Transfer** column.
- A catalog description of the course from the other institution.

- Unofficial copy of your SU transcript from Axess
- Request that the Student Services Center forward a copy of your transcript from the other institution to either your department or to the SoE Dean's office, depending on the course(s) being petitioned. The transcript must come to your department or the Dean's office from the SU Registrar's Office, not directly from the school where you took the course. This indicates to the SoE that the University has already accepted the credit, an essential first step in receiving credit for your major.

The results of your SoE petition will be emailed to you and the original petition documents mailed to your major department. The department will notify you of Depth petition results. Approval of transfer credits is indicated by the appropriate initials and date on your Program Sheet in the Transfer/AP Approval column.

While the Office of Student Affairs and the student's Major Advisor evaluate transfer credit requests on a case-by-case basis, the following general guidelines apply:

- Transfer courses should be substantially equivalent to those offered at Stanford.
- The number of units transferred for a given course is usually equal to the number of units taken at the other institution, adjusted for different unit values at the two schools. For example, a 3-unit course at a semester-based school will usually transfer as 4.5 units in Stanford's quarter system.

**Transfer Students:** All engineering transfer students should arrange to see the Senior Associate Dean for Student Affairs in Terman 201 during their first year at Stanford for an evaluation of transfer credits toward School of Engineering requirements.

## ADVANCED PLACEMENT CREDITS

Advanced Placement (AP) credits apply toward both the university 180-unit requirement and the School of Engineering requirements in Mathematics, Chemistry, Physics, and Computer Science (see approval process below). AP credits in mathematics are applied only if the parallel Stanford courses are skipped. Thus, a student cannot receive 10 units of AP mathematics credit and then enroll in MATH 41; to apply these AP units at Stanford, the first mathematics course taken must be beyond the MATH 40 series, typically MATH 51 or CME 100. AP credits in Chemistry and Physics are accepted as satisfying the School of Engineering Science requirement, though some departments prefer that you retake certain courses at Stanford (e.g., Environmental Engineering majors are encouraged to take CHEM 31X and forfeit their AP Chemistry credit). Note that AP Physics C counts toward the Physics 40 series, whereas AP Physics B applies only to the non-

calculus-based Physics 20 series. AP Biology credits are not accepted for students entering Stanford after 2003-04 and AP Statistics credits are not accepted for students entering after 2004-05. See the *Stanford Bulletin* for further details on AP policy.

To receive approval for math and science AP credits, take your Program Sheet and a copy of your unofficial SU transcript to 201 Terman. Approval of Advanced Placement is indicated by the appropriate initials and date on the Program Sheet (bring in your current PS on file in your major department, not a copy) in the **Transfer/AP Approval** column. The initials "AP" should be entered in the title column, followed by the number of units in the Total Units column.

## GRADUATION PROCEDURES

Four separate approvals are needed to certify completion of all requirements for conferral of the bachelor's degree:

| REQUIREMENT | | APPROVER |
|---|---|---|
| 1)* | Depth courses in your major program (usually, page 2 of your Program Sheet) | Go to major department Student Services for review of your PS. Most require an advisor and departmental signature; inquire well before final quarter course sign-ups so corrections to your program can be made, if needed.* |
| 2) | Writing, Language, GERs (completion of University requirements) | Information available on Axess, or consult with your advisor or the Student Services Center |
| 3) | School of Engineering/department requirements (Math, Science, TIS, Fundamentals) to complete major program | Your department will forward your major file to the Dean's office in 201 Terman for final approval of your Engineering program |
| 4) | Completion of University-required units and final approval for degree conferral | Stanford University Senate |

*Student must initiate this review and signature process early in their senior year.

Students nearing the completion of their degree programs must do the following to assure that they graduate on time:

1. School of Engineering Program Sheet—An up-to-date, completed, and recently signed program sheet form must be in the student's academic file at the beginning of the quarter prior to the quarter that he or she intends to graduate. Program sheets for each department are included in the detailed program descriptions later in this

Handbook, and are available electronically from the online version of the Handbook at **http://ughb.stanford.edu**. Students in most majors are required to obtain signatures from their advisor, student services contact, and in some cases, departmental chair, indicating that their major program is complete and approved. Review your final program sheet with your student services contact at least two quarters in advance of your final quarter in order to allow time to correct errors in your program and file any necessary petitions.

a) Any transfer courses used for SoE requirements or deviations from the major plan must be clearly indicated on the program sheet, with the appropriate approvals by the advisor or Dean's office in ink in the given spaces. (The transfer credit process is described in detail earlier in this section under the heading "Transfer Credit.")

b) Deviations from a previously approved program must be evaluated and re-approved by your department (your Student Services contact) AND by your advisor. Deviations in the Math, Science, Technology in Society, and Engineering Fundamental areas need to be petitioned for approval by the Dean's Office in 201 Terman after first obtaining departmental approval. Petition forms are available on the web at **http://ughb.stanford.edu**. Deviations in Engineering Depth need be approved only by the student's department and advisor. Approval of a deviation is indicated by the appropriate signature/initials and date in ink on the **final** Program Sheet. In other words, if the student's program has deviated in any way from what is on the signed Program Sheet, the change must be approved and the PS signed again prior to the student's filing to graduate.

c) The program sheet must list all courses taken for the major, including those in which the student is currently enrolled. The student should delete any courses not taken from the sample program given, and fill in grades and units for every course. Grades in courses taken the quarter of graduation will be added to the program sheet by the Dean's office staff as they become available at the end of Finals Week.

d) If you are a Co-term student, you must check your undergraduate transcript on Axess to ensure that any course needed for your UG major appears there.

2. At the appropriate time as listed in the University Calendar, an *Intent to Graduate* application should be filed through Axess.

3. Status for completion of the University's Writing, GER, and Foreign Language requirements should be verified through Axess. Completion of the Engineering Requirements will be verified by the SoE Dean's office in 201 Terman.

# 5. PROGRAM DESCRIPTIONS AND REQUIREMENTS FOR ENGINEERING MAJORS

Within the context of the broad, liberal-arts education that is the hallmark of all Stanford undergraduate programs, the School of Engineering strives to provide the scientific and technical education necessary for both a satisfying and productive engineering career and for a successful graduate school experience. The curricula of the School emphasize fundamental knowledge, tools, and skills, while allowing many opportunities for engineering students to take advantage of the excellent courses and programs offered by the other schools of the University. About 10 percent of all engineering majors choose to double-major, many study overseas for a quarter or more, and most are involved in extracurricular activities. While engineering curricula are among the most demanding at the University and require careful academic planning to take full advantage of the many opportunities at Stanford, we aim to strike a balance between the technical sophistication and the social and cultural breadth demanded of engineers in modern society.

Engineering courses, however, represent only a part of a liberal-arts education. To ensure that every engineer receives a well-rounded undergraduate experience, all students must meet the general requirements of the University in addition to the disciplinary requirements for a degree in engineering. These requirements are detailed in other University publications such as the *Stanford Bulletin* and *Approaching Stanford.*

## UNDERGRADUATE PROGRAM SHEETS

A student's undergraduate **Program Sheet** is an essential document for planning and for degree certification by the School of Engineering. In effect, it represents the student's "contract" with the School of Engineering, because completion of all courses listed on the sheet is a requirement for receiving the B.S. or B.A.S. degree with a major in the School. Each department has its own requirements regarding program sheets but, in general, a student is advised to complete a form as s/he prepares to declare her/his major or, in some cases, as they enter their senior year.

### CREATE A PROGRAM SHEET

**You will see examples of Program Sheets for each of the majors in the sections that follow.** These Program Sheets represent sample full or partial curricula for the majors, not a complete

program that must be followed exactly in all cases. Your personal Program Sheet is created by you: Go to **http://ughb.stanford.edu** and choose from a selection of departmental and blank Program Sheets; each major program has one or more on file. You may fill it out electronically or in hardcopy. Carefully review the notes and footnotes on the Program Sheet for directions on completing the form, and for details about major courses and alternatives. Remember that each course can only be listed under one category on the program sheet; that is, a course may not "double count" for more than one requirement. You may select a Program Sheet from any year in which you are enrolled at Stanford.

### SUBMIT A PROGRAM SHEET TO YOUR DEPARTMENT

A signed copy of your own Program Sheet generally must be submitted to the major department at the beginning of the quarter prior to the quarter in which you intend to graduate. *However, it is prudent to have a completed and approved Program Sheet on file with your department by the end of your junior year*, and some departments have special requirements: Electrical Engineering majors are required to submit their Program Sheet by the end of the quarter following their declaration; revisions are allowed up to the beginning of the final quarter before graduation.

### REVISING AN APPROVED PROGRAM SHEET

A program sheet that has been approved and signed by your advisor must be resubmitted for approval if you change your program. That is, any deviation from required courses or transfer of credit from another institution must be petitioned using your current program sheet, which you should then have re-approved/re-signed by your advisor and department. The final program sheet you will use to graduate must have all changes initialed and dated in ink by your advisor, and must be reviewed and signed by your department, etc. See Chapter 4 for details on petitions. Petitions to alter graduation requirements, for transfer credit evaluation, or for course substitutions should be submitted as early as possible and always at least one quarter before your final quarter as an undergraduate student.

### FULFILLING REQUIREMENTS FOR ACCREDITED PROGRAMS

The Program Sheet provides a convenient way to assess a program with respect to accreditation requirements, which are not the same as the School's curricular requirements. In order to satisfy Accreditation Board for Engineering and Technology (ABET) requirements, a student majoring in Chemical , Civil, Electrical, Environmental, or Mechanical Engineering must complete one and a half years (minimum of 68 units) of Engineering Science and Engineering Design appropriate to the student's field of study. Engineering Science and Design units are not the same as total units;

see program sheet forms and major descriptions for details. A minimum 8 units of Experimentation units are also required for ABET-accredited programs.

## DECLARING AN ENGINEERING MAJOR

Stanford has a long-standing policy that any student may declare any major. Hence, there are no separate "entrance" requirements for the School of Engineering. Students at Stanford also have considerable time to weigh their choice of major, and it is useful to take a variety of courses in engineering before settling on a particular major. The majors offered by the School of Engineering are demanding, but also extremely rewarding.

Students at Stanford must declare a major by the time they achieve junior status (85 completed units). Prospective Engineering majors should review their departmental program section for any major-specific declaration procedures. As the final step, students will formally declare their major in Axess. The link for Declaring a Major/Minor is under the Academics tab.

- Departmental majors (ChemE, CEE, CS, EE, MS&E, MatSci, ME) should select a Department Plan. Check your major program section in Chapter 5 for detailed instructions.
- Engineering majors (Aeronautics and Astronautics, Architectural Design, Atmosphere/Energy, Bioengineering, Biomechanical Engineering, Biomedical Computation, Computer Systems Engineering, Engineering Physics, and Product Design) should select "Engineering" as their plan and then the appropriate Subplan. Check your major program section in Chapter 5 for detailed instructions.
- Individually Designed Majors should select the IDMEN Plan (see Chapter 2 for detailed instructions).

You must satisfy department or program declaration requirements before you are officially declared in a major; see instructions for each major in the appropriate section of Chapter 5. Your academic record will not be changed until you have satisfied all requirements. When the department certifies in Axess that you have met its declaration requirements, an e-mail message will be sent to notify you that your academic record has been updated.

# MAJOR PROGRAMS AND THEIR REQUIREMENTS

In the following sections you will find detailed descriptions of the programs in:

- **Chemical Engineering**
- **Civil Engineering**
- **Computer Science**
- **Electrical Engineering**
- **Engineering**
  - **Aeronautics and Astronautics**
  - **Architectural Design**
  - **Atmosphere/Energy**
  - **Bioengineering**
  - **Biomechanical Engineering**
  - **Biomedical Computation**
  - **Computer Systems Engineering**
  - **Engineering Physics**
  - **Product Design**
- **Environmental Engineering**
- **Individually Designed Major in Engineering (described in Chapter 2)**
- **Management Science and Engineering**
- **Materials Science and Engineering**
- **Mechanical Engineering**

# AERONAUTICS AND ASTRONAUTICS

The principal purpose of the undergraduate interdisciplinary major in Aeronautics and Astronautics is to prepare students who are strongly interested in aerospace for subsequent graduate study in the field. In particular, it is expected that students completing this undergraduate curriculum can then satisfy the requirements for the degree of Master of Science in Aeronautics and Astronautics at Stanford University in one additional academic year or, alternatively, complete the B.S. in General Engineering and the M.S. in Aeronautics and Astronautics as a co-terminal program in five years.

Another objective of the program is to provide an opportunity for interested undergraduates to become acquainted with the challenges of the aerospace field, with aeronautical and astronautical principles, and with the faculty who teach and do research in aeronautics and astronautics.

Students interested in aerospace are also encouraged to consider the undergraduate minor in Aeronautics and Astronautics, which is described in the "Minors and Honors" section of this Handbook.

The departmental requirements of this major include a core set of courses required of every Aeronautics and Astronautics major; a set of depth areas from which two areas (four courses) must be chosen; and an engineering elective. Students are expected to consult closely with an advisor about how best to satisfy these and all other requirements of the major, to submit a program planning sheet when declaring the major, and to have a final plan (program sheet) approved by the advisor and department at least one quarter prior to graduation.

## REQUIREMENTS

**Mathematics: 24 units (Fr, So, Jr)**

Mathematics through ordinary differential equations is a prerequisite to depth courses. Some statistics is desirable. For a list of acceptable courses, see the Mathematics Requirement section of this handbook. Required: Ordinary Differential Equations, satisfied by MATH 53 or CME 102 (same as ENGR 155A).

### Science: 18 units (Fr, So)

For a list of courses approved by the School, see the Science Requirement section of this handbook. Aero/Astro depth courses rely on a strong foundation in classical physics, particularly mechanics. Chemistry is needed for students without high school chemistry and is recommended for others. Required: Physics 41 and 43, plus one more advanced physics course.

### Technology in Society: One course

See Chapter 3, Figure 3-3 for a list of courses that fulfill the Technology in Society requirement.

**ENGINEERING FUNDAMENTALS:**
**Three courses minimum, at least one of which is left up to the student to choose.**

| Course | Title | Units |
|---|---|---|
| ENGR 30 | Engineering Thermodynamics (req'd) | 3 |
| CS106A | Programming Methodology (recommended) | 3-5 |
| | Fundamentals Elective | |

**DEPARTMENTAL REQUIREMENTS: 39 UNITS**

| Course | Title | Units |
|---|---|---|
| AA 100 | Introduction to Aeronautics & Astronautics | 3 |
| ME 70 | Introductory Fluids Engineering | 4 |
| ME 131A | Heat Transfer | 3-4 |
| ENGR 15 | Dynamics | 3 |
| ME 161 *or*<br>PHYS 110 | Dynamic Systems<br>Intermediate Mechanics | 3-4<br>4 |
| CEE 101A *or*<br>ME 80 | Mechanics of Materials<br>Strength of Materials | 4<br>3 |
| AA 190 | * Directed Research & Writing in Aero/Astro | 3 |
| Depth Area I | two courses from a department Depth Area (see Depth Area lists below) | 6 |
| Depth Area II | two courses from a second Depth Area | 6 |
| One engineering elective | | 3 |

* Students should discuss their AA190 (WIM) topic with their advisor & the Student Services Manager during their junior year.

### Depth Areas

Students should select four courses from the list on the next page, two from each of two areas. One additional engineering elective (at least 3 units) should also be selected: this may be an additional course from any of the depth areas below, another course in Aeronautics and Astronautics, or an appropriate elective from another Engineering department. In any case, the choice of depth areas and engineering elective should be determined in consultation with the Aeronautics and Astronautics major advisor.

**DEPTH AREA: FOUR COURSES, TWO FROM EACH OF TWO AREAS**

| Course | Title | Units |
|---|---|---|
| **Dynamics and Controls** | | |
| ENGR 105 | Feedback Control Design | 3 |
| ENGR 205 | Intro to Control Design Techniques | 3 |
| AA 242A | Classical Dynamics | 3 |
| AA 271A | Dynamics and Control of Spacecraft and Aircraft | 3 |
| AA 279 | Spacecraft Mechanics | 3 |
| **Systems Design** | | |
| AA 236A,B | Spacecraft Design, Spacecraft Design Laboratory | 3-5, 3 |
| AA 241A,B | Introduction to Aircraft Design, Synthesis, and Analysis | 3, 3 |
| **Fluids and CFD** | | |
| AA 200A | Applied Aerodynamics | 3 |
| AA 210A | Fundamentals of Compressible Flow | 3 |
| AA 214A | Numerical Methods in Fluid Mechanics | 3 |
| AA 283 | Aircraft & Rocket Propulsion | 3 |
| ME 131B | Fluid Mechanics: Compressible Flow and Turbomachinery | 4 |
| **Structures** | | |
| AA 240A | Analysis of Structures I | 3 |
| AA 240B | Analysis of Structures II | 3 |
| AA 256 | Mechanics of Composites | 3 |

*It is recommended that students review prerequisites for all courses.

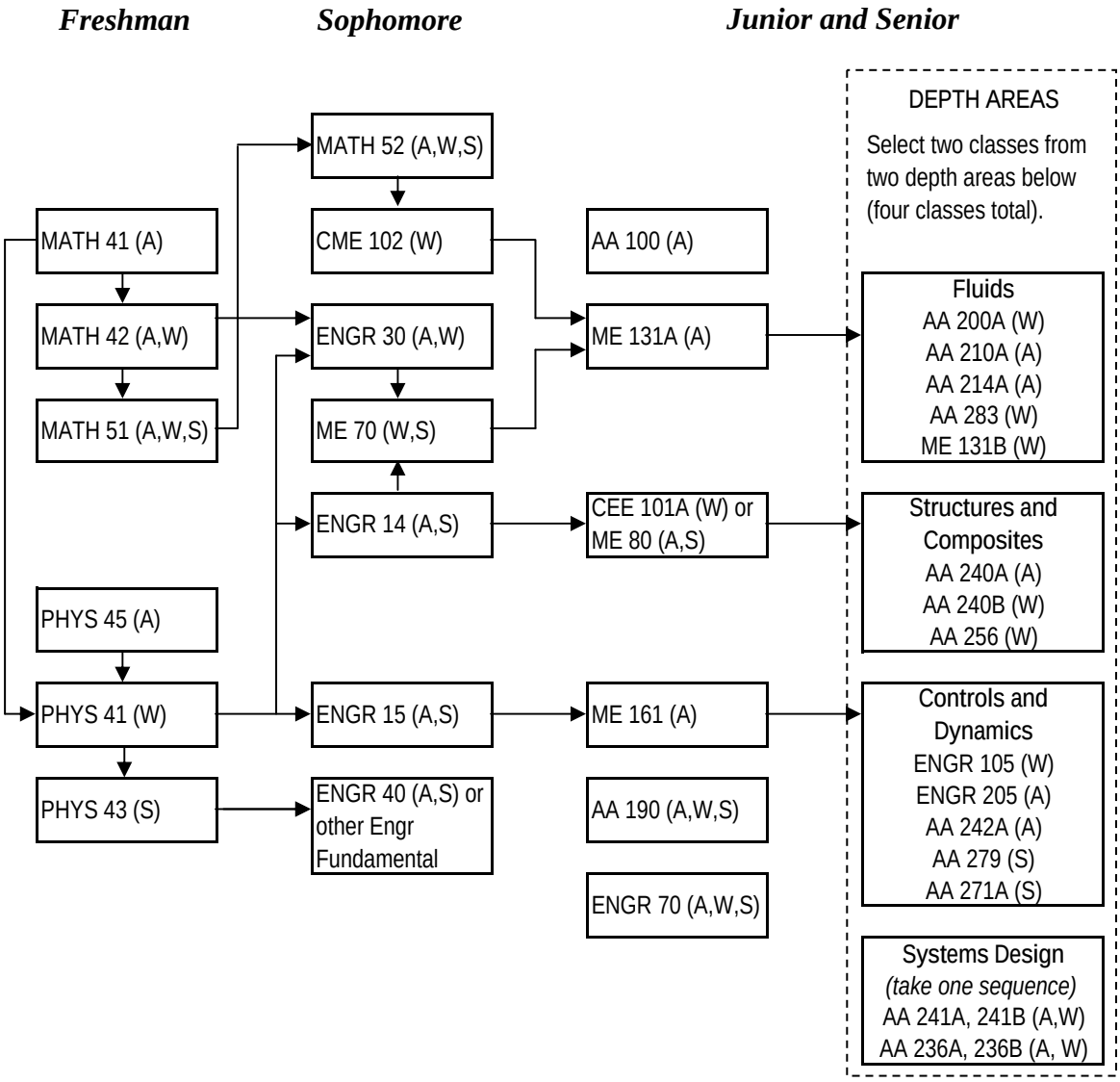
## Free Electives

To bring total units to the 180 required for graduation.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook went was published in August 2009, download the online AA program sheet from **`ughb.stanford.edu`** to ensure you are using an accurate major plan.

# Aeronautics and Astronautics

*Typical Sequence of Courses*




* Plus one engineering elective and additional free electives to bring the total to 180 units.

# Aeronautical and Astronautical Engineering

*Sample Program with Math 40 Series**

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci | Engr | Other | Class | Math/ Sci | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | IHUM | | | 4 | IHUM | | | 4 | IHUM | | | 4 |
| | Writing | - | - | 4 | Writing | - | - | 3 | MATH 51 | 5 | - | - |
| | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | PHYSICS 43 | 4 | - | - |
| | PHYSICS 45 | 4 | - | - | PHYSICS 41 | 4 | - | - | | - | - | - |
| | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *0* | *4* |
| | Total | | | 17 | Total | | | 16 | Total | | | 13 |
| *Sophomore* | AA100 | - | 3 | - | ME70 | - | 4 | - | ENGR 15 | - | 3 | - |
| | ME80 | - | 3 | - | CME 102 | 5 | - | - | Sci. Elective | 3 | - | - |
| | MATH 52 | 5 | - | - | ENGR 30 | - | 3 | - | ENGR 40 | - | 5 | - |
| | Writing | - | - | 4 | Elective | - | - | 3 | GER | - | - | 4 |
| | *Subtotals* | *5* | *6* | *4* | *Subtotals* | *5* | *7* | *3* | *Subtotals* | *3* | *8* | *4* |
| | Total | | | 15 | Total | | | 15 | Total | | | 15 |
| *Junior* | ME 131A | - | 4 | - | ENGR 70A | - | 5 | - | Elective | - | - | 3 |
| | ME 161 | - | 4 | - | Language | - | - | 5 | Language | - | - | 5 |
| | Language | - | - | 5 | GER | - | - | 4 | GER | - | - | 4 |
| | Sci. Elective | 3 | - | - | Depth course | - | 3 | - | Depth Course | - | 3 | - |
| | *Subtotals* | *3* | *8* | *5* | *Subtotals* | *0* | *8* | *9* | *Subtotals* | *0* | *3* | *12* |
| | Total | | | 16 | Total | | | 17 | Total | | | 15 |
| *Senior* | Elective | - | 3 | - | AA 190 | - | 3 | - | Elective | - | - | 3 |
| | Depth Course | - | 3 | - | Depth Course | - | 3 | - | Elective | - | - | 3 |
| | TIS course | - | - | 5 | GER | - | - | 5 | Elective | - | - | 3 |
| | GER | - | - | 5 | GER | - | - | 4 | GER | - | - | 5 |
| | *Subtotals* | *0* | *6* | *10* | *Subtotals* | *0* | *6* | *9* | *Subtotals* | *0* | *0* | *14* |
| | Total | | | 16 | Total | | | 15 | Total | | | 14 |

| | |
|---|---|
| Total Math & Science Units: | 43 |
| Total Engineering Units: | 52 |
| Total Other Units: | 89 |
| **Total Units:** | 184 |

*Notes:*

*AP Math may be used for Math 41 & 42; see *Stanford Bulletin* for placement

AA190 fulfills the Writing in the Major requirement.

Students who test out of the language requirement should replace language units with technical electives.

CME 100, 102, 104 are also listed as ENGR 154, 155A, and 155B.

# INSTRUCTIONS FOR DECLARING MAJOR IN ENGINEERING: AERONAUTICS & ASTRONAUTICS

1. Print your Stanford unofficial transcript from Axess.
2. Download the AA Program Sheet from the School of Engineering web site. Complete the Program Sheet indicating how you plan to fulfill the major requirements – or do this when you meet with your advisor. Your program proposal may change as you progress in the program: submit revisions in consultation with your advisor. Submit a final Program Sheet at least two quarters before you graduate.
3. Complete the form below and take it, along with your transcript and Program Sheet, to the Aero/Astro Student Services Manager (Durand Building, room 117) for an academic advisor assignment.
4. Make an appointment with your advisor to discuss your program. Have your advisor sign the Program Sheet and the declaration form.
5. Return the signed forms to the Aero/Astro Student Services Manager.
6. Declare the Aero/Astro major on Axess!

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**MAJOR DECLARATION**
**BS ENGINEERING: AERONAUTICS AND ASTRONAUTICS**

Student Information (please print)

Date _____

Name (last) _____(first)_____

Student ID _____

Email _____**@stanford.edu**

For Office Use

Advisor Professor _____

Office _____

Advisor's Signature _____ Date _____

Student Services _____ Date _____

**Stanford University ♦ School of Engineering**

# Aeronautics and Astronautics
# 2009–2010 Program Sheet

**Final version of completed and signed program due to the department no later than one month prior to the last quarter of senior year.**

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (24 units minimum; must include differential equations, eg CME 102 or Math 53)* | | | | | | | |
| CME *or* | 102 | Ordinary Differential Eq for Engineers *or* | | | | 5 | |
| Math | 53 | Ordinary Differential Eq w/ Linear Algebra (req'd) | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *(24 units minimum)* | | |
| *Science (18 units minimum)* | | | | | | | |
| PHYS | 41 | Mechanics (req'd) | | | | 4 | |
| PHYS | 43 | Electricity and Magnetism (req'd) | | | | 4 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Science (18 units minimum)* | 8 | |
| | | | | | *Mathematics and Science (42 units minimum)* | | |

**Technology in Society Requirement** (1 course required; see note 1)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**NOTES**

- * This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.
- * Read all emails from the Office of Student Affairs; this is the School's only effective mehtod of communicating key information to ENGR majors.
- * All courses listed on this form must be taken for a letter grade if offered by the instructor.
- * Minimum Combined Grade Point Average for all courses in Engineering Topics (Engineering Fundamentals and Depth courses) is 2.0.
- * Transfer and AP credits in Math, Science, Funamentals, & TIS must be approved by the SoE Dean's office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.
- * All courses listed on this form must only be included under one category. Delete courses not taken.
- ( 1 ) For a list of approved TIS courses, see Figure 3-3 in the UGHB.

*program sheet continues on page 2*

# Aeronautics and Astronautics Program Sheet (continued)

**Engineering Fundamentals** *(3 courses required, at least one of which the student may choose)*

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| ENGR | 30 | Engineering Thermodynamics (req'd) | | | | 3 | |
| ENGR | 70A | Programming Methodology | | | | 5 | |
| | | Fundamentals Elective; see UGHB, Fig 3-4 for options | | | | | |
| | | | | | | | |

**Engineering Depth**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| AA | 100 | Intro to Aeronautics & Astronautics (req'd) | | | | 3 | |
| AA | 190 | Dir Rsch & Writing in AeroAstro (req'd) (WIM) | | | | 3 | |
| ME | 70 | Introductory Fluids Engineering (req'd) | | | | 4 | |
| ME | 131A | Heat Transfer (req'd) | | | | 4 | |
| ENGR | 15 | Dynamics (req'd) | | | | 3 | |
| ME 161 *or* PHYS 110 | | Dynamic Systems or Intermediate Mechanics (one req'd) | | | | 4 | |
| CEE 101A *or* ME 80 | | Mechanics of Materials or Strength of Materials (one req'd) | | | | 3 | |
| | | Engineering Elective | | | | | |
| | | Engineering Elective | | | | | |

*Depth Area I* [ ]Fluid [ ]Struc [ ]Dyn/Ctrl [ ] Dsgn *(check 1)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | depth course | | | | | |
| | | depth course | | | | | |

*Depth Area II* [ ]Fluid [ ]Struc [ ]Dyn/Ctrl [ ] Dsgn *(check 1)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | depth course | | | | | |
| | | depth course | | | | | |

*Engineering Depth Unit Totals (39 units minimum)* ____

**Program Totals**

*Mathematics and Science* *(42 units minimum)* ____

*Engineering Depth* *(39 units minimum)* ____

**Program Approvals**

*Advisor*

Printed Name: _____ Date: _____

Signature: _____

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (Signature not necessary for graduation)*

Printed Name: _____ Date: _____

Signature: _____

# ARCHITECTURAL DESIGN

The Architectural Design major seeks to integrate engineering and architecture in ways that blend innovative architectural design with cutting-edge engineering technologies. Combining hands-on architectural design studios with a wide variety of courses, students can choose from a broad mix of elective courses in energy conservation, sustainability, building systems, structures, as well as design foundation and fine arts courses.

In addition to preparing students for advanced studies in architecture and construction management, the program's strong math and science requirements prepare students well for graduate work in other fields, such as civil and environmental engineering, law, and business. The major provides a background for individuals wanting to explore a diversity of careers in architecture, engineering, construction, and structures.

This undergraduate major grants a degree of Bachelor of Science in Engineering with a specialization in Architectural Design. This engineering major is not an ABET-accredited engineering degree, nor is it designed to lead directly to professional licensure in architecture. In order to become a professional architect or engineer, additional graduate training is required.

The program's courses also benefit civil engineering majors who want to develop a "concentration" in architecture. In addition, for students majoring in related fields such as Urban Studies, Product Design, and Studio Arts, the course offerings in architecture and engineering can be used to fulfill the requirements for a minor in the Department of Civil and Environmental Engineering.

## REQUIREMENTS

A total of 100 units are required, distributed as follows.

**Mathematics and Science (36 units minimum),** *including*
Math 19, 20, 21 (or 41 & 42)
One course in Statistics required (see Chapter 3, Fig. 3-1 for list of approved courses)

Physics 21 or 41 (Mechanics) is required.

For other courses, choose from the School of Engineering approved list of math and science courses (listed in this handbook [Fig. 3-1] and online at http://ughb.stanford.edu), and the following lists of additional approved *or* recommended courses for the major.

Specially approved science courses for the AD Major

- Earth Systems 101 (Energy and the Environment).
- Earth Systems 102 (Renewable Energy Sources and Greener Energy Processes).

Recommended math and science courses for the AD Major

- CEE 101D (Mathematical Laboratory Applications in CEE Engineering).
- CME 100 (Introduction to Engineering Mathematics).
- CEE 64 (Air Pollution: Urban Smog to Global Change).
- CEE 70 (Environmental Science and Technology).
- Geology & Env Sciences (GES) 1 (Dynamic Earth: Fundamentals of Earth Science).
- Physics 23 or 43 (Electricity).

### Technology in Society

One course required. Choose from the approved list of courses in this handbook (Figure 3-3).

### Engineering Fundamentals and Depth

60 units minimum required from Engineering Fundamentals; Required Depth Classes; and Required Depth Electives

**ENGINEERING FUNDAMENTALS: THREE COURSES REQUIRED**

| Course | Title | Units |
|---|---|---|
| ENGR 14 | Applied Mechanics: Statics (req'd) | 3 |
| ENGR 60 | Engineering Economy (req'd) | 3 |
| | Fundamentals Elective | 3-5 |

**REQUIRED DEPTH COURSES**

| Course | Title | Units |
|---|---|---|
| CEE 100 | Managing Sustainable Building Projects **fulfills writing in major** | 4 |
| CEE 101A | Mechanics of Materials | 4 |
| CEE 110 | Building Information Modeling | 4 |
| CEE 31 *or* 31Q | Accessing Architecture Through Drawing | 4 |
| CEE 130 | Architectural Design: 3-D Modeling, Methodology, and Process | 4 |
| CEE 136 | Green Architecture | 5 |
| CEE 137B *or* other in 137 series | Intermediate Architecture Studio | 4 |
| CEE 156 | Building Systems | 4 |
| Art History 3 | Introduction to the History of Architecture | 5 |

## DEPTH ELECTIVES

The number of units of Depth Electives must be such that courses in Engineering Fundamentals, Required Depth and Depth Electives total at least 60 units.

## DEPTH ELECTIVE COURSES

*At least one of the following courses:*

| | | |
|---|---|---|
| CEE 111 | Multidisciplinary Modeling (Computer focus) | 3-4 |
| CEE 115 | Goals & Methods for Sustainable Design (Sustainability focus) | 3-4 |
| CEE 138A | Contemporary Architecture: Materials, Structures, and Innovations (Arch Discourse focus) | 3 |
| CEE 131A | Introduction to Design Professions (Arch Practice focus) | 2 |

*Plus additional units from the following, including a minimum of 3 units from Engineering Electives, to bring Fundamental + Depth total to at least 60 units.*

| Engineering Electives | Title | Units |
|---|---|---|
| CEE 80N | The Art of Structural Engineering | 4 |
| CEE 101B | Mechanics of Fluids | 4 |
| CEE 101C | Geotechnical Engineering | 3-4 |
| CEE 111 | Multidisciplinary Modeling and Analyses | 3-4 |
| CEE 115 | Goals and Methods for Sustainable Design of Buildings | 3-4 |
| CEE 122A,B | Computer Integrated Architecture/Engr./Construction | 3,2 |
| CEE 124 | Sustainable Development Studio | 1-5 |
| CEE 131A | Architectual Design Process | 4 |
| CEE 132 | Interplay of Architecture and Engineering | 4 |
| CEE 134B | Architectural Studio: Special Topic | 4 |
| CEE 135A | Parametrics: Applications in Architecture and Product Design | 4 |
| CEE 138A | Contemporary Architecture: Materials, Structures, and Innovations | 3 |
| CEE 139 | Design Portfolio Methods | 2 |
| CEE 154 | Cases in Estimating Costs | 3 |
| CEE 172A | Indoor Air Quality | 2-3 |
| CEE 176A | Energy Efficient Buildings | 3-4 |
| CEE 180 | Structural Analysis | 4 |
| CEE 181 | Design of Steel Structures | 4 |
| CEE 182 | Design Experience – Steel Structures | 4 |
| CEE 183 | Integrated Building Design | 4 |
| ENGR 50 | Introductory Science of Materials | 4 |
| ENGR 103 | Public Speaking | 3 |
| ENGR 131 | Ethical Issues in Engineering | 4 |
| ME 101 | Visual Thinking | 3 |
| ME 110A | Design Sketching | 1 |
| ME 115 | Human Values in Design | 3 |
| ME 120 | History and Philosophy of Design | 3-4 |
| ME 222 | Beyond Green Theory: Workshop in Ecological Design | 2-3 |
| | | |
| ARTHIST 141 | The Invention of Modern Architecture | 4 |
| ARTHIST 142 | Varieties of Modern Architecture | 4 |
| ARTHIST 143A | American Architecture | 4 |
| ARTHIST 188A | The History of Modern and Contemporary Japanese and Chinese Architecture and Urbanism | 4 |
| ARTHIST 252A | Place: Making Space Now | 5 |

| | | |
|---|---|---|
| ARTSTUDI 60 | Design I: Fundamental Visual Language | 3-5 |
| ARTSTUDI 70 | Introduction to Photography | 4 |
| ARTSTUDI 140 | Drawing I | 3 |
| ARTSTUDI 145 | Painting I | 3 |
| ARTSTUDI 148 | Printmaking | 3 |
| ARTSTUDI 151 | Sculpture | 4 |
| ARTSTUDI 271 | The View Camera: Its Uses and Techniques | 3 |
| DRAMA 137 | Drafting and Construction | 2-3 |
| FILMPROD 114 | Introduction to Film and Video Production | 5 |
| URBANST 110 | Introduction to Urban Studies | 4 |
| URBANST 113 | Introduction to Urban Design: Contemporary Urban Design in Theory and Practice | 5 |
| URBANST 163 | Land Use Control | 4 |
| URBANST 171 | Urban Design Studio | 3 |

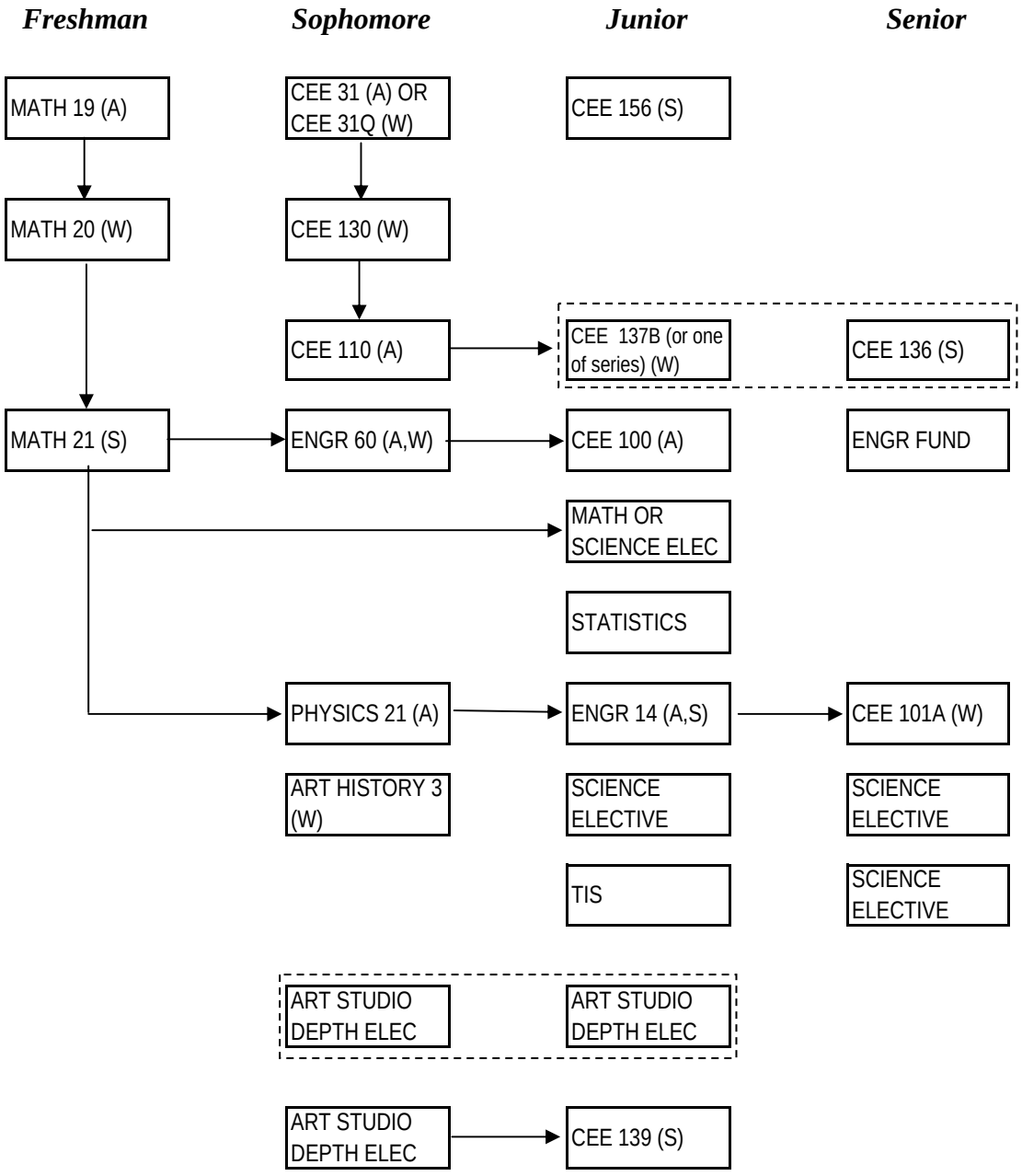
## SUGGESTED COURSE CONCENTRATIONS AND SEQUENCES

Subject to the requirements outlined above, students have considerable leeway in choosing their depth electives and other courses to best suit their background and interests. By careful selection of technically-oriented depth electives, students can complement their studio experience with courses in structural analysis, construction, cost estimating, and energy efficiency.

Students intent on applying to architecture graduate school are encouraged to take studio art courses as early as possible in their academic career and to take more than the required number of architecture studios. In preparation for architecture graduate school applications, students should plan on taking the portfolio preparation class (CEE 139). It is also recommended that students take computer modeling courses which will enable them to pursue summer internships. Internships are valuable since they allow students to test their interest in architecture as a profession.

# Architectural Design

*Typical Sequence of Courses*




*Arrows represent direct prerequisites

*Dashed-line boxes enclose alternates. These may indicate alternated years in which to take a given course, or alternate courses that may be taken at a given time.

**Plus other courses to include :*

Third Engineering Fundamentals course

The number of departmental electives must be such that courses in Engineering Fundamentals, Required Depth, and Depth Electives total at least 60 units

# Architectural Design

*Typical 4-Year Plan*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci | Engr | Other | Class | Math/ Sci | Engr | Other | Class | Math/ Sci | Engr | Other |
| *Freshman* | MATH 19 | 3 | | | MATH 20 | 3 | | | MATH 21 | 4 | | |
| | IHUM | | | 4 | IHUM | | | 4 | IHUM | | | 4 |
| | Physics 21/22 | 4 | | | Physics 23/24 | 4 | | | Writing | | | 4 |
| | GER | | | 4 | GER | | | 4 | | | | |
| | *Subtotals* | *7* | *0* | *8* | *Subtotals* | *7* | *0* | *8* | *Subtotals* | *4* | *0* | *8* |
| | Total | | | 15 | Total | | | 15 | Total | | | 12 |
| *Sophomore* | Language | | | 4 | Language | | | 4 | Language | | | 5 |
| | CEE 110 | | 4 | | ENGR 60 | | 3 | | CEE 100* | | 4 | |
| | CEE 31 | | 4 | | CEE130 | | 4 | | Depth Elctv (Art Studio) | | 3 | |
| | | | | | ARTHIS3 | | 5 | | Writing | | | 4 |
| | *Subtotals* | *0* | *8* | *4* | *Subtotals* | *0* | *12* | *4* | *Subtotals* | *0* | *7* | *9* |
| | Total | | | 12 | Total | | | 16 | Total | | | 16 |
| *Junior* | TIS | | | 4 | STAT 60 | 5 | | | ENGR 14 | | 3 | |
| | GER | | | 4 | CEE 136 | | 4 | | CEE 156 | | 4 | |
| | Math or Sci Elctv | 5 | | | Depth Elctv | | 4 | | Science Elctv | 4 | | |
| | Unrstr Elctv | | | 3 | Unrstr Elctv | | | 3 | Depth Elctv | | 4 | |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *5* | *8* | *3* | *Subtotals* | *4* | *11* | *0* |
| | Total | | | 16 | Total | | | 16 | Total | | | 15 |
| *Senior* | Science Elctv | 4 | | | CEE 101A | | 4 | | Science Elctv | 4 | | |
| | Depth Elctv | | 4 | | CEE 137B | | 5 | | Unrstr Elctv | | | 5 |
| | Unrstr Elctv | | | 4 | Funds Elctv | | 3 | | Elctv Studio | | 4 | |
| | GER | | | 5 | Unrstr Elctv | | | 5 | | | | |
| | *Subtotals* | *4* | *4* | *9* | *Subtotals* | *0* | *12* | *5* | *Subtotals* | *4* | *4* | *5* |
| | Total | | | 17 | Total | | | 17 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 40 |
| Total Engineering Units: | 66 |
| Total Other Units: | 74 |
| Total Units: | 180 |

*Notes:*

* CE100 fulfills the WIM (writing in the major) requirement.

\+ At least 3 units of Depth Electives must be taken from departments within the School of Engineering.

# INSTRUCTIONS FOR DECLARING MAJOR IN ENGINEERING: ARCHITECTURAL DESIGN (BS-ENGR)

1. Print your unofficial Stanford transcript from Axess and download the Architectural Design (AD) program sheet from the Undergraduate Handbook site **ughb@stanford.edu**.
2. Complete the AD program sheet, indicating how you plan to fulfill the major requirements and which electives you plan to take. Fill in every course you intend to take as well as courses you have already taken for your major. Please include full titles of the classes. Refer to the UGHB for approved math, science, Engineering Fundamental, and TIS courses (pages 19-26) Complete as much of the program sheet as possible on your own.
3. Make an appointment with Program Director John Barton (Y2E2 Bldg., Room 267), bringing your SU transcript and program sheet to the meeting. Review your program sheet and clarify questions regarding your academic plan.
4. AD advisor John Barton will sign your program sheet which you will then deliver to Sandra Wetzel, CEE Student Services Specialist, Bldg Y2E2, Room 316.
5. Sandra Wetzel will email you when you can go on Axess and declare online.
6. Locate your freshman advising folder and deliver to Sandra Wetzel, CEE Student Services
7. If your program sheet changes as you progress in the program, you should submit revisions in consultation with your advisor. Note that any deviations from the approved program need to be petitioned; see below. Submit a final program sheet at least two quarters before you graduate. Your folder will be on file with Student Services in CEE

Other information:

- Procedures for requesting transfer credits and program deviations are described in detail in Chapter 4 - "Policies and Procedures." The relevant forms are in the back of the Handbook in the "Forms" section, or on the UGHB site under the "Petitions" link. The online forms may be filled out electronically. If you are requesting transfer credits or program deviations for the Depth portion of your program, you should bring a copy of your completed petition form and your unofficial transcript to the CEE Student Services office; obtain your program sheet from your file and attach to your other forms for processing.
- Check with the CEE Student Services Office to make sure that you are signed up on the CEE undergraduate student e-mail list server for important announcements about CEE Department events and activities.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download the online AD program sheet from **ughb.stanford.edu** to ensure you are using an accurate major plan.

**Stanford University ♦ School of Engineering**

# Architectural Design
# 2009–2010 Program Sheet

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirements (36 units minimum)**

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (see notes 1 & 2)* | | | | | | | |
| STATS | | Statistics (req'd) | | | | | |
| MATH | 19 | Calculus (req'd) | | | | | |
| MATH | 20 | Calculus (req'd) | | | | | |
| MATH | 21 | Calculus (req'd) | | | | | |
| or MATH | 41 & 42 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | *Mathematics Unit Total* | |

*Science (see notes 1& 2)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PHYS | 21 or 41 | Mechanics (req'd) | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | *Science Unit Total* | |
| | | | | | | *Mathmematics and Science Total (36 units minimum)* | |

**Technology in Society Requirement** (1 course required; see UGHB, Fig. 3-3 for approved list)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**NOTES**

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and if required, by the departmental representative. Changes must be initialed in ink.

* Read all emails from the Office of Student Affairs; this is the School's only effective mehtod of communicating key information to ENGR majors.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Grade Point Average (GPA) for all courses in Engineering Fundamentals and Depth (combined) is 2.0.

* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Required Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.

* All courses listed on this form must only be included under one category. Delete courses not taken.

( 1 ) AP units can be applied; must be approved by the SoE Dean's Office.

( 2 ) Select from SoE approved list (Handbook, Fig. 3-2) and/or specially approved Science courses EARTHSYS 101 and EARTHSYS 102 and/or recommended Math and Science courses CEE 101D, CME 100, CEE 64, CEE 70, GES 1A, 1B or 1C; PHYSICS 23 OR 43.

# Architectural Design Program Sheet (continued)

**Engineering Fundamentals** *(3 courses required)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENGR | 14 | Applied Mechanics: Statics (req'd) | | | | 3 | |
| ENGR | 60 | Engineering Economy (req'd) | | | | 3 | |
| | | *Fundamentals Elective* | | | | | |
| | | | | | *Engineering Fundamentals Total (3 courses required)* | | |

**Required Depth** *(38 units minimum)*

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| CEE | 100 | Managing Sustainable Building Projects (WIM; see note 3) | | | | 4 | |
| CEE | 101A | Mechanics of Materials | | | | 4 | |
| CEE | 110 | Building Information Modeling | | | | 4 | |
| CEE | 31(Q) | Accessing Architecture Through Drawing | | | | 4 | |
| CEE | 130 | Architectural Design | | | | 4 | |
| CEE | 137B* | Intermediate Architecture Studio | | | | 5 | |
| CEE | 136 | Green Architecture | | | | 4 | |
| CEE | 156 | Building Systems | | | | 4 | |
| ARTHIST | 3 | Introduction to Architecture History (Not offered AY 09-10) | | | | 5 | |

*or one of the 137 series

*Required Depth Total (38 units required)*

**Depth Electives** *(See Note 4) (Elective units must be such that courses in Eng Fundamentals, Required Depth, and Depth Electives total at least 60 units.)*

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Depth Total* | | |

**Program Totals**

| | |
|---|---|
| *Mathematics and Science (36 units minimum)* | |
| *Technology in Society Units (1 course required)* | |
| *Engineering Fundamentals Units (3 courses required)* | |
| *Required Depth Units (38 units minimum)* | |
| *Depth Electives (no. of required units to bring total to 100)* | |
| *TOTAL (100 units minimum)* | |

**NOTES continued**

( 3 ) Fulfills the "Writing in the Major" requirement.

( 4 ) At least one of the following courses must be taken as a Depth elective: CEE 111, 115, 131A, or 138A.

**Program Approvals**

*Advisor*

Printed Name: _____ Dat _____

Signature: _____

*Departmental*

Printed Name: _____ Dat _____

Signature: _____

*School of Engineering* (signature not required prior to graduation)

Printed Name: _____ Dat _____

Signature: _____

# ATMOSPHERE/ENERGY

Atmosphere and energy are strongly linked: Fossil-fuel energy use contributes to air pollution, climate change, and perturbations to the weather, and the atmosphere feeds back as renewable wind, solar, and hydroelectric energy sources. Because atmospheric problems can be mitigated by increasing energy efficiency, developing new energy technologies, and shifting to less-polluting energy sources, and because it is important to study the atmospheric impacts of new energy technologies, the two areas, atmosphere and energy, are naturally coupled together.

The Atmosphere/Energy (A/E) undergraduate major provides a curriculum that prepares undergraduates for an A/E master's degree program, as well as careers in industry, research, consulting, government, non-governmental organizations, and academia. The A/E degree is *NOT* an ABET-accredited degree, as ABET accreditation is advantageous only for obtaining specific jobs that do not overlap with those that students obtaining the A/E degree would generally consider.

A/E students take classes in both Atmosphere and Energy, as well as classes that integrate the two. The curriculum is flexible in that students more interested in one field or the other can take most of their Engineering Depth classes in the area of their choice. Similarly, students desiring to focus more on technology or on science can take the appropriate Depth classes to suit their interest.

Students may also take courses in A/E to fulfill the requirements for a minor in the Department of Civil and Environmental Engineering.

## REQUIREMENTS

A total of 101 units are required, distributed as follows:

**Mathematics (23 units minimum, including at least one class from each group):**

Group A:

| | |
|---|---|
| MATH 53 Ordinary Differential Equations with Linear Algebra | 5 |
| CME 102 Ordinary Differential Equations for Engineers | 5 |

Group B:

| | |
|---|---|
| CME 106 Introduction to Probability and Statistics for Engineers | 4 |
| STATS 60 Introduction to Statistical Methods: Pre-calculus | 5 |
| STATS 110 Statistical Methods in Eng. and the Physical Sciences | 4-5 |
| GES 160 Statistical Methods for Earth and Env. Sciences | 3-4 |

**Science (22 units minimum, including all of the following):**

| | | |
|---|---|---|
| PHYS 41 | Mechanics | 4 |
| PHYS 43 | Electricity/Magnetism –OR– PHYS 45 Light/Heat | 4 |
| CHEM 31B | Chemical Principles II (or CHEM 31X) | 4 |
| CEE 70 | Environmental Science and Technology | 3 |

**Engineering Fundamentals (three courses minimum, including the following):**

| | | |
|---|---|---|
| ENGR 30 | Engineering Thermodynamics | 3 |

*and at least one of the following two courses:*

| | | |
|---|---|---|
| ENGR 60 | Engineering Economy | 3 |
| ENGR 70A | Programming Methodology | 3-5 |

**Technology in Society**

| | |
|---|---|
| STS 110 Ethics and Public Policy (also fulfills Writing in Major req.) | 5 |

**Engineering Depth (42 units minimum):**

*Required:*

| | |
|---|---|
| CEE 64 Air Pollution: From Urban Smog to Global Change (W) | 3 |
| CEE 173A Energy Resources (A) | 5 |

*At least 34 units from the following, with at least 4 courses from each group:*

**Group A: Atmosphere**

| | | | |
|---|---|---|---|
| AA 100 | Introduction to Aeronautics and Astronautics (A) | | 3 |
| CEE 63 | Weather and Storms (A) | | 3 |
| Either | CEE 101B | Mechanics of Fluids (S) | 3 |
| OR | ME 70 | Introd Fluids Engineering (W,S) | 4 |
| CEE 164 | Introduction to Physical Oceanography (W) | | 4 |
| CEE 171 | Environmental Planning Methods (W) | | 3 |
| CEE 172 | Air Quality Management (W) | | 3 |
| CEE 172A | Indoor Air Quality (S) (Alt. years) | | 2-3 |

| | | |
|---|---|---|
| CEE 178 | Introduction to Human Exposure Analysis (Sum) | 3 |
| EARTHSYS 111 | Biology and Global Change (W) | 3 |
| Either | EARTHSYS 144 Fundamentals of GIS (A) | 4 |
| –OR– | EE 140 Intro. Remote Sensing (W) (alt. years) | 3 |
| EARTHSYS 147 | Control. Climate Chge/21st Cent. (W) (alt. years) | 3 |
| EARTHSYS 184 | Climate and Agriculture (S) | 3 |
| GES 90 | Introduction to Geochemistry (W) | 3-4 |
| ME 131B | Fluid Mechanics: Compr. Flow /Turbomachinery (W) | 4 |

**Group B: Energy**

| | | |
|---|---|---|
| CEE 115 | Goals/Methods for the Sustainable Bldg Projects(S) | 3-4 |
| CEE 142A | Creating Sustainable Development (W) | 3 |
| CEE 156 | Building Systems (W) | 4 |
| CEE 172P | Distrib Generation & Grid Integ of Renewables (W) | 3-4 |
| CEE 176A | Energy Efficient Buildings (W) | 3-4 |
| CEE 176B | Electric Power: Renewables and Efficiency (S) | 3-4 |
| CEE 176F | Energy Systems Field Trips (W) (Alt. years) | 4 |
| CEE 177S | Design for a Sustainable World (S) | 1-5 |
| EARTHSYS 45N | Energy Issues Confronting the World (W) (Alt. years) | 3 |
| EARTHSYS 133 | California Climate Change Law and Policy (S) | 3 |
| EARTHSYS 148 | Copenhagen Climate Protocol: Interpr. the Chaos (A) | 2 |
| Either | ENERGY 104 Technol. in the Greenhouse (S) | 4 |
| –OR– | ENERGY 153 Carbon Capture/Sequestration (A) | 3 |
| MATSCI 156 | Solar Cells, Fuel Cells, and Batteries (A) | 4 |

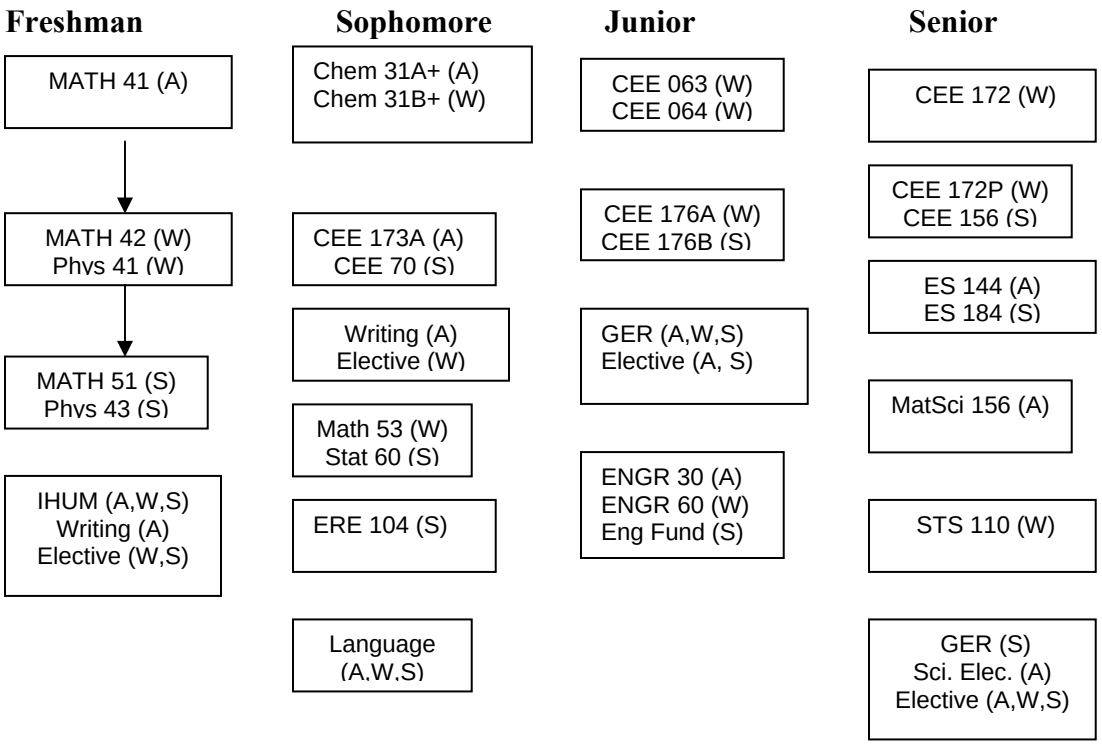
## SUGGESTED COURSE CONCENTRATIONS AND SEQUENCES

Subject to the requirements outlined above, students have flexibility in selecting their depth electives and other courses to best suit their interests. On the following pages, two suggested programs are outlined, one with an emphasis on energy and the other on atmospheric studies. Either approach provides the necessary preparation for the master's degree program in Atmosphere/Energy.

# Atmosphere/Energy

Typical Sequence of Courses

**Energy Emphasis**




Arrows represent direct prerequisites

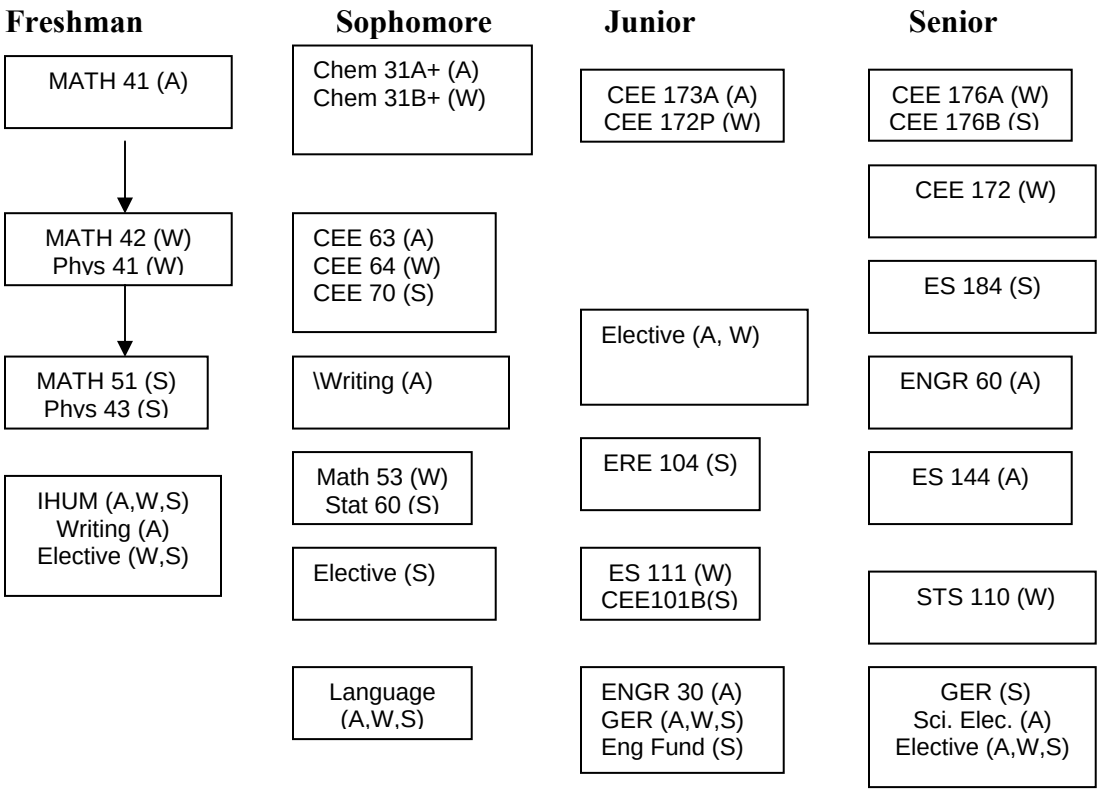
*Courses given alternate years.

+ If Chem 31X is taken, replace Chem 31B with another science elective.

# Atmosphere/Energy

Typical Sequence of Courses

**Atmosphere Emphasis**




Arrows represent direct prerequisites

*Courses given alternate years.

+ If Chem 31X is taken, replace Chem 31B with another science elective.

# Atmosphere/Energy

Energy Emphasis

*Sample 4-Year Plan*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci | A/E Depth | Other | Class | Math/ Sci | A/E Depth | Other | Class | Math/ Sci | A/E Depth | Other |
| *Freshman* | MATH 41 | 5 | | | MATH 42 | 5 | | | MATH 51 | 5 | | |
| | IHUM | | | 4 | IHUM | | | 4 | IHUM | | | 4 |
| | Writing | | | 4 | Elective | | | 3 | Elective | | | 3 |
| | | | | | PHYS 41 | 4 | | | PHYS 43 | 4 | | |
| | *Subtotals* | *5* | *0* | *8* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *0* | *7* |
| | Total | | | 13 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | | | 5 | Language | | | 5 | Language | | | 5 |
| | Chem 31A+ | 4 | | | Chem 31B+ | 4 | | | CEE 70 | 3 | | |
| | Writing | | | 4 | MATH 53 | 5 | | | STAT 60 | 5 | | |
| | CEE 173A | | 5 | | Elective | | | 3 | ERE 104^ | | 3 | |
| | *Subtotals* | *4* | *5* | *9* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *8* | *3* | *5* |
| | Total | | | 18 | Total | | | 17 | Total | | | 16 |
| *Junior* | CEE 63* | | 3 | | CEE 176A^ | | 4 | | CEE 176B^ | | 3 | |
| | Elective | | | 3 | CEE 64 | | 3 | | Elective | | | 3 |
| | ENGR 30 | | | 3 | ENGR 60 | | | 3 | Engr Fund | | | 3 |
| | GER | | | 5 | GER | | | 4 | GER | | | 5 |
| | *Subtotals* | *0* | *3* | *11* | *Subtotals* | *0* | *7* | *7* | *Subtotals* | *0* | *3* | *11* |
| | Total | | | 14 | Total | | | 14 | Total | | | 14 |
| *Senior* | ES 144* | | 4 | | CEE 172* | | 3 | | ES 184* | | 3 | |
| | MatSci 156^ | | 4 | | CEE 172P^ | | 3 | | CEE 156^ | | 4 | |
| | Sci. Elect. | 3 | | | STS 110 | | | 5 | GER | | | 4 |
| | Elective | | | 3 | Elective | | | 3 | Elective | | | 3 |
| | *Subtotals* | *3* | *8* | *3* | *Subtotals* | *0* | *6* | *8* | *Subtotals* | *0* | *7* | *7* |
| | Total | | | 14 | Total | | | 14 | Total | | | 14 |

| | |
|---|---|
| Total Math & Science Units: | 47 |
| Total A/E Depth Units: | 42 |
| Total Other Units: | 91 |
| Total Units: | 180 |

*Notes:*

Courses in row can be rearranged to accommodate Writing in any quarter.

\+ If Chem 31X is taken, replace Chem 31B with another science elective.

* Can be replaced with other Group A (Atmosphere) classes -- minimum of 4 classes needed

^ Can be replaced with other Group B (Energy) classes -- minimum of 4 classes needed

# Atmosphere/Energy

Atmosphere Emphasis

*Sample 4-Year Plan*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci | A/E Depth | Other | Class | Math/ Sci | A/E Depth | Other | Class | Math/ Sci | A/E Depth | Other |
| *Freshman* | MATH 41 | 5 | | | MATH 42 | 5 | | | MATH 51 | 5 | | |
| | IHUM | | | 4 | IHUM | | | 4 | IHUM | | | 4 |
| | Writing | | | 4 | Elective | | | 3 | Elective | | | 3 |
| | | | | | PHYS 41 | 4 | | | PHYS 43 | 4 | | |
| | *Subtotals* | *5* | *0* | *8* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *0* | *7* |
| | Total | | | 13 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | | | 5 | Language | | | 5 | Language | | | 5 |
| | Chem 31A+ | 4 | | | Chem 31B+ | 4 | | | CEE 70 | 3 | | |
| | Writing | | | 4 | MATH 53 | 5 | | | STAT 60 | 5 | | |
| | Elective | | | 3 | CEE 64 | | 3 | | Elective | | | 3 |
| | *Subtotals* | *4* | *0* | *12* | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *8* | *0* | *8* |
| | Total | | | 16 | Total | | | 17 | Total | | | 16 |
| *Junior* | CEE 63* | | 3 | | ES 111* | | 3 | | CEE 101B* | | 4 | |
| | CEE 173A | | 5 | | CEE 172P^ | | 4 | | ERE 104^ | | 3 | |
| | ENGR 30 | | | 3 | Elective | | | 3 | Engr Fund | | | 3 |
| | GER | | | 4 | GER | | | 5 | GER | | | 5 |
| | *Subtotals* | *0* | *8* | *7* | *Subtotals* | *0* | *7* | *8* | *Subtotals* | *0* | *7* | *8* |
| | Total | | | 15 | Total | | | 15 | Total | | | 15 |
| *Senior* | ES 144* | | 4 | | CEE 172* | | 3 | | ES 184* | | 3 | |
| | ENGR 60 | | | 3 | CEE 176A^ | | 4 | | CEE 176B^ | | 3 | |
| | Sci. Elect. | 3 | | | STS 110 | | | 5 | GER | | | 4 |
| | Elective | | | 3 | Elective | | | 3 | Elective | | | 3 |
| | *Subtotals* | *3* | *4* | *6* | *Subtotals* | *0* | *7* | *8* | *Subtotals* | *0* | *6* | *7* |
| | Total | | | 13 | Total | | | 15 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 47 |
| Total A/E Depth Units: | 42 |
| Total Other Units: | 91 |
| Total Units: | 180 |

*Notes:*

Courses in row can be rearranged to accommodate Writing in any quarter.

\+ If Chem 31X is taken, replace Chem 31B with another science elective.

* Can be replaced with other Group A (Atmosphere) classes -- minimum of 4 classes needed

^ Can be replaced with other Group B (Energy) classes -- minimum of 4 classes needed

# INSTRUCTIONS FOR DECLARING MAJOR IN ENGINEERING: ATMOSPHERE/ENERGY (BS-ENGR)

1. Enter your major declaration for Atmosphere/Energy in Axess. Select ENGR-BS as your major and Atmosphere/Energy as your subplan.
2. Pick up your academic folder from your freshman/sophomore adviser and print out your Stanford transcript (unofficial is fine) from Axess.
3. Download and complete your major Program Sheet, which you can obtain from the UGHB website at **`http://ughb.stanford.edu/`**. Be sure to fill in all courses that you have taken and those which you plan to take. You will have the opportunity to revise this later, so please fill in as many courses as you can.
4. Bring your academic folder, transcript and completed program sheet to the CEE Student Services office to Room 316 of the Jerry Yang and Akiko Yamazaki Environment & Energy (Y2E2) Building and request to have a CEE advisor assigned to you. You may request a specific advisor if you wish. Office hours are10:00 am to noon and 2:00 to 4:00 pm, Monday through Friday.
5. Meet with Mark Jacobson and have him review and sign your program sheet.
6. Return your signed program sheet to the CEE Student Services Specialist, who upon receiving your signed sheet will approve your major declaration in Axess.
7. You are encouraged to meet with Mark Jacobson at least once a quarter to review your academic progress. Changes to your program sheet can be made by printing out a revised sheet, obtaining your A/E undergraduate adviser's signature, and returning the approved sheet to the CEE Student Services Office. *NOTE – It is very important to confirm that your program sheet is up to date at least one quarter prior to graduation. Changes to your program may not be accepted within your final quarter.*

**Other information:**

- Procedures for requesting transfer credits and program deviations are described in detail in at the beginning of Chapter 4: "Policies and Procedures." The relevant forms may be downloaded from **`http://ughb.stanford.edu`** under the "Petitions" link. If you are requesting transfer credits or program deviations, you should bring your completed petition form with your transcript to the CEE Student Services office. Attach your program sheet on file in CEE.
- Check with the CEE Student Services Office to make sure that you are on the CEE undergraduate student email list for important announcements about department events and activities.
- **Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download the online AE program sheet from **`ughb.stanford.edu`** to ensure you are using an accurate major plan.

**Stanford University ♦ School of Engineering**

# Atmosphere/Energy
# 2009–2010 Program Sheet

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date BS expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Mathematics (23 units minimum)* | | | | | | | |
| CME | 102 | Math/Comp. Methods for Eng. (req'd; see note 1) | | | | 5 | |
| CME | 106 | Statistical Methods (req'd; see note 2) | | | | 4 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (23 units minimum)* | | |

*Science (22 units minimum)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PHYS | 41 | Mechanics (req'd) | | | | 4 | |
| PHYS | 43 or 45 | Electricity & Magnetism OR Light & Heat (req'd) | | | | 4 | |
| CHEM | 31B or 31X | Chemical Principles (req'd) (or ENGR 31) | | | | 4 | |
| CEE | 70 | Environmental Science & Technology (req'd) | | | | 3 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Science Unit Total (22 units minimum)* | | |
| | | | | | *Mathematics and Science (45 units minimum)* | | |

## Technology in Society Requirement

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| STS | 110 | Ethics and Public Policy (req'd) WIM; see note 3) | | | | 5 | |

**NOTES**

- This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.
- Read all emails from the Office of Student Affairs; this is the SoE's only effective method of communicating key information to ENGR majors.
- All courses listed on this form must be taken for a letter grade if offered by the instructor.
- Minimum Grade Point Average (GPA) for all courses in Engineering Fundamentals and Materials Science and Engineering Depth (combined) is 2.0.
- Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.
- All courses listed on this form must only be included under one category; no double-counting.

( 1 ) Math 53 may be substituted for CME 102

( 2 ) The statistical methods requirement may also be satisfied by taking STATS 60, STATS 110, or GES 160.

( 3 ) Fulfills the "Writing in the Major" (WIM) requirement; offered Wtr quarter

*program sheet continues on page 2*

# Atmosphere/Energy

**Engineering Fundamentals** *(3 courses required)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENGR | 30 | Engineering Thermodynamics | | | | 3 | |
| ENGR | 60 (or 70A) | Engineering Economy or Programming Methodology | | | | 3 to 5 | |
| | | *Fundamental Elective* | | | | | |
| | | | | | *Engineering Fundamentals Total* | | |

**Engineering Depth** *(42 units minimum)*

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Required:* | | | | | | | |
| CEE | 64 | Air Pollution: From Urban Smog to Global Change | | | | 3 | |
| CEE | 173A | Energy Resources | | | | 5 | |
| | | | | | | | |

*Depth Electives (at least 34 units, 4 courses minimum from each of Groups A and B; see note 4)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Group A: Atmosphere | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| Group B: Energy | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Atmosphere/Energy Engineering Depth Total (42 units minimum)* | | |

**Program Totals**

| | |
|---|---|
| *Mathematics and Science (45 units minimum)* | |
| *Atmosphere/Energy Depth (42 units minimum)* | |

**Program Approvals**

*Advisor*

Printed Name: _____ Date: _____

Signature: _____

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 4 ) Choose at least 4 courses from each of the two groups: Group A (Atmosphere): CEE 63; 101B or ME 70; CEE 164, 171, 172, 172A, 178; AA 100, EARTHSYS 111; EARTHSYS 144 or EE 140; EARTHSYS 147, EARTHSYS 184; GES 90; ME 131B. Group B (Energy): CEE 115, 142A, 156, 172P, 176A,B or F; 177S; EARTHSYS 45N, 133, 148; either ENERGY 104 OR 153; MATSCI 156.

# BIOENGINEERING

Bioengineers are focused on advancing human health and promoting environmental sustainability, two of the greatest challenges for our world. Understanding complex living systems is at the heart of meeting these challenges. The mission of Stanford's Department of Bioengineering is to create a fusion of engineering and the life sciences that promotes scientific discovery and the development of new biomedical technologies and therapies through research and education. The Department of Bioengineering is jointly supported by the Schools of Medicine and Engineering. The Bioengineering (BIOE) major enables students to embrace biology as a new engineering paradigm and apply engineering principles to medical problems and biological systems.

BIOE is an IDP, or interdisciplinary program, with its home in the School of Engineering. Students who major in BIOE will obtain a solid background in the basic sciences (chemistry, physics and biology) and mathematics. They will take three engineering fundamentals courses including an introductory bioengineering course and computer programming. Starting in the sophomore year, BIOE students will take six core classes to gain essential knowledge to pursue a career in bioengineering and will then have the opportunity to pursue elective courses suited to their own interests.

Bioengineering students have a wide variety of options upon graduation. Many will continue on to graduate school or medical school. Others will choose to work in the biotechnology, medical device, medical imaging, or other medical and non-medical industries. Other BIOE graduates may choose to pursue advanced degrees in business or law or follow a different career path.

NOTE: Students intending to apply to medical school will need to take additional advanced science courses; see Flowchart and 4-Year Plan #3 (pages 67 and 70) for details.

# COMPONENTS OF BIOE:

**Math, Science, Engineering Fundamentals, and TIS**

All BIOE students take courses to get a solid foundation to prepare them for the study of bioengineering. Most of these courses are typically taken during freshman and sophomore year. These courses include:

**Math**: Math 41, 42, 53 (or CME 102); STATS 110 or 141 or CME 106; CME 104 recommended.

**Chemistry**: CHEM31A+B *or* 31X *or* ENGR 31; CHEM 33

**Biology:** BIO Core 41, 42, BIO lab 44X, 44Y (optional)

**Physics:** PHYSICS 41, 43

**Engineering Fundamentals**: E80 and CS 106A, plus one additional elective (see Chapter 3, Figure 3-4 for list of SoE approved courses)

**Technology in Society (TIS):** One course required; BIOE 131 is recommended but additional list of SoE approved courses can be found in Chapter 3, Figure 3-3

Please see the program sheets for the exact course list.

**Writing in the Major**: A BioE WIM course is pending approval and will be offered in 2010-11.

**BioE Core:**

All BIOE students are required to take a common set of depth courses:

**Physical Biology**: BIOE 41, 42.

**Systems Biology and Physiology**: BIOE 101, 102, 103

**Senior Project**: BIOE 141 (satisfies Writing in the Major, Capstone requirement)

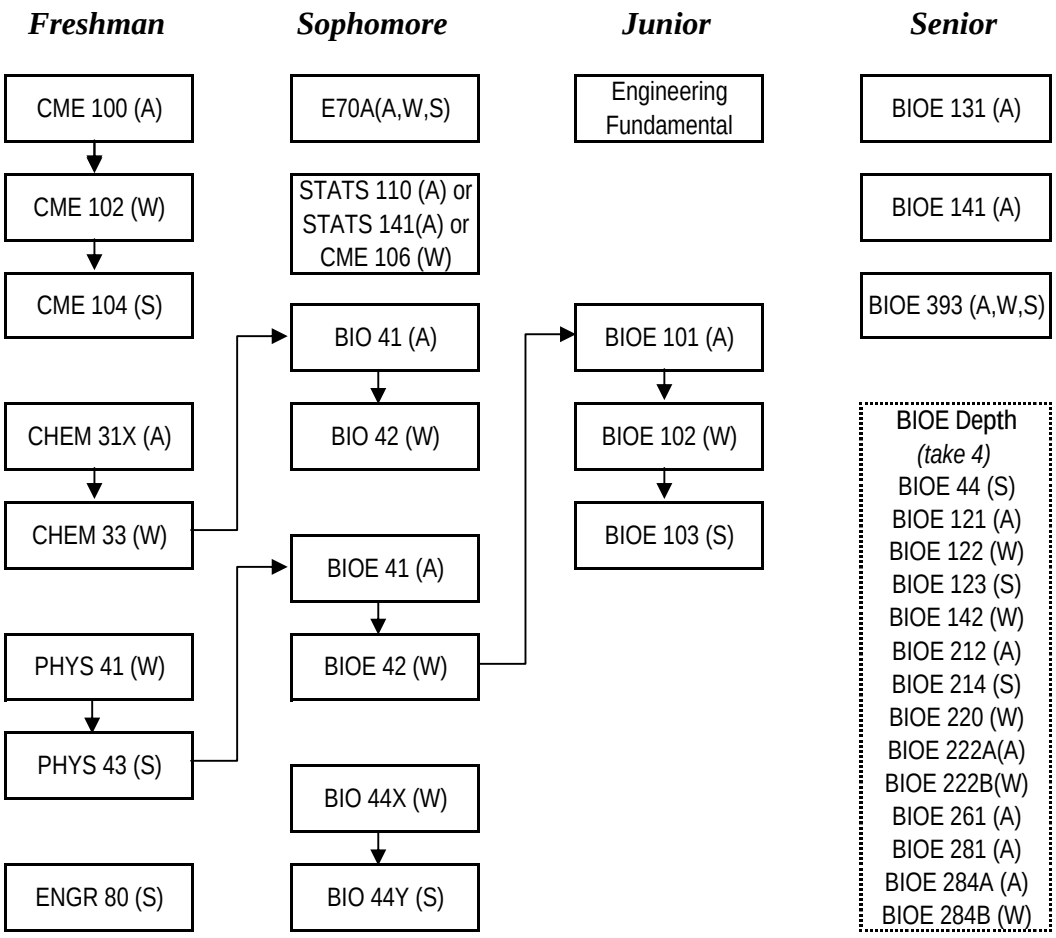
**Seminar**: BIOE 393

**BioE Depth Electives**

All BioE students are required to take four electives from the list of approved Bioengineering undergraduate courses (BIOE 44, 121, 122, 123, 142, 212, 214, 220, 222A, 222B, 261, 281, 284A, 284B).

# Bioengineering

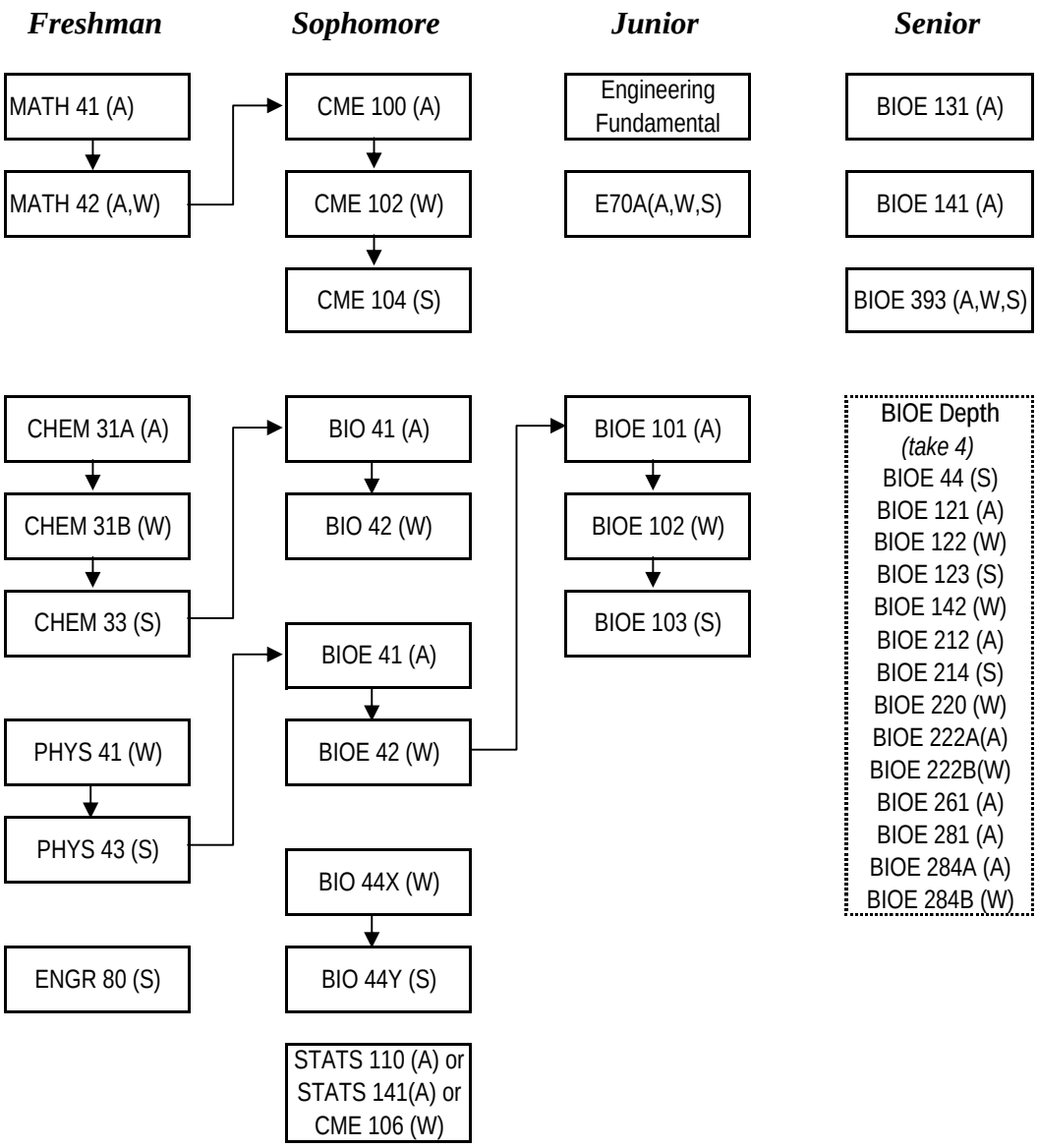
*Typical Sequence of Courses*
Starting with CME 100 and Chem 31X




* Arrows represent direct prerequisites
* Dashed-line boxes enclose alternates. These may indicate alternate years in which to take a given course, and/or alternate courses that may be taken at a given time.
* Students enrolled in BIOE 41 should be concurrently enrolled in BIO 41
* Students enrolled in BIOE 42 should be concurrently enrolled in BIO 42

# Bioengineering

*Typical Sequence of Courses*
Starting with Math 40 Series and Chem 31A

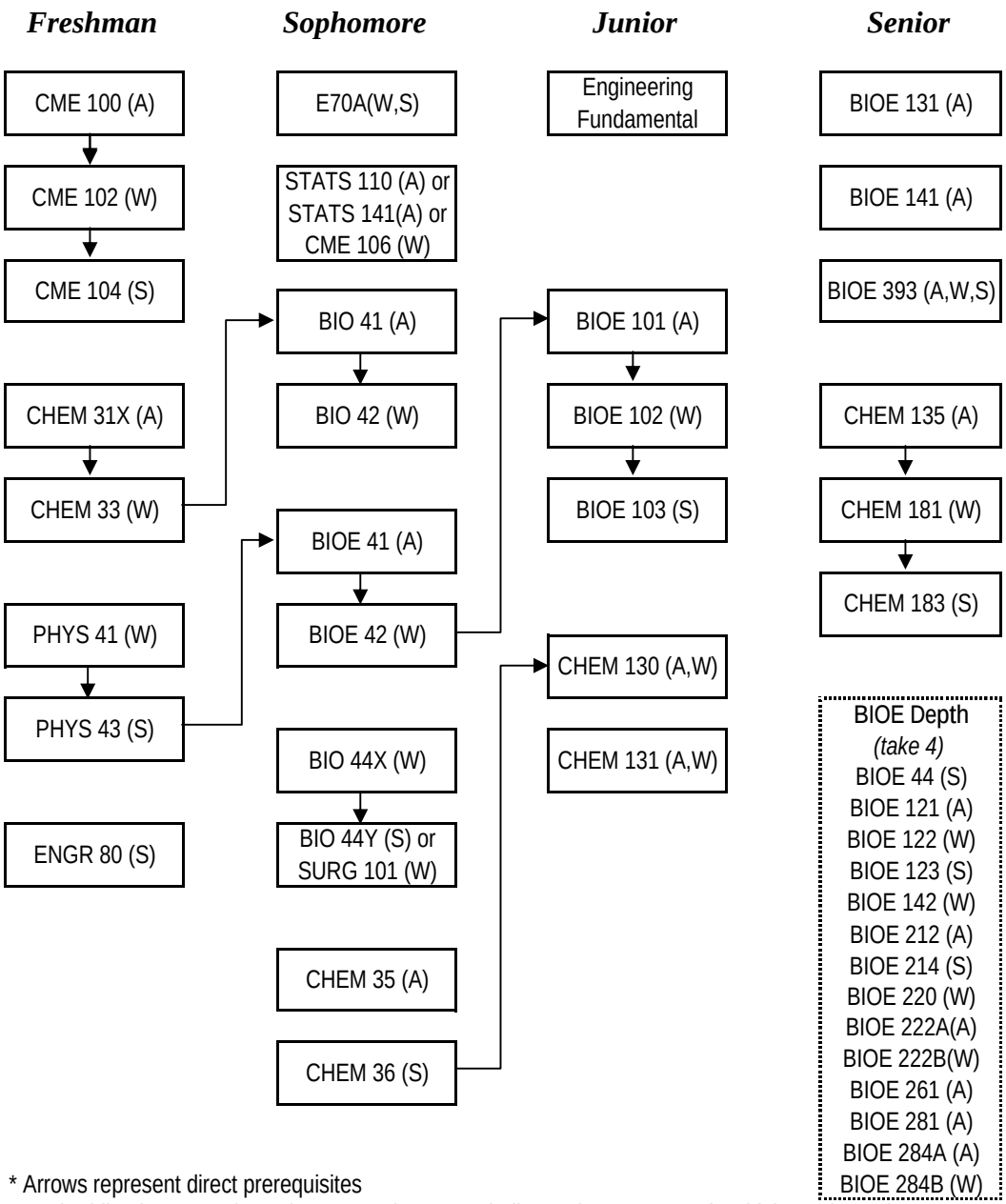



* Arrows represent direct prerequisites
* Dashed-line boxes enclose alternates. These may indicate alternate years in which to take a given course, and/or alternate courses that may be taken at a given time.
* Students enrolled in BIOE 41 should be concurrently enrolled in BIO 41
* Students enrolled in BIOE 42 should be concurrently enrolled in BIO 42

# Bioengineering

*Typical Sequence of Courses*

Starting with CME 100 and Chem 31X, Satisfies Premed requirements




* Arrows represent direct prerequisites
* Dashed-line boxes enclose alternates. These may indicate alternate years in which to take a given course, and/or alternate courses that may be taken at a given time.
* Students enrolled in BIOE 41 should be concurrently enrolled in BIO 41
* Students enrolled in BIOE 42 should be concurrently enrolled in BIO 42
* CHEM 33 is a pre-requisite for CHEM 35, CHEM 36
* CHEM 35 is a co-requisite for CHEM 130 and a pre-requisite for CHEM 131

# Bioengineering

*4-Year Plan (Starting with CME 100 series and Chem 31X)*

| | Fall | | | | Winter | | | | Spring | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Class** | **Math/ Sci.** | **Engr** | **Other** | **Class** | **Math/ Sci.** | **Engr** | **Other** | **Class** | **Math/ Sci.** | **Engr** | **Other** |
| *Freshman* | IHUM | | | 4 | IHUM | | | 4 | IHUM | | | 4 |
| | CME 100 | 5 | | | CME 102 | 5 | | | CME 104 | 5 | | |
| | CHEM 31X | 4 | | | CHEM 33 | 4 | | | ENGR 80 | | 4 | |
| | Writing | | | 4 | PHYS 41 | 4 | | | PHYS 43 | 4 | | |
| | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *13* | *0* | *4* | *Subtotals* | *9* | *4* | *4* |
| | Total | | | 17 | Total | | | 17 | Total | | | 17 |
| *Sophomore* | BIO 41 | 5 | | | BIO 42 | 5 | | | ENGR 70A | | 4 | |
| | BIOE 41 | | 4 | | BIOE 42 | | 4 | | BIOE Depth | | 4 | |
| | STATS 141 | 5 | | | BIO 44X | 4 | | | BIO 44Y | 4 | | |
| | Writing | | | 4 | | | | | CHEM 36 | 3 | | |
| | *Subtotals* | *10* | *4* | *4* | *Subtotals* | *9* | *4* | *0* | *Subtotals* | *7* | *8* | *0* |
| | Total | | | 18 | Total | | | 13 | Total | | | 15 |
| *Junior* | BIOE 101 | | 4 | | BIOE 102 | | 4 | | BIOE 103 | | 4 | |
| | E50M | | 4 | | GER | | | 3 | GER | | | 3 |
| | Elective | | | 3 | Elective | | | 3 | Elective | | 3 | |
| | Language | | | 5 | Language | | | 5 | Language | | | 5 |
| | *Subtotals* | *0* | *8* | *8* | *Subtotals* | *0* | *4* | *11* | *Subtotals* | *0* | *7* | *8* |
| | Total | | | 16 | Total | | | 15 | Total | | | 15 |
| *Senior* | BIOE Depth | | 3 | | BIOE Depth | | 3 | | BIOE Depth | | 3 | |
| | BIOE 141 | | 4 | | GER | | | 3 | Elective | | 4 | |
| | BIOE 131 | | 3 | | Elective | | 4 | | Elective | | 4 | |
| | Elective | | | 3 | GER | | | 3 | GER | | | 3 |
| | BioE 393 | | 1 | | | | | | | | | |
| | *Subtotals* | *0* | *11* | *3* | *Subtotals* | *0* | *7* | *6* | *Subtotals* | *0* | *11* | *3* |
| | Total | | | 14 | Total | | | 13 | Total | | | 14 |

| | |
|---|---|
| Total Math & Science Units: | 57 |
| Total Engineering Units: | 68 |
| Total Other Units: | 59 |
| **Total Units:** | 184 |

# Bioengineering

*4-Year Plan (Starting with Math 41 series and Chem 31A)*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Class** | **Math/ Sci.** | **Engr** | **Other** | **Class** | **Math/ Sci.** | **Engr** | **Other** | **Class** | **Math/ Sci.** | **Engr** | **Other** |
| *Freshman* | IHUM | | | 4 | IHUM | | | 4 | IHUM | | | 4 |
| | MATH 41 | 5 | | | MATH 42 | 5 | | | CHEM 33 | 4 | | |
| | CHEM 31A | 4 | | | CHEM 31B | 4 | | | ENGR 80 | | 4 | |
| | Writing | | | 4 | PHYS 41 | 4 | | | PHYS 43 | 4 | | |
| | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *13* | *0* | *4* | *Subtotals* | *8* | *4* | *4* |
| | Total | | | 17 | Total | | | 17 | Total | | | 16 |
| *Sophomore* | BIO 41 | 5 | | | BIO 42 | 5 | | | STATS 116 | 4 | | |
| | BIOE 41 | | 4 | | BIOE 42 | | 4 | | BIOE Depth | | 3 | |
| | Writing | | | 4 | BIO 44X | 4 | | | BIO 44Y | 4 | | |
| | CME 100 | 5 | | | CME 102 | | 5 | | CME 104 | | 5 | |
| | *Subtotals* | *10* | *4* | *4* | *Subtotals* | *9* | *9* | *0* | *Subtotals* | *8* | *8* | *0* |
| | Total | | | 18 | Total | | | 18 | Total | | | 16 |
| *Junior* | BIOE 101 | | 4 | | BIOE 102 | | 4 | | BIOE 103 | | 4 | |
| | ENGR 50M | | 4 | | E 70A/CS 106A | | 5 | | GER | | | 3 |
| | Elective | | 3 | | Elective | | 3 | | Elective | | 3 | |
| | Language | | | 5 | Language | | | 5 | Language | | | 5 |
| | *Subtotals* | *0* | *11* | *5* | *Subtotals* | *0* | *12* | *5* | *Subtotals* | *0* | *7* | *8* |
| | Total | | | 16 | Total | | | 17 | Total | | | 15 |
| *Senior* | BioE Depth | | 3 | | BioE Depth | | 3 | | BioE Depth | | 3 | |
| | BIOE 141 | | 4 | | GER | | | 3 | GER | | | 3 |
| | BIOE 131 | | 3 | | GER | | | 3 | Elective | | 4 | |
| | Elective | | 4 | | Elective | | 4 | | Elective | | 4 | |
| | BioE 393 | | 1 | | | | | | | | | |
| | *Subtotals* | *0* | *15* | *0* | *Subtotals* | *0* | *7* | *6* | *Subtotals* | *0* | *11* | *3* |
| | Total | | | 15 | Total | | | 13 | Total | | | 14 |

| | |
|---|---|
| Total Math & Science Units: | 57 |
| Total Engineering Units: | 88 |
| Total Other Units: | 47 |
| **Total Units:** | 192 |

# Bioengineering

*4-Year Plan (Starting with CME 100 series and Chem 31X; Satisfies Premed Requirements)*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Class** | **Math/ Sci.** | **Engr** | **Other** | **Class** | **Math/ Sci.** | **Engr** | **Other** | **Class** | **Math/ Sci.** | **Engr.** | **Other** |
| *Freshman* | IHUM | | | 4 | IHUM | | | 4 | IHUM | | | 4 |
| | CME 100 | 5 | | | CME 102 | 5 | | | CME 104 | 5 | | |
| | CHEM 31X | 4 | | | CHEM 33 | 4 | | | ENGR 80 | | 4 | |
| | Writing | | | 4 | PHYS 41 | 4 | | | PHYS 43 | 4 | | |
| | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *13* | *0* | *4* | *Subtotals* | *9* | *4* | *4* |
| | Total | | | 17 | Total | | | 17 | Total | | | 17 |
| *Sophomore* | BIO 41 | 5 | | | BIO 42 | 5 | | | ENGR 70A | | 5 | |
| | BIOE 41 | | 4 | | BIOE 42 | | 4 | | BIOE Core | | 4 | |
| | Writing | | | 4 | BIO 44X | 4 | | | BIO 44Y | 4 | | |
| | CHEM 35 | 4 | | | CME 106 | 4 | | | CHEM 36 | 3 | | |
| | *Subtotals* | *14* | *4* | *0* | *Subtotals* | *9* | *4* | *4* | *Subtotals* | *7* | *9* | *0* |
| | Total | | | 18 | Total | | | 17 | Total | | | 16 |
| *Junior* | BIOE 101 | | 4 | | BIOE 102 | | 4 | | BIOE 103 | | 4 | |
| | E50M | | 4 | | GER | | | 3 | GER | | | 3 |
| | CHEM 130 | 4 | | | CHEM 131 | 3 | | | Elective | | 3 | |
| | Language | | | 5 | Language | | | 5 | Language | | | 5 |
| | *Subtotals* | *4* | *8* | *5* | *Subtotals* | *3* | *4* | *8* | *Subtotals* | *0* | *7* | *8* |
| | Total | | | 17 | Total | | | 15 | Total | | | 15 |
| *Senior* | BIOE Core | | 3 | | BIOE Core | | 3 | | BIOE Core | | 3 | |
| | BIOE 141 | | 4 | | GER | | | 3 | Elective | | 4 | |
| | BIOE 131 | | 3 | | Elective | | 4 | | Elective | | 4 | |
| | CHEM 135 | 3 | | | CHEM 181 | 3 | | | CHEM 183 | 3 | | |
| | BioE 393 | | 1 | | | | | | | | | |
| | *Subtotals* | *3* | *11* | *0* | *Subtotals* | *3* | *7* | *3* | *Subtotals* | *3* | *11* | *0* |
| | Total | | | 14 | Total | | | 13 | Total | | | 14 |

| | |
|---|---|
| Total Math & Science Units: | 77 |
| Total Engineering Units: | 68 |
| Total Other Units: | 44 |
| Total Units: | 190 |

# INSTRUCTIONS FOR DECLARING MAJOR IN ENGINEERING: BIOENGINEERING (BS-ENGR)

1. Gather information about the major by talking to students and professors.
2. Design a 4-year plan based on the samples on previous pages.
3. Print a copy of your transcript from Axess.
4. Complete and submit the BIOE major declaration form below to the Student Services Office in Clark S165; the department will assign you an advisor.
5. Download the BS-BIOE program sheet from the School of Engineering handbook web site (**`http://ughb.stanford.edu`**).
6. Meet with your assigned advisor to review the 4-year plan
7. Based on your plan, fill out your program sheet
8. Turn in your completed and signed Program Sheet, 4-Year Plan, and an unofficial Stanford transcript to Olgalydia Urbano in Clark S166. You must then declare your major in Axess:
    a. Select "Engineering" as your Major
    b. Select "BIOE" as your subplan
    c. Ask Lisa Lambeth at llambeth@stanford.edu to approve your major in PeopleSoft
9. When your major is approved, Lisa Lambeth will notify you via email.

**********

**BS in Bioengineering Declaration**

*(Please print).*Name_____ Student ID_____

E-Mail_____ Month/Year entered Stanford _____

Please rank your top 3 choices (1 to 3) for your Bioengineering advisor:

____ Russ Altman
____ Annelise Barron
____ Kwabena Boahen
____ Zev Bryant
____ Dennis Carter
____ Jennifer Cochran
____ Markus Covert
____ Karl Deisseroth
____ Scott Delp
____ Drew Endy
____ KC Huang
____ Norbert Pelc
____ Stephen Quake
____ Matthew Scott
____ Christina Smolke
____ James Swartz
____ Charles Taylor
____ Fan Yang
____ Paul Yock

*For Office Use:*

Assigned Advisor: Professor_____ Office Location_____

Declaration Approval_____Date_____

**Stanford University ♦ School of Engineering**

# Bioengineering
# 2009–2010 Program Sheet

**Final version of completed and signed program due to the department no later than one month prior to the last**

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

E-mail: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Mathematics** *(21 units minimum required; see UGHB Fig. 3-1 for approved courses)* | | | | | | | |
| MATH | 41 & 42 | *or* AP Calculus | | | | 10 | |
| CME or MATH | | CME 102 or Math 53 (see Note 1) | | | | 5 | |
| STATS | | STAT 110, 141 or CME 106 (see Note 1) | | | | 3-5 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics Total* | | |
| **Science** *(30 units minimum required; see UGHB Fig. 3-2 for approved courses)* | | | | | | | |
| CHEM | 31 | X *or* A and B required (see Note 2) | | | | 4 | |
| CHEM | 33 | Structure and Reactivity (req'd) | | | | 4 | |
| BIO | 41 | Genetics, Biochem, & Molecular Biology (req'd) | | | | 5 | |
| BIO | 42 | Cell Biology and Animal Physiology (req'd) | | | | 5 | |
| BIO | 44X | Core Experimental Lab (req'd) | | | | 4 | |
| PHYS | 41 | Mechanics (req'd) | | | | 4 | |
| PHYS | 43 | Electricity and Magnetism (req'd) | | | | 4 | |
| | | | | | *Science Total* | | |
| **Technology in Society** *(1 course required; see Note 3)* | | | | | | | |
| BIOE | 131 | Ethics | | | | 3 | |

**NOTES**

* This form is available as an Excel file at ughb.stanford.edu. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.

* All courses listed on this form must be taken for a letter grade if offered by the instructor. Minimum Grade Point Average (GPA) for all courses in Engineering Fundamentals and Engineering Depth (combined) is a 2.0.

* All transfer and AP credits must be approved by the SoE Dean's office. Transfer credits in Engineering Depth must be approved by the advisor.

* Read all emails from the Office of Student Affairs; this is the School's only effective method of communicating with you.

1) Mathematics courses must include Math 53 or CME 102 (differential equations) and STAT 110, 141 or CME 106 (probability).

2) Science must include both Chemistry (CHEM 31A+B or 31X or ENGR 31) and Physics with two quarters of course work in each and two courses of BIO core. CHEM 31A and B are considered one course even though given over two quarters. Premeds should take Chemistry, not ENGR 31.

3) BIOE 131 will be offered starting in 2011-12; if you will graduate before 2012, see UGHB, Chap 3, Fig 3-3 for a list of other approved options.

## Bioengineering Major cont.

**Engineering Fundamentals** *(3 courses required)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENGR | 80 | Introd to Bioengineering (same as BIOE 80; req'd) | | | | 3 | |
| ENGR | 70A | Programming Methodology (same as CS 106A; recommended) | | | | 5 | |
| | | Fundamentals Elective; see UGHB for options | | | | | |
| | | | | | *Engineering Fundamentals Total (3 courses required)* | | |

**Engineering Depth** *(25 units; BIOE 101 to 393 will be offered starting in 2010-11)*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| BIOE | 41 | Physical Biology of Macromolecules | | | | 4 | |
| BIOE | 42 | Physical Biology of the Cell | | | | 4 | |
| BIOE | 101 | Systems Biology | | | | 4 | |
| BIOE | 102 | Systems Physiology & Design I | | | | 4 | |
| BIOE | 103 | Systems Physiology & Design II | | | | 4 | |
| BIOE | 141 | Biodesign Project I (See Note 3) | | | | 4 | |
| BIOE | 393 | Bioengineering Dept Research Colloquium | | | | 1 | |
| | | | | | | | |
| | | | | | *Engineering Depth Total* | | |

**BIOE Depth Electives** *(4 courses; minimum 12 units; Premeds see Note 4)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
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| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Engineering Courses (Funds + Depth) Total (48 minimum)* | | |
| | | | | | *Totals from previous page* | | |
| | | | | | *Program Totals* | | |

Advisor

Printed Name: _____ Date: _____

Signature: _____

Department

Printed Name: _____ Date: _____

Signature: _____

School of Engineering Approval *(signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

3) WIM course pending approval; offered 2010-11

4) Students pursuing a pre-med program will need to take additional courses; see BioE 4-Year Plan #3 in the UGHB.

# BIOMECHANICAL ENGINEERING

The Biomechanical Engineering major integrates biology and clinical medicine with engineering mechanics and design. Research and teaching in the Biomechanical Engineering Group are primarily focused on neuromuscular, musculoskeletal, cardiovascular biomechanics, and cell and tissue mechanics. Research in other areas such as hearing, vision, ocean and plant biomechanics, biomaterials, biosensors, and imaging informatics are also conducted in collaboration with associated faculty in medicine, biology, and engineering.

This degree introduces fundamental biological and biophysical principles while developing strengths in traditional engineering areas, specifically mechanical engineering. Primarily geared toward the students' interests, this major offers a plethora of courses for students interested in specific fields of biology and mechanical engineering such as design, biomechanics, and medicine.

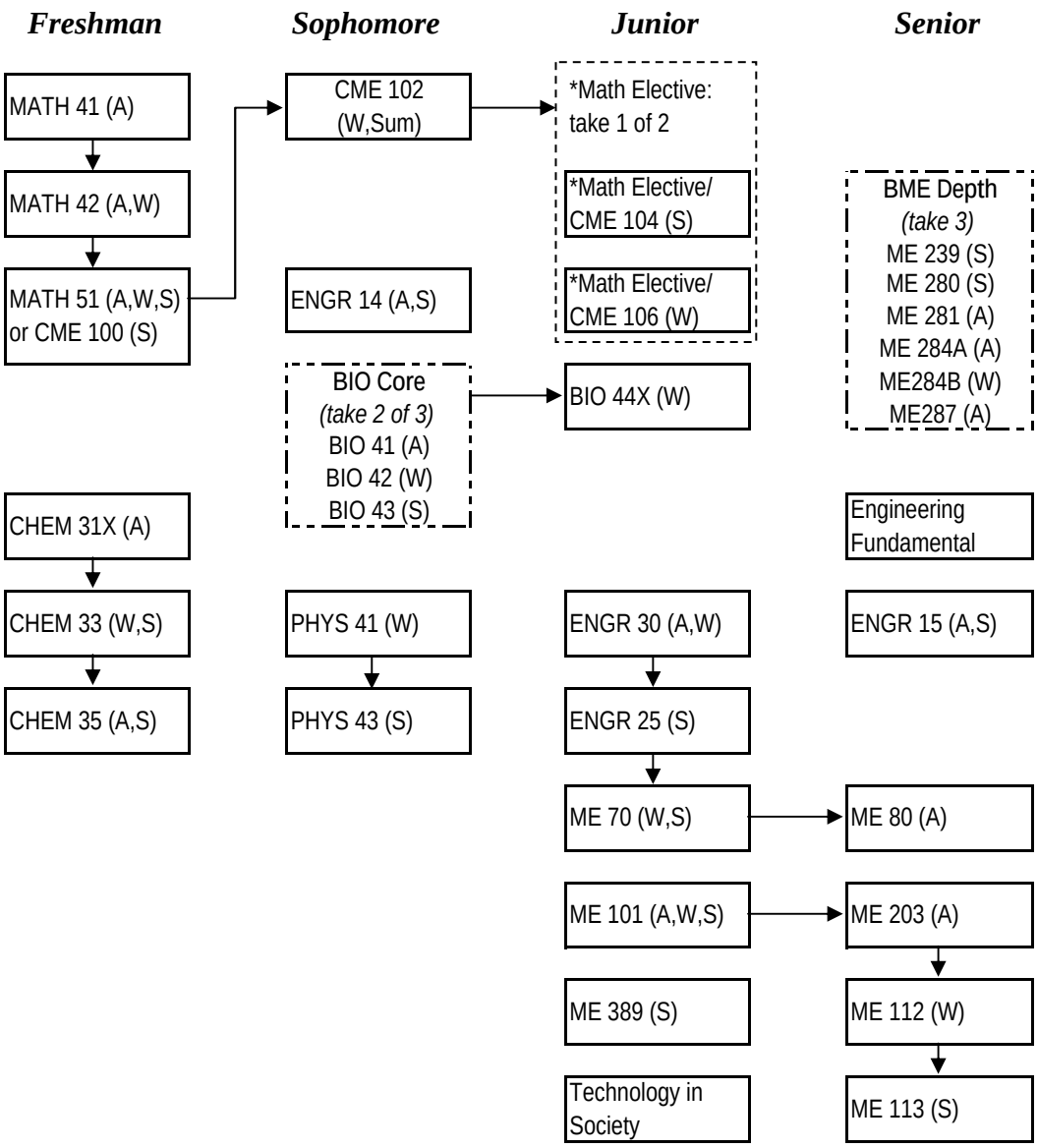
The Biomechanical Engineering major provides a fundamental understanding of mechanics in the fields of biology and medicine. However, it is not normally recommended as a terminal degree. This major is well suited for those interested in future graduate studies in bioengineering, medicine, and related areas. The course of study allows students to satisfy many premedical, pre-dental, or pre-paramedical requirements.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download the online BME program sheet from **`ughb.stanford.edu`** to ensure you are using an accurate major plan

# Biomechanical Engineering

*Typical Sequence of Courses*

Starting with Math 40 Series, Chemistry, Biology, & Design track

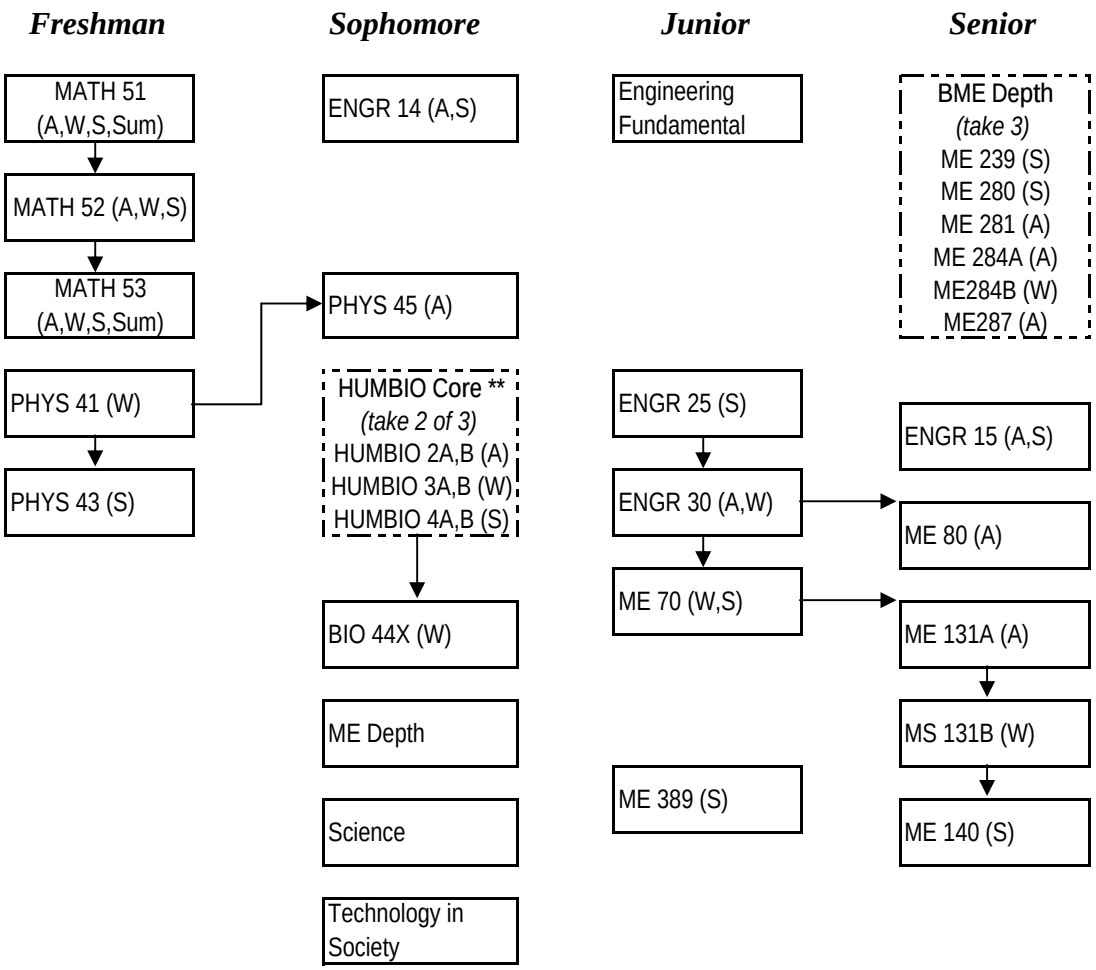



* Arrows represent direct prerequisites
* Dashed-line boxes enclose alternates. These may indicate alternate years in which to take a given course, and/or alternate courses that may be taken at a given time.

# Biomechanical Engineering

*Typical Sequence of Courses*

Starting with Math 50 Series, Physics, HumBio, & Fluids Track




** According to the Human Biology Department, students taking the A series of the HumBio core must take the B series at the same time

* Arrows represent direct prerequisites
* Dashed-line boxes enclose alternates. These may indicate alternate years in which to take a given course, and/or alternate courses that may be taken at a given time.

# Biomechanical Engineering

*4 Year Plan: Starting with MATH 40 series, with Chemistry*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | Writing | | | 4 | MATH 42 | 5 | | | IHUM | | | 4 |
| | IHUM | | | 4 | IHUM | | | 4 | CHEM 33 | 4 | | |
| | CHEM 31A* | 4 | | | CHEM 31B* | 4 | | | Elective | | | 4 |
| | MATH 41 | 5 | | | GER | | | 4 | GER | | | 3 |
| | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *4* | *0* | *11* |
| | Total | | | 17 | Total | | | 17 | Total | | | 15 |
| *Sophomore* | BIO 41 | 5 | | | BIO 42 | 5 | | | BIO 43 | 5 | | |
| | Writing | | | 4 | PHYS 41 | 4 | | | ME101 | | 3 | |
| | CHEM 35 | | 4 | | ENGR 155A | 5 | | | ENGR 14 | | 3 | |
| | CME 100 | 5 | | | | | | | BME Depth | | 3 | |
| | *Subtotals* | *10* | *4* | *4* | *Subtotals* | *14* | *0* | *0* | *Subtotals* | *5* | *9* | *0* |
| | Total | | | 18 | Total | | | 14 | Total | | | 14 |
| *Junior* | ENGR 15 | | 3 | | ENGR 30 | | 3 | | ENGR 25 | | 3 | |
| | ME 203 | | 4 | | ME 70 | | 4 | | Language | | | 5 |
| | ME 103D | | 1 | | BIO 44x | 4 | | | GER | | | 5 |
| | Language | | | 5 | Language | | | 5 | GER | | | 5 |
| | GER | | | 4 | | | | | | | | |
| | *Subtotals* | *0* | *8* | *9* | *Subtotals* | *4* | *7* | *5* | *Subtotals* | *0* | *3* | *15* |
| | Total | | | 17 | Total | | | 16 | Total | | | 18 |
| *Senior* | ME 80 | | 4 | | ME Depth | | 4 | | Elective | | | 4 |
| | BME Depth | | 3 | | BME Depth | | 3 | | GER | | | 5 |
| | ME 389 | | 1 | | GER | | | 4 | Elective | | | 4 |
| | TIS Course | | | 4 | Elective | | | 4 | | | | |
| | *Subtotals* | *0* | *8* | *4* | *Subtotals* | *0* | *7* | *8* | *Subtotals* | *0* | *0* | *13* |
| | Total | | | 12 | Total | | | 15 | Total | | | 13 |

| | |
|---|---|
| Total MATH & Science Units: | 55 |
| Total Engineering Units: | 46 |
| Total Other Units: | 85 |
| Total Units: | 186 |

Notes:

* CHEM 31A/B may be replaced with 31X (accelerated). CHEM 31A is not considered a stand alone course.
* BIO44X fulfills the "Writing in the Major" requirement.
* Students who place out of the language requirement should replace language units with technical electives.

# Biomechanical Engineering

*4 Year Plan: Starting with MATH 40 series, with Physics*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | Writing | | | 4 | MATH 42 | 5 | | | IHUM | | | 4 |
| | IHUM | | | 4 | IHUM | | | 4 | CHEM 33 | 4 | | |
| | MATH 41 | 5 | | | CHEM 31B* | 4 | | | MATH 51 | 5 | | |
| | CHEM 31A* | 4 | | | GER | | | 4 | | | | |
| | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *4* |
| | Total | | | 17 | Total | | | 17 | Total | | | 13 |
| *Sophomore* | BIO 41 | 5 | | | BIO 42 | 5 | | | PHYS 43 | 4 | | |
| | PHYS 45 | 4 | | | PHYS 41 | 4 | | | ENGR 14 | | 3 | |
| | MATH 52 | 5 | | | MATH 53 | 5 | | | BME Depth | | 3 | |
| | Writing | | | 4 | Engr. Fund. | | 3 | | ME Depth | | 3 | |
| | *Subtotals* | *14* | *0* | *4* | *Subtotals* | *14* | *3* | *0* | *Subtotals* | *4* | *9* | *0* |
| | Total | | | 18 | Total | | | 17 | Total | | | 13 |
| *Junior* | ENGR 15 | | 3 | | ENGR 30 | | 3 | | ENGR 25 | | 3 | |
| | ME Depth | | 4 | | ME 70 | | 4 | | Language | | | 5 |
| | Language | | | 5 | BIO 44x | 4 | | | GER | | | 5 |
| | GER | | | 4 | Language | | | 5 | ME Depth | | 3 | |
| | *Subtotals* | *0* | *7* | *9* | *Subtotals* | *4* | *7* | *5* | *Subtotals* | *0* | *6* | *10* |
| | Total | | | 16 | Total | | | 16 | Total | | | 16 |
| *Senior* | ME 80 | | 4 | | ME Depth | | 4 | | Elective | | | 4 |
| | BME Depth | | 3 | | BME Depth | | 3 | | GER | | | 5 |
| | ME 389 | | 1 | | GER | | | 4 | Elective | | | 4 |
| | TIS Course | | | 4 | Elective | | | 4 | | | | |
| | Sci Elective | 4 | | | | | | | | | | |
| | *Subtotals* | *4* | *8* | *4* | *Subtotals* | *0* | *7* | *8* | *Subtotals* | *0* | *0* | *13* |
| | Total | | | 16 | Total | | | 15 | Total | | | 13 |

| | |
|---|---|
| Total MATH & Science Units: | 67 |
| Total Engineering Units: | 47 |
| Total Other Units: | 73 |
| Total Units: | 187 |

Notes:

* CHEM 31A/B may be replaced with 31X (accelerated). CHEM 31A is not considered a stand alone course.
* BIO44X fulfills the "Writing in the Major" requirement.
* Students who place out of the language requirement should replace language units with technical electives.

# Biomechanical Engineering

*4 Year Plan: Starting with CME 100, 102, 104 and BIO Core*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | Writing | | | 4 | CME 102 | | 5 | | IHUM | | | 4 |
| | IHUM | | | 4 | IHUM | | | 4 | CHEM 33 | 4 | | |
| | CME 100 | | 5 | | CHEM 31B* | 4 | | | CME 104 | | 5 | |
| | CHEM 31A* | 4 | | | GER | | | 4 | | | | |
| | *Subtotals* | *4* | *5* | *8* | *Subtotals* | *4* | *5* | *8* | *Subtotals* | *4* | *5* | *4* |
| | Total | | | 17 | Total | | | 17 | Total | | | 13 |
| *Sophomore* | BIO 41 | 5 | | | BIO 42 | 5 | | | PHYS 43 | 4 | | |
| | PHYS 45 | 4 | | | PHYS 41 | 4 | | | ENGR 14 | | 3 | |
| | Writing | | | 4 | Engr. Fund. | | 3 | | BME Depth | | 3 | |
| | | | | | BIO 44x | 4 | | | ME Depth | | 3 | |
| | *Subtotals* | *9* | *0* | *4* | *Subtotals* | *13* | *3* | *0* | *Subtotals* | *4* | *9* | *0* |
| | Total | | | 13 | Total | | | 16 | Total | | | 13 |
| *Junior* | ENGR 15 | | 3 | | ENGR 30 | | 3 | | ENGR 25 | | 3 | |
| | ME Depth | | 4 | | ME 70 | | 4 | | Language | | | 5 |
| | Language | | | 5 | Language | | | 5 | GER | | | 5 |
| | GER | | | 4 | | | | | ME Depth | | 3 | |
| | *Subtotals* | *0* | *7* | *9* | *Subtotals* | *0* | *7* | *5* | *Subtotals* | *0* | *6* | *10* |
| | Total | | | 16 | Total | | | 12 | Total | | | 16 |
| *Senior* | ME 80 | | 4 | | ME Depth | | 4 | | Elective | | | 4 |
| | BME Depth | | 3 | | BME Depth | | 3 | | GER | | | 5 |
| | ME 389 | | 1 | | GER | | | 4 | Elective | | | 4 |
| | TIS Course | | | 4 | Elective | | | 4 | | | | |
| | Sci Elective | 4 | | | | | | | | | | |
| | *Subtotals* | *4* | *8* | *4* | *Subtotals* | *0* | *7* | *8* | *Subtotals* | *0* | *0* | *13* |
| | Total | | | 16 | Total | | | 15 | Total | | | 13 |

| | |
|---|---|
| Total MATH & Science Units: | 42 |
| Total Engineering Units: | 62 |
| Total Other Units: | 73 |
| Total Units: | 177 |

Notes:

* CHEM 31A/B may be replaced with 31X (accelerated). CHEM 31A is not considered a stand alone course.
* BIO44X fulfills the "Writing in the Major" requirement.
* Students who place out of the language requirement should replace language units with technical electives.

# Biomechanical Engineering

*4 Year Plan: Starting with MATH 50 Series and Human Biology Core*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | Writing | | | 4 | MATH 52 | 5 | | | IHUM | | | 4 |
| | IHUM | | | 4 | IHUM | | | 4 | CHEM 33 | 4 | | |
| | MATH 51 | 4 | | | CHEM 31B* | 4 | | | MATH 53 | 5 | | |
| | CHEM 31A* | 5 | | | GER | | | 4 | | | | |
| | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *4* |
| | Total | | | 17 | Total | | | 17 | Total | | | 13 |
| *Sophomore* | HUMBIO 2A | 5 | | | HUMBIO 3A | 5 | | | PHYS 43 | 4 | | |
| | HUMBIO2B | 5 | | | HUMBIO 3B | 5 | | | ENGR 14 | | 3 | |
| | Writing | | | 4 | PHYS 41 | 4 | | | BME Depth | | 3 | |
| | | | | | | | | | ME Depth | | 3 | |
| | *Subtotals* | *10* | *0* | *4* | *Subtotals* | *14* | *0* | *0* | *Subtotals* | *4* | *9* | *0* |
| | Total | | | 14 | Total | | | 14 | Total | | | 13 |
| *Junior* | ENGR 15 | | 3 | | ENGR 30 | | 3 | | ENGR 25 | | 3 | |
| | ME Depth | | 4 | | ME 70 | | 4 | | Language | | | 5 |
| | Language | | | 5 | Language | | | 5 | GER | | | 5 |
| | GER | | | 4 | Bio 44x | 4 | | | ME Depth | | 3 | |
| | *Subtotals* | *0* | *7* | *9* | *Subtotals* | *4* | *7* | *5* | *Subtotals* | *0* | *6* | *10* |
| | Total | | | 16 | Total | | | 16 | Total | | | 16 |
| *Senior* | ME 80 | | 4 | | ME Depth | | 4 | | Elective | | | 4 |
| | BME Depth | | 3 | | BME Depth | | 3 | | GER | | | 5 |
| | ME 389 | | 1 | | GER | | | 4 | Elective | | | 4 |
| | TIS Course | | | 4 | Elective | | | 4 | Sci Elective | 4 | | |
| | Engr. Fund. | | 3 | | | | | | | | | |
| | *Subtotals* | *0* | *11* | *4* | *Subtotals* | *0* | *7* | *8* | *Subtotals* | *4* | *0* | *13* |
| | Total | | | 15 | Total | | | 15 | Total | | | 17 |

| | |
|---|---|
| Total MATH & Science Units: | 63 |
| Total Engineering Units: | 47 |
| Total Other Units: | 73 |
| Total Units: | 183 |

**Notes:**

* CHEM 31A/B may be replaced with 31X (accelerated). CHEM 31A is not considered a stand alone course.
* BIO 44X fulfills the "Writing in the Major" requirement.
* Students who place out of the language requirement should replace language units with technical electives.

# INSTRUCTIONS FOR DECLARING MAJOR IN ENGINEERING: BIOMECHANICAL ENGINEERING (BS-ENGR)

1. Print a copy of your transcript from Axess.
2. Download the BSE:BME program sheet from the School of Engineering web site **(http://ughb.stanford.edu)**. Please make sure to include courses you plan to take as well as those you have already taken. Complete the sheet and attach a ½ page Statement of Purpose.
3. Set up a short appointment with the BME undergraduate coordinator: **bme-ugradsc@lists.stanford.edu** to discuss proposed courses, advisors, etc.
4. Pick up a BME major declaration form from the Student Services Office (Building 530, room 125)
5. Identify an undergraduate program advisor from the list on the back of the major declaration form. If you prefer, the Student Services Office will assign one to you.
6. Discuss the program with your BME advisor and have him/her approve and sign your program sheet and declaration form.
7. Return completed documents (including any transfer credit forms) to the Student Services Office.
8. Login to Axess and formally declare your major. **NOTE: Select "Engineering" as your major** (NOT Mechanical Engineering), **with a subplan in "Biomechanical Engineering"**.
9. E-mail Christine Crapps **(crapps@stanford.edu)** and ask her to approve your declaration

---

Please Print Neatly

Name (Last _____First _____

ID# _____ Email _____

**Declaration Authorization**

Assigned to: _____

Major Advisor Signature _____

Date _____

**DON'T FORGET TO DECLARE IN AXESS! (see step #8)**

**Stanford University ♦ School of Engineering**

# Biomechanical Engineering
# 2009–2010 Program Sheet

**Final version of completed and signed program due to the department no later than one month prior to the last quarter of senior year.**

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____
Email: _____ Local Phone: _____
Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Mathematics (21 units minimum)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics (21 units minimum)* | | |

*Science (22 units minimum, see note 1)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BIO | 44X | Biology Labs (WIM; see note 2) | | | | 4 | |
| Bio/HumBio | | Bio Core/ HumBio A/B Core | | | | 5 | |
| Bio/HumBio | | Bio Core/ HumBio A/B Core | | | | 5 | |
| Chem | 31X | Chemical Principals (see note 3) | | | | 4 | |
| | | | | | | | |
| | | | | | *Science (22 units minimum)* | | |
| | | | | | *Mathematics and Science (43 units minimum)* | | |

## Technology in Society Requirement *(1 course req'd; see UGHB, Chap 3, Fig. 3-3 for SoE approved list)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

## Engineering Fundamentals *(3 courses required - see UGHBChap 3, Fig. 3-4 for SoE approved list*

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| ENGR | 14 | Applied Mechanics: Statics | | | | 3 | |
| ENGR | 25 | Biotechnology | | | | 3 | |
| | | Fundamental Elective | | | | | |

**NOTES**

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.

* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to Engr majors.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Transfer and AP credits in Math, Science, Funamentals, & TIS must be approved by the SoE Dean's office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.

* All courses listed on this form must only be included under one category. Delete courses not taken.

( 1 ) Must include both Chemistry and Physics with a depth (three quarters) in at least one, 2 quarters of HumBio A/B core or Bio core, and Chem31X (see note 3). Please note that a depth in chemistry can be fulfilled with Chem31A,

( 2 ) Fulfills the "Writing in the Major" requirement. Bio44X can be replaced with Bio54

( 3 ) Chem31X can be replaced with ENGR 31, or with two-quarter sequence Chem31A and Chem31B

| **Engineering Depth**: *ME Core (Be advised, no course may be listed twice on this sheet; no double-counting.)* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
| | | | | Initials | Date | | |
| ENGR | 15 | Dynamics | | | | 3 | |
| ENGR | 30 | Engineering Thermodynamics | | | | 3 | |
| ME | 70 | Introductory Fluids Engineering | | | | 4 | |
| ME | 80 | Strength of Materials | | | | 4 | |
| ME | 389 | BioEngineering & BioDesign Forum | | | | 1 | |
| | | | | | *ME Core Units* | | |

*Options to complete ME depth sequence (select 3 courses, min. 9 units; see note 4)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *ME Depth Units (9 units minimum)* | | |

*Options to complete BME depth sequence (select 3 courses, minimum 9 units; see note 5)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *BME Depth Units (9 units minimum)* | | |
| | | | | | *Engineering Depth Unit Totals (33 units minimum)* | | |

*Additional Courses (as needed to bring unit total to 99)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BIO | 44Y | Biology Lab | | | | | |
| Surg | 101 | Introduction to Surgery | | | | | |
| BIO | 112 | Human Physiology | | | | | |
| HumBio | 160 | Human Behavioral Biology | | | | | |
| BIO | 118 | Genetic Analysis of Biological Processes | | | | | |
| BIO | 129A/B | Cellular Dynamics I & II | | | | | |
| BIO | 136 | Evolutionary Paleobiology | | | | | |
| | | | | | *BME Elective Units (as needed)* | | |

**Program Totals**

| | |
|---|---|
| *Mathematics and Science (43 units minimum)* | |
| *Engineering & Fundamentals Depth (42 units minimum)* | |
| *TIS Course + Depth Electives* | |
| *Total Program Units (99 units minimum)* | |

**Program Approvals** *(see note 6)*

*Advisor*
Printed Name: _____ Date: _____
Signature: _____

*Departmental*
Printed Name: _____ Date: _____
Signature: _____

*School of Engineering (signature not required prior to graduation)*
Printed Name: _____ Date: _____
Signature: _____

**NOTES (continued from page 1)**

* Minimum combined grade point average for all courses in Engineering Topics (Engr Funds & Depth) is 2.0

( 4 ) Choose three courses from ME 101, 103D, 105, 112, 113, 131A, 131B, 140, 161, 203, 210, 220

( 5 ) Choose three courses from ME 280, 281, 287, 284A, 284B, 294

( 6 ) Bring completed Program Sheet and 1/2 page Statement of Purpose to the Student Services Office, Bldg. 530, Room 125. This form must be completed and approved by the first quarter of the junior year AND revised (if necessary) by the second quarter of the senior year.

# BIOMEDICAL COMPUTATION

Computational techniques are now being used to ask and answer fundamental questions in biology and medicine in ways never before possible. The Biomedical Computation (BMC) major allows students to focus on this exciting interdisciplinary field – the use of advanced computational techniques in biology and medicine.

BMC is an IDP, or interdisciplinary program, with its home in the School of Engineering. Students who major in BMC will gain a rigorous foundation in the many component fields that go into biomedical computation, including computer science, math and statistics, biology, and chemistry. Each student then has the opportunity to pursue one of four tracks most suited to his or her interests.

Our graduates have gone on to pursue a wide range of paths after graduation. Many of our students have chosen to continue their studies and pursue advanced degrees in various fields, including bioinformatics, bioengineering, or any of the pure biological or computational sciences. We have also had a number of students enroll in medical school or MD/PhD programs. BMC graduates have also ended up in fields a bit farther away from biomedical computation, such as law school, management consulting, and others. BMC gives students a solid foundation in a number of different fields, and students have the ability to pursue a variety of career paths in any of the fields that make up the major.

## COMPONENTS OF BMC:

### BMC Core: Math, Science, Engineering Fundamentals, and TIS

All BMC students take courses to get a solid foundation in the component disciplines of biomedical computation. Most of these courses are typically taken during freshman and sophomore year. These courses include:

**Math**: Math 41, 42, Stat116 (or equivalent), and one additional math course specific to your track.

**Chemistry**: Chem31A+B *or* X; Chem 33

**Biology:** BIO Core or Human Biology Core (each is a 3-quarter sequence, ideally taken in sophomore year)

**Physics:** Physics 41

**Computer Science:** CS 107; CS106B or X; CS107; CS 161

**Engineering Fundamentals**: CS 106 (see above) plus one additional elective (see Chapter 3, Figure 3-4 for list of SoE approved courses)

**Technology in Society (TIS):** One course required; see list of SoE approved courses in Chapter 3, Figure 3-3. HUMBIO 174, Foundations of Bioethics (3 units, Wtr, prerequisite of Humbio core), is an option to fulfill this requirement only for BMC majors.

Please see the program sheets for the exact course list.

### Tracks

For the upper division courses in the major, a student must choose between one of the four tracks of BMC. The four tracks are

**Informatics**
**Simulation**
**Cellular/Molecular**
**Organs/Organ Systems**

Two of the tracks, Informatics and Simulation, put a bit more emphasis on the computational aspects of the discipline, while the other two, Cellular/Molecular and Organs/Organ Systems, provide more depth in biology.

Each of the tracks consists of a core of about three to five courses. These are courses that provide students the core knowledge related to their in-depth area of study. The tracks also have elective requirements, to ensure students gain breadth in upper division courses as well. The entire track portion of BMC is composed of nine to ten courses in total. Lists of electives can be found on the BMC website at **`bmc.stanford.edu`**.

**BMC Depth: Research, Writing in the Major, and Capstone Class**

**Research**: Every BMC student must complete 6 units of directed research under a faculty member. This requirement of research is fairly unique to BMC among majors at Stanford. It allows our students to work on cutting-edge projects as a part of their undergraduate curriculum. This research typically occurs during the junior or senior year, and may be undertaken with faculty members from any School at Stanford. The main requirement is that the student be doing actual, hands-on biomedical computation as a part of the research project. The student must get approval from the BMC Program Directors before undertaking his or her research project.

**WIM**: The Writing in the Major requirement gives students an opportunity to learn to effectively communicate ideas in their fields of study. In BMC, there are two ways to satisfy this requirement:

1. Students may fulfill the WIM requirement by writing a ~15 page technical report concurrently with performing the research for the research requirement. This report is in the form of a technical publication about the students work, and is completed under supervision of your research mentor and the School of Engineering writing tutors. For this option, student can either 1) Enroll in least 3 of the 6 research units as CS191W, or 2) enroll in 5 units of research and 1 unit of E199W.
2. Students wishing to satisfy their WIM requirement independently of their research work may enroll in CS272.

**Capstone Class**: The BMC Capstone class gives students the chance to take a rigorous course that thoroughly integrates various aspects of biology and computation. This course is typically taken during junior or senior year. Currently, this requirement is satisfied by one of the following courses: CS270, CS273A, CS274, CS275, CS278, or CS279

## ADVISING IN BMC

There are two types of advisors for the major: an academic advisor and a research advisor. The academic advisor is the person who oversees your path through BMC. In is necessary to have found an academic advisor in order to declare the major. Because BMC is in the School of

Engineering, the student's academic advisor must have an appointment in the School of Engineering. The one major commitment that this advisor makes in BMC that is different from other majors is that, in the case that the BMC student has trouble finding a research mentor, the academic advisor agrees that the student can work in his or her lab to fulfill the BMC research requirement.

The other advisor is the research mentor. Because there is interesting biomedical computation work being done throughout Stanford, not just in the School of Engineering, we place no restrictions as to where within Stanford the faculty mentor conducts his or her research. It is not necessary to have a research advisor at the time of declaring; many of our students do not.

One question we often get is whether it is possible or advisable for the student's academic and research advisor to be the same person. We do not have an opinion either way on this – plenty of students have chosen to do research with their academic advisor and plenty have done their research with a different faculty member. Either way is fine by us.

For additional information about the major, and for step-by-step instructions on how to declare, please visit the BMC website at **`http://bmc.stanford.edu.`** If you have further questions, please contact the student advisor for the major, Amit Kaushal, at **`akaushal@stanford.edu`**.

## PROGRAM OPTIONS

**If I do BMC can I also…**

*Be Premed?*

Yes. This requires taking about six additional chemistry, physics, and biology lab courses. While we can offer some advice here, it is important to talk to a premed advisor to cover which additional courses you need to take.

*Study abroad?*

Absolutely! Though the major requirements are many, it is quite possible to go abroad. The earlier you start planning, the easier this will be.

*Do an Honor thesis?*

No. The BMC subplan lives under the School of Engineering, which does not grant honors. However, you will be doing a significant amount of research, and you can satisfy your WIM requirement by writing a thesis-like report on that research.

*Do an additional major or minor in something else?*

Yes. While the major is demanding, some students have managed to squeeze in other areas of study as well. Some students have asked about double-majoring or minoring in Computer Science or Biology. It does not make much sense to do so, since the BMC major has a large number of courses from these departments already. BMC majors can tailor their curriculum so that they are quite well trained in either of these disciplines.

*Coterm?*

Absolutely. Stanford offers students the opportunity to study an additional year or so and obtain a coterminal Master's degree. Many of our students have gone on to coterm in various departments at Stanford. Please contact the department in which you wish to coterm in your junior year – requirements vary from department to department, and this will leave enough time to plan for the application process and the courses you might have to take before enrolling.

### MAJOR REQUIREMENTS FOR ALL BMC TRACKS:

See chart on next page for course requirements for all four tracks. For the most up-to-date information on BMC courses, go to **`http://bmc.stanford.edu`**

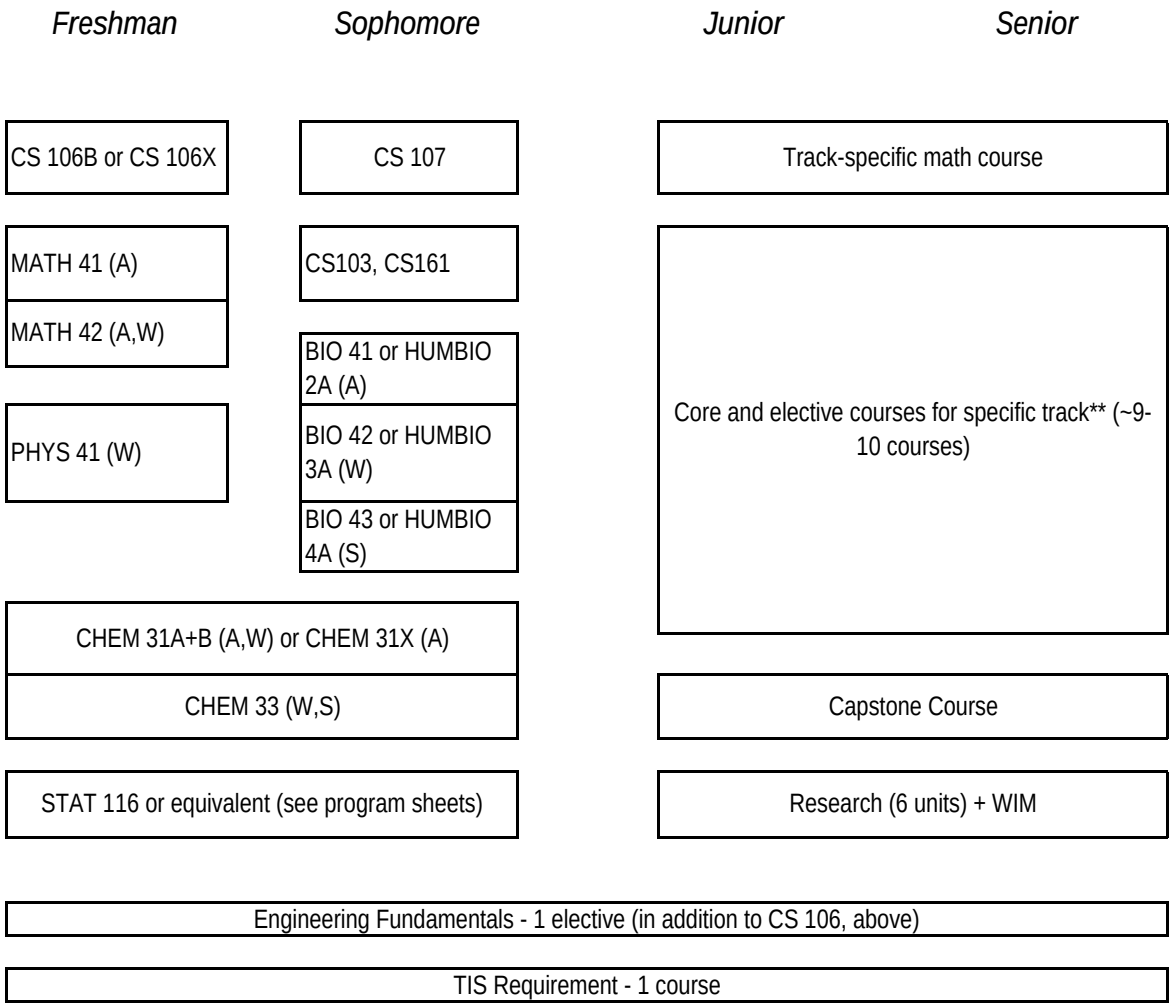
**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download an online BMC program sheet from **`ughb.stanford.edu`** to ensure you are using an accurate major plan

| | Informatics | Simulation | Cellular/Molecular | Organs/Organisms |
|---|---|---|---|---|
| **SoE: Math Requirement** | Math 41: Calculus | | | |
| | Math 42: Calculus | | | |
| | CS109 or Stat116 or MS&E120 or MS&E220 or EE178 or CME106: Probability | | | |
| | CS103: Mathematical Foundations of Computing | | | |
| | CS161: Data Structures and Algorithms | | | |
| | STAT141 or STAT 203 or STAT 205 or STAT 215 or STAT 225: Advanced Statistics/Biostatistics | CME100 or MATH 51: Advanced Calculus I | CME100, MATH 51, or STAT 141: Advanced Calculus or Biostatistics | CME100, MATH 51, or STAT 141: Advanced Calculus or Biostatistics |
| **SoE: Science Requirement** | Physics 41: Mechanics | | | |
| | CHEM 31A and B, or CHEM 31X: Chemical Principles (regular or accelerated) | | | |
| | CHEM 33: Structure and Reactivity | | | |
| | BIO 41 or HUMBIO 2A: Biology or Human Biology Core I | | | |
| | BIO 42 or HUMBIO 3A: Biology or Human Biology Core II | | | |
| | BIO 43 or HUMBIO 4A: Biology or Human Biology Core III | | | |
| **SoE: TIS** | Technology in Society: 1 course; see UGHB, Fig. 3-3 for approved list | | | |
| **SoE: Engineering Fundamentals** | CS106B or CS106X: Programming Abstractions | | | |
| | Any additional fundamental | E30: Thermodynamics | Any additional fundamental | Any additional fundamental |
| | | | | |
| **BMC Depth: Additional BMC Core requirements** | CS107: Programming Paradigms | | | |
| | Capstone Class: One of CS270, CS273A, CS274, CS275, CS278, or CS279 | | | |
| | Independent Research: 6 units, any department | | | |
| | CS191W, E199W, or CS272: Writing in the Major (see note 1) | | | |
| **BMC Depth: Track Core and Elective Requirements** | CS145: Databases or CS147: HCI | CME102 or MATH 52: Advanced Calculus II | BIO129A: Cell Bio I | BIO112: Physiology |
| | CS121 or 221, or CS228 or CS229 or CS 223B (AI/Machine Learning) | CME 104 or Math 53: Advanced Calculus III | BIO129B: Cell Bio II | BIO188 or BIOE/Rad200: Biochemistry or Intro to Imaging |
| | One additional course from the Informatics core (CS145, 147, 121, 221, 228, 229 or 223B) | PHYS 43 or 45: Electricity and Magnetism, or Light/Heat | BIO188 or CHEM135 or CHEM171: Biochemistry or Physical Chemistry | Organs Elective |
| | Informatics Elective | One of: E14, E15, or ME80 | BIO203 or 118: Genetics | Organs Elective |
| | Informatics Elective | One more of: E14, E15, or ME80 | Informatics Elective | Informatics Elective |
| | Informatics Elective | Simulation Elective | Informatics Elective | Informatics Elective |
| | Cell/Mol Elective | Simulation Elective | Simulation Elective | Simulation Elective |
| | Cell/Mol Elective | Cell/Mol Elective | Simulation Elective | Simulation Elective |
| | Organs Elective | Organs Elective | Inf, Sim, or Cell/Mol Elec. | Inf, Sim, or Organs Elec. |
| | Organs Elective | | | |

(1) Students may fulfill Writing in the Major and research requirements with E199W or CS191W, or they may take CS272 to fulfill WIM only. See program sheet for details

# Biomedical Computation

*Typical Sequence of Courses*




*The CS, Math, Stat, Chem, and BIO courses listed under freshman and sophomore year tend to be prerequisites for the upper-division core and elective courses in the major. Thus, it is worth taking these courses during the first two years of study if possible.

** For complete details about courses for each of the BMC tracks, visit bmc.stanford.edu.

# Biomedical Computation

*Molecular and Cellular*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | CS107 | - | 5 | - |
| | CHEM 31X | 4 | - | - | CHEM 33 | 4 | - | - | STAT 116 | 5 | - | - |
| | CS106A | - | 4 | - | CS106B | - | 4 | - | | | | |
| | *Subtotals* | *9* | *4* | *0* | *Subtotals* | *9* | *4* | *0* | *Subtotals* | *5* | *5* | *0* |
| | Total | | | 13 | Total | | | 13 | Total | | | 10 |
| *Sophomore* | BIO 41 | 5 | - | - | BIO 42 | 5 | - | - | BIO 43 | 5 | - | - |
| | CS103 | - | 5 | - | CS161 | - | 4 | - | | | | |
| | STAT 141 | 4 | - | - | PHYS 41 | 4 | - | - | | | | |
| | *Subtotals* | *9* | *5* | *0* | *Subtotals* | *9* | *4* | *0* | *Subtotals* | *5* | *0* | *0* |
| | Total | | | 14 | Total | | | 13 | Total | | | 5 |
| *Junior* | Info Elective | - | 3 | - | BIO 129A | 4 | - | - | BIO 129B | 4 | - | - |
| | E30 | - | 3 | - | BIO 188 | 5 | - | - | Simul elct | - | 3 | - |
| | E130 | - | 4 | - | BMI 210 | - | 3 | - | | | | |
| | *Subtotals* | *0* | *10* | *0* | *Subtotals* | *9* | *3* | *0* | *Subtotals* | *4* | *3* | *0* |
| | Total | | | 10 | Total | | | 12 | Total | | | 7 |
| *Senior* | Genetics 203 | 4 | - | - | CS/ME191 | - | 3 | - | CS/ME191W | - | 3 | - |
| | Elective | - | - | 3 | Info elective | - | 3 | - | Simul elct | - | 3 | - |
| | *Subtotals* | *4* | *0* | *3* | *Subtotals* | *0* | *6* | *0* | *Subtotals* | *0* | *6* | *0* |
| | Total | | | 7 | Total | | | 6 | Total | | | 6 |

| | |
|---|---|
| Total Math & Science Units: | 63 |
| Total Engineering Units: | 50 |
| Total Other Units: | 3 |
| Total Units: | 116 |

# Biomedical Computation

*Organs and Organisms*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | CS107 | - | 5 | - |
| | CHEM 31X | 4 | - | - | CHEM 33 | 4 | - | - | STAT 116 | 5 | - | - |
| | CS106A | - | 4 | | CS106B | - | 4 | - | | | | |
| | *Subtotals* | *9* | *4* | *0* | *Subtotals* | *9* | *4* | *0* | *Subtotals* | *5* | *5* | *0* |
| | Total | | | 13 | Total | | | 13 | Total | | | 10 |
| *Sophomore* | BIO 41 | 5 | - | - | BIO 42 | 5 | - | - | BIO 43 | 5 | - | - |
| | CS103 | - | 5 | - | CS161 | - | 4 | - | | | | |
| | MATH 51 | 5 | - | - | PHYS 53 | 4 | - | - | | | | |
| | *Subtotals* | *10* | *5* | *0* | *Subtotals* | *9* | *4* | *0* | *Subtotals* | *5* | *0* | *0* |
| | Total | | | 15 | Total | | | 13 | Total | | | 5 |
| *Junior* | ENGR 30 | - | 3 | - | BIO 112 | 4 | - | - | Elective | 3 | - | - |
| | Organs elect | 3 | - | - | BIO 188 | 5 | - | - | Simul elct | - | 3 | - |
| | | | | | CS 201 | - | 4 | - | | | | |
| | *Subtotals* | *3* | *3* | *0* | *Subtotals* | *9* | *4* | *0* | *Subtotals* | *3* | *3* | *0* |
| | Total | | | 6 | Total | | | 13 | Total | | | 6 |
| *Senior* | Info Elective | - | 3 | - | CS/ME191 | - | 3 | - | CS/ME191W | - | 3 | - |
| | Simul elct | - | 3 | - | BMI 210 | - | 3 | - | Info elective | - | 3 | - |
| | *Subtotals* | *0* | *6* | *0* | *Subtotals* | *0* | *6* | *0* | *Subtotals* | *0* | *6* | *0* |
| | Total | | | 6 | Total | | | 6 | Total | | | 6 |

| | |
|---|---|
| Total Math & Science Units: | 62 |
| Total Engineering Units: | 50 |
| Total Other Units: | 0 |
| Total Units: | 112 |

# Biomedical Computation

*Simulation*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | ENGR 14 | - | 3 | - |
| | CHEM 31X | 4 | - | - | CHEM 33 | 4 | - | - | PHYS 43 | 3 | - | - |
| | CS106X | - | 5 | - | PHYS 41 | 4 | - | - | MATH 51 | 5 | - | - |
| | *Subtotals* | *9* | *5* | *0* | *Subtotals* | *13* | *0* | *0* | *Subtotals* | *8* | *3* | *0* |
| | Total | | | 14 | Total | | | 13 | Total | | | 11 |
| *Sophomore* | BIO 41 | 5 | - | - | BIO 42 | 5 | - | - | BIO 43 | 5 | - | - |
| | ENGR 15 | - | 3 | - | ENGR155A | - | 5 | - | ENGR155B | - | 5 | - |
| | ENGR 30 | - | 3 | - | | | | | | | | |
| | *Subtotals* | *5* | *6* | *0* | *Subtotals* | *5* | *5* | *0* | *Subtotals* | *5* | *5* | *0* |
| | Total | | | 11 | Total | | | 10 | Total | | | 10 |
| *Junior* | CS107 | - | 5 | - | Simul Elct | - | 3 | - | Simul Elct | - | 3 | - |
| | CS103 | - | 5 | - | BIO Elective | 3 | - | - | BIO Elective | 3 | - | - |
| | | | | | CS161 | - | 4 | - | STAT 116 | 5 | - | - |
| | *Subtotals* | *0* | *10* | *0* | *Subtotals* | *3* | *7* | *0* | *Subtotals* | *8* | *3* | *0* |
| | Total | | | 10 | Total | | | 10 | Total | | | 11 |
| *Senior* | BMI 210 | - | 3 | - | ME 191 | - | 3 | - | ME 191W | - | 3 | - |
| | | | | | CS 201 | - | 4 | - | | | | |
| | *Subtotals* | *0* | *3* | *0* | *Subtotals* | *0* | *7* | *0* | *Subtotals* | *0* | *3* | *0* |
| | Total | | | 3 | Total | | | 7 | Total | | | 3 |

| | |
|---|---|
| Total Math & Science Units: | 56 |
| Total Engineering Units: | 57 |
| Total Other Units: | 0 |
| Total Units: | 113 |

# Biomedical Computation

*Informatics (early)*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | CS107 | - | 5 | - |
| | CHEM 31X | 4 | - | - | CHEM 33 | 4 | - | - | ENGR 62 | - | 4 | - |
| | CS106X | - | 5 | - | PHYS 41 | 4 | - | - | STAT 116 | 5 | - | - |
| | *Subtotals* | *9* | *5* | *0* | *Subtotals* | *13* | *0* | *0* | *Subtotals* | *5* | *9* | *0* |
| | Total | | | 14 | Total | | | 13 | Total | | | 14 |
| *Sophomore* | BIO 41 | 5 | - | - | BIO 42 | 5 | - | - | BIO 43 | 5 | - | - |
| | CS103 | - | 5 | - | CS161 | - | 4 | - | CS145 | - | 4 | - |
| | STAT 141 | 4 | - | - | CS 201 | - | 4 | - | | | | |
| | *Subtotals* | *9* | *5* | *0* | *Subtotals* | *5* | *8* | *0* | *Subtotals* | *5* | *4* | *0* |
| | Total | | | 14 | Total | | | 13 | Total | | | 9 |
| *Junior* | CS147 | - | 4 | - | Cellular Elct | 3 | - | - | Info Elective | - | 3 | - |
| | CS 221 | - | 4 | - | Info Elective | - | - | - | Organs Elct | 3 | - | - |
| | *Subtotals* | *0* | *8* | *0* | *Subtotals* | *3* | *0* | *0* | *Subtotals* | *3* | *3* | *0* |
| | Total | | | 8 | Total | | | 3 | Total | | | 6 |
| *Senior* | Info Elective | - | 3 | - | CS191 | - | 3 | - | Cellular Elct | 3 | - | - |
| | BMI 210 | - | 3 | - | Organs Elct | 3 | - | - | CS191W | - | 3 | - |
| | | | | | Info Elective | - | 3 | - | | | | |
| | *Subtotals* | *0* | *6* | *0* | *Subtotals* | *3* | *6* | *0* | *Subtotals* | *3* | *3* | *0* |
| | Total | | | 6 | Total | | | 9 | Total | | | 6 |

| | |
|---|---|
| Total Math & Science Units: | 58 |
| Total Engineering Units: | 57 |
| Total Other Units: | 0 |
| **Total Units:** | 115 |

# Biomedical Computation

*Informatics (late)*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | | | | |
| | | | | | PHYS 41 | 4 | - | - | | | | |
| | *Subtotals* | *5* | *0* | *0* | *Subtotals* | *9* | *0* | *0* | *Subtotals* | *0* | *0* | *0* |
| | Total | | | 5 | Total | | | 9 | Total | | | 0 |
| *Sophomore* | STAT 116 | 5 | - | - | CS103 | - | 5 | - | CS161 | - | 4 | - |
| | CHEM 31X | 4 | - | - | CHEM 33 | 4 | - | - | CS107 | - | 5 | - |
| | CS106A | - | 4 | | CS106B | - | 4 | - | ENGR 62 | - | 4 | - |
| | *Subtotals* | *9* | *4* | *0* | *Subtotals* | *4* | *9* | *0* | *Subtotals* | *0* | *13* | *0* |
| | Total | | | 13 | Total | | | 13 | Total | | | 13 |
| *Junior* | BIO 41 | 5 | - | - | BIO 42 | 5 | - | - | BIO 43 | 5 | - | - |
| | STAT 141 | 4 | - | - | CS 201 | - | 4 | - | CS145 | - | 4 | - |
| | CS147 | - | 4 | - | CS121 | - | 3 | - | Info Elective | - | 3 | - |
| | *Subtotals* | *9* | *4* | *0* | *Subtotals* | *5* | *7* | *0* | *Subtotals* | *5* | *7* | *0* |
| | Total | | | 13 | Total | | | 12 | Total | | | 12 |
| *Senior* | Cellular Elct | 3 | - | - | CS191 | - | 3 | - | Organs Elct | 3 | - | - |
| | BMI 210 | - | 3 | - | Cellular Elct | 3 | - | - | CS191W | - | 3 | - |
| | Organs Elct | 3 | - | - | Info elective | - | 3 | - | Info Elective | - | 3 | - |
| | *Subtotals* | *6* | *3* | *0* | *Subtotals* | *3* | *6* | *0* | *Subtotals* | *3* | *6* | *0* |
| | Total | | | 9 | Total | | | 9 | Total | | | 9 |

| | |
|---|---|
| Total Math & Science Units: | 58 |
| Total Engineering Units: | 59 |
| Total Other Units: | 0 |
| **Total Units:** | 117 |

# INSTRUCTIONS FOR DECLARING MAJOR IN ENGINEERING: BIOMEDICAL COMPUTATION (BS-ENGR)

1. Gather information about the major by talking to students and professors.
2. Design a 4-year plan based on the samples previous pages.
3. Print a copy of your transcript from Axess.
4. Select an advisor (choose from the list of faculty listed under "BMC Faculty Advisors" on the BMC website at **`http://bmc.stanford.edu`**).
5. Download the BSE:BMC program sheet from the School of Engineering web site (**`http://ughb.stanford.edu`**).
6. Meet with your advisor to review the 4-year plan
7. Based on your plan, fill out your program sheet
8. Meet with either Prof. Russ Altman or Prof. Daphne Koller to get approval; have them sign your program sheet.
9. Turn in your completed and signed Program Sheet, 4-Year Plan, and an unofficial Stanford transcript to Darlene Lazar in Terman 201. She will review for completion. You must then declare your major in Axess:
    a. Select "Engineering" as your Major
    b. Select "BMC" as your subplan
    c. Ask Darlene (**`dlazar@stanford.edu`**) to approve your major in PeopleSoft
10. When your major is approved, Darlene will notify you via email.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook went to press in August 2009, download the online BMC program sheet from **`ughb.stanford.edu`** to ensure you are using an accurate major plan.

**Stanford University ♦ School of Engineering**

# Biomedical Computation - Informatics Track
# 2009–2010 Program Sheet

***Final version of completed and signed program due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (21 units minimum)* | | | | | | | |
| MATH | 41 | Calculus | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS109 or Stat116 or MS&E120 or MS&E220 or | | Probability | | | | | |
| CS | 103 | Mathematical Foundations of Computing | | | | 5 | |
| CS | 161 | Data Structures and Algorithms | | | | 4 | |
| Stat141, Stat203, Stat205, Stat215 OR Stat225 | | Advanced Statistics or Biostatistics | | | | | |
| | | | | | *Mathematics Unit Total (21 units minimum)* | | |

*Science (17 units minimum)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PHYS | 41 | Mechanics | | | | 4 | |
| CHEM 31A&B or 31X | | Chemical Principles (regular or accelerated | | | | | |
| CHEM | 33 | Structure & Reactivity | | | | 4 | |
| BIO41 or HumBio2A | | Biology or Human Biology Core I | | | | 5 | |
| BIO42 or HumBio3A | | Biology or Human Biology Core II | | | | 5 | |
| BIO43 or HumBio4A | | Biology or Human Biology Core III | | | | 5 | |
| | | | | | *Science Unit Total (17 units minimum)* | | |
| | | | | | *Math + Science Total (41 units minimum)* | | |

**Technology in Society Requirement** (1 course required; see UGHB, Fig. 3-3 for approved list)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**Engineering Fundamentals** (2 courses required)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CS | 106B or X | Programming Abstractions | | | | 5 | |
| | | Elective (see note 1) | | | | | |
| | | | | | *Engineering Fundamentals Total* | | |

**NOTES**

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.

* Read all emails from the Office of Student Affairs; this is the School's only effective mehtod of communicating with you.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Combined Grade Point Average for all courses in the major (combined) is 2.0.

* Transfer & AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's office. Transfer credits in Engr Depth must be approved by the Advisor. Information & petitions at http://ughb.stanford.edu/

* All courses listed on this form must only be included under one category. Delete courses not taken.

1 One course required, 3 to 5 units. See Engineering Fundamentals list in UGHB.

**BMC Depth** *(42 units minimum; see note 2)*

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Units | Grade |
|---|---|---|---|---|---|---|---|
| **Additional BMC Core requirements** | | | | | | | |
| CS | 107 | Programming Paradigms | | | | 5 | |
| CS270, CS273A, CS274, CS275, CS278, or CS279 | | Capstone Class - select one | | | | | |
| (any department) | | Independent Research (see note 3) | | | | 6 | |
| CS191W, E199W, or CS272 | | WIM (if not already satisfied by Independent Research - see note 3) | | | | | |
| ***Track Core (3 courses required)*** | | | | | | | |
| CS145 or CS147 | | Databases or Human-Computer Interaction | | | | 4 | |
| CS121 or 221, or CS228, or CS229, or CS223B | | Artificial Intelligence/Machine Learning | | | | | |
| (additional course from above) | | One additional course from Infromatics track core (see previous two lines) | | | | | |
| ***Track Depth (7 courses required)*** | | | | | | | |
| *Informatics Electives (3 courses required: see note 4)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| *Cellular/Molecular Electives (2 courses required: see note 4)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| *Organs/Organisms Electives (2 courses required: see note 4)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |

*BMC Depth Total (Total of all units on this page) (42 units minimum)*

**Program Totals**

| | |
|---|---|
| *Mathematics and Science (41 units minimum)* | |
| *BMC Depth Total (Total of all units on this page) (42 units minimum)* | |
| *Engineering (Fundamentals + Depth) Units (see note 2) (40 units minimum)* | |

## Program Approvals

*Advisor*
Printed Name: _____ Date: _____
Signature: _____

*Departmental*
Printed Name: _____ Date: _____
Signature: _____

*School of Engineering (signature not required prior to graduation)*
Printed Name: _____ Date: _____
Signature: _____

**NOTES (continued from page 1)**

( 2 ) 40 units of engineering courses are required, to be met through the Engr Fundamentals and BMC Depth courses.

( 3 ) Students must complete 6 units of BMC research in any department, with project approval from BMC program coordinators. Research can satisfy WIM if student enrolls in CS191W or E199W. See bmc.stanford.edu for details.

( 4 ) The list of electives is continually updated to include all applicable courses. For the current list of electives, please visit http://bmc.stanford.edu. Electives may only be listed once on program sheet; no double-counting.

**Stanford University ♦ School of Engineering**

# Biomedical Computation - Simulation Track
# 2009–2010 Program Sheet

***Final version of completed and signed program due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requiremens**

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (21 units minimum)* | | | | | | | |
| MATH | 41 | Calculus | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS109 or Stat116 or MS&E120 or MS&E220 or | | Probability | | | | | |
| CS | 103 | Mathematical Foundations of Computing | | | | 5 | |
| CS | 161 | Data Structures and Algorithms | | | | 4 | |
| CME100 or Math51 | | Advanced Calculus I | | | | 5 | |
| | | | | | *Mathematics Unit Total (21 units minimum)* | 24 | |
| *Science (17 units minimum)* | | | | | | | |
| PHYS | 41 | Mechanics | | | | 4 | |
| CHEM 31A&B or CHEM 31X | | Chemical Principles (regular sequence or accelerated) | | | | 8 or 4 | |
| CHEM | 33 | Structure & Reactivity | | | | 4 | |
| BIO41 or HumBio2A | | Biology or Human Biology Core I | | | | 5 | |
| BIO42 or HumBio3A | | Biology or Human Biology Core II | | | | 5 | |
| BIO43 or HumBio4A | | Biology or Human Biology Core III | | | | 5 | |
| | | | | | *Science Unit Total (17 units minimum)* | | |
| | | | | | *Math + Science Total (41 units minimum)* | | |

**Technology in Society Requirement** (1 course required; see UGHB, Fig. 3-3 for approved list)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**Engineering Fundamentals** (2 courses required)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CS | 106B or X | Programming Abstractions | | | | 5 | |
| ENGR | 30 | Eng. Thermodynamics | | | | 3 | |
| | | | | | *Engineering Fundamentals Total* | | |

**NOTES**

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.
* Read all emails from the Office of Student Affairs; this is the School's only effective mehtod of communicating with you.
* All courses listed on this form must be taken for a letter grade if offered by the instructor.
* Minimum Combined Grade Point Average for all courses in the major (combined) is 2.0.
* Transfer & AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's office. Transfer credits in Engr Depth must be approved by the Advisor. Information & petitions at http://ughb.stanford.edu/
* All courses listed on this form must only be included under one category. Delete courses not taken.

*program sheet continues on page 2*

**BMC Depth** *(42 units minimum; see note 2)*

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Additional BMC Core requirements** | | | | | | | |
| CS | 107 | Programming Paradigms | | | | 5 | |
| CS270, CS273A, CS274, CS275, CS278, or CS279 | | Capstone Class - select one | | | | | |
| (any department) | | Independent Research (see note 3) | | | | 6 | |
| CS191W, E199W, or CS272 | | WIM (if not already satisfied by Independent Research - see note 3) | | | | | |
| ***Track Core (5 courses required)*** | | | | | | | |
| CME102 or Math52 | | Advanced Calculus II | | | | 5 | |
| CME104 or Math53 | | Advanced Calculus III | | | | 5 | |
| Physics 43 or 45 | | Electricity/Magnetism or Light/Heat | | | | 4 | |
| E14, E15, or ME80 | | Statics or Dynamics or Stress/Strain | | | | 3 | |
| E14, E15, or ME80 | | (do not repeat from previous) | | | | | |
| ***Track Depth (4 courses required)*** | | | | | | | |
| *Simulation Electives (2 courses required: see note 4)* | | | | | | | |
| | | | | | | 3 | |
| | | | | | | 3 | |
| *Cellular/Molecular Elective (1 course required: see note 4)* | | | | | | | |
| | | | | | | 3 | |
| *Organs/Organ Systems Elective (1 courses required: see note 4)* | | | | | | | |
| | | | | | | 3 | |
| | | *BMC Depth Total (Total of all units on this page) (42 units minimum)* | | | | | |

**Program Totals**

| | |
|---|---|
| *Mathematics and Science (41 units minimum)* | |
| *BMC Depth Total (Total of all units on this page) (42 units minimum)* | |
| *Engineering (Fundamentals + Depth) Units (see note 2) (40 units minimum)* | |

## Program Approvals

*Advisor*
Printed Name: _____ Date: _____
Signature: _____

*Departmental*
Printed Name: _____ Date: _____
Signature: _____

*School of Engineering (signature not required prior to graduation)*
Printed Name: _____ Date: _____
Signature: _____

**NOTES (continued from page 1)**

( 2 ) 40 units of engineering courses are required, to be met through the Engr Fundamentals and BMC Depth courses.

( 3 ) Students must complete 6 units of BMC research in any department, with project approval from BMC program coordinators. Research can satisfy WIM if student enrolls in CS191W or E199W. See bmc.stanford.edu for details.

( 4 ) The list of electives is continually updated to include all applicable courses. For the current list of electives, please visit http://bmc.stanford.edu. Electives may only be listed once on program sheet; no double-counting.

**Stanford University ♦ School of Engineering**

# Biomedical Computation - Cellular/Molecular Track
# 2009–2010 Program Sheet

***Final version of completed and signed program due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Mathematics (21 units minimum)* | | | | | | | |
| MATH | 41 | Calculus | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS 109 or STAT 116 or MS&E 120 or MS&E 220 or EE 178 or CME 106 | | Probability | | | | | |
| CS | 103 | Mathematical Foundations of Computing | | | | 5 | |
| CS | 161 | Data Structures and Algorithms | | | | 4 | |
| CME100, MATH 51, or STAT 141 | | Advanced Calculus or Biostatistics | | | | 5 | |
| | | | | | *Mathematics Unit Total (21 units minimum)* | | |
| *Science (17 units minimum)* | | | | | | | |
| PHYS | 41 | Mechanics | | | | 4 | |
| CHEM 31A&B or 31X | | Chemical Principles (regular seq. or accelerated) | | | | | |
| CHEM | 33 | Structure & Reactivity | | | | 4 | |
| BIO41 or HumBio2A | | Biology or Human Biology Core I | | | | 5 | |
| BIO42 or HumBio3A | | Biology or Human Biology Core II | | | | 5 | |
| BIO43 or HumBio4A | | Biology or Human Biology Core III | | | | 5 | |
| | | | | | *Science Unit Total (17 units minimum)* | | |
| | | | | | *Math + Science Total (41 units minimum)* | | |

**Technology in Society Requirement** (1 course required; see UGHB, Fig. 3-3 for approved list)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**Engineering Fundamentals** (2 courses required)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CS | 106B or X | Programming Abstractions | | | | 5 | |
| | | Elective (see note 1) | | | | | |
| | | | | | *Engineering Fundamentals Total* | | |

**NOTES**

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.

* Read all emails from the Office of Student Affairs; this is the School's only effective mehtod of communicating.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Combined Grade Point Average for all courses in the major (combined) is 2.0.

* Transfer & AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's office. Transfer credits in Engr Depth must be approved by the Advisor. Information & petitions at http://ughb.stanford.edu/

* All courses listed on this form must only be included under one category. Delete courses not taken.

( 1 ) One course required, 3 to 5 units. See Engineering Fundamentals list in UGHB.

**BMC Depth** *(42 units minimum; delete courses not taken. See note 2)*

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Additional BMC Core requirements** | | | | | | | |
| CS | 107 | Programming Paradigms | | | | 5 | |
| CS270, CS273A, CS274, CS275, CS278, or CS279 | | Capstone Class - select one | | | | | |
| (any department) | | Independent Research (see note 3) | | | | 6 | |
| CS191W, E199W, or CS272 | | WIM (if not already satisfied by Independent Research - see note 3) | | | | | |
| ***Track Core (4 courses required)*** | | | | | | | |
| BIO | 129A | Cellular Dynamics I | | | | 4 | |
| BIO | 129B | Cellular Dynamics II | | | | 4 | |
| BIO 188 or CHEM 135 or 171 | | Biochemistry or Physical Chemistry | | | | 3 | |
| BIO 203 or 118 | | Genetics | | | | | |
| ***Track Depth (5 courses required)*** | | | | | | | |
| *Informatics Electives (2 courses required: see note 4)* | | | | | | | |
| | | | | | | 3 | |
| | | | | | | 3 | |
| *Simulation Electives (2 courses required: see note 4)* | | | | | | | |
| | | | | | | 3 | |
| | | | | | | 3 | |
| *Informatics, Simulation, or Cell/Mol Elective (1 courses required: see note 4)* | | | | | | | |
| | | | | | | 3 | |
| | | *BMC Depth Total (Total of all units on this page) (42 units minimum)* | | | | | |

**Program Totals**

| | |
|---|---|
| *Mathematics and Science (41 units minimum)* | |
| *BMC Depth Total (Total of all units on this page) (42 units minimum)* | |
| *Engineering (Fundamentals + Depth) Units (see note 2) (40 units minimum)* | |

**Program Approvals**

*Advisor*
Printed Name: _____ Date: _____
Signature: _____

*Departmental*
Printed Name: _____ Date: _____
Signature: _____

*School of Engineering (signature not required prior to graduation)*
Printed Name: _____ Date: _____
Signature: _____

**NOTES (continued from page 1)**

( 2 ) 40 units of engineering courses are required, to be met through the Engr Fundamentals and BMC Depth courses.

( 3 ) Students must complete 6 units of BMC research in any department, with project approval from BMC program coordinators. Research can satisfy WIM if student enrolls in CS191W or E199W. See bmc.stanford.edu for details.

( 4 ) The list of electives is continually updated to include all applicable courses. For the current list of electives, please visit http://bmc.stanford.edu. Electives may only be listed once on program sheet; no double-counting.

**Stanford University ♦ School of Engineering**

# Biomedical Computation - Organs and Organisms Track
# 2009–2010 Program Sheet

***Final version of completed and signed program due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Mathematics (21 units minimum)* | | | | | | | |
| MATH | 41 | Calculus | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS109 or Stat116 or MS&E120 or MS&E220 or EE178 or CME106 | | Probability | | | | | |
| CS | 103 | Mathematical Foundations of Computing | | | | 5 | |
| CS | 161 | Data Structures and Algorithms | | | | 4 | |
| CME100, Math51, or Stat141 | | Advanced Calculus or Biostatistics | | | | 5 | |
| | | *Mathematics Unit Total (21 units minimum)* | | | | | |
| *Science (17 units minimum)* | | | | | | | |
| PHYS | 41 | Mechanics | | | | 4 | |
| CHEM 31A&B or 31X | | Chemical Principles (regular seq. or accelerated) | | | | | |
| CHEM | 33 | Structure & Reactivity | | | | 4 | |
| BIO41 or HumBio2A | | Biology or Human Biology Core I | | | | 5 | |
| Bio42 or HumBio3A | | Biology or Human Biology Core II | | | | 5 | |
| Bio43 or HumBio4A | | Biology or Human Biology Core III | | | | 5 | |
| | | *Science Unit Total (17 units minimum)* | | | | | |
| | | *Math + Science Total (41 units minimum)* | | | | | |

**Technology in Society Requirement** (1 course required; see UGHB, Fig. 3-3 for approved list)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**Engineering Fundamentals** (2 courses required)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CS | 106B or X | Programming Abstractions | | | | 5 | |
| | | Elective (see note 1) | | | | | |
| | | *Engineering Fundamentals Total* | | | | | |

**NOTES**

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.

* Read all emails from the Office of Student Affairs; this is the School's only effective mehtod of communicating.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Combined Grade Point Average for all courses in the major (combined) is 2.0.

* Transfer & AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's office. Transfer credits in Engr Depth must be approved by the Advisor. Information & petitions at http://ughb.stanford.edu/

* All courses listed on this form must only be included under one category. Delete courses not taken.

1 One course required, 3 to 5 units. See Engineering Fundamentals list in Chapter 3 of UGHB.

**BMC Depth** *(42 units minimum; see note 2)*

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Additional BMC Core requirements** | | | | | | | |
| CS | 107 | Programming Paradigms | | | | 5 | |
| CS270, CS273A, CS274, CS275, CS278, or CS279 | | Capstone Class - select one | | | | | |
| (any department) | | Independent Research (see note 3) | | | | 6 | |
| CS191W, E199W, or CS272 | | WIM (if not already satisfied by Independent Research - see note 3) | | | | | |
| ***Track Core (2 courses required)*** | | | | | | | |
| BIO | 112 | Human Physiology | | | | 4 | |
| BIO 188 or BioE/Rad 220 | | Biochemistry or Introduction to Imaging | | | | 3 | |
| ***Track Depth (6 courses required)*** | | | | | | | |
| *Organs/Organ Systems Elective (2 courses required: see note 4)* | | | | | | | |
| | | | | | | 3 | |
| | | | | | | 3 | |
| *Informatics Electives (2 courses required: see note 4)* | | | | | | | |
| | | | | | | 3 | |
| | | | | | | 3 | |
| *Simulation Electives (2 courses required: see note 4)* | | | | | | | |
| | | | | | | 3 | |
| | | | | | | 3 | |
| *Informatics, Simulation, or Organs/Organ Systems Elective (1 course required: see note 4)* | | | | | | | |
| | | | | | | 3 | |
| | | | | | *BMC Depth Total (Total of all units on this page) (42 units minimum)* | | |

**Program Totals**

| | |
|---|---|
| *Mathematics and Science (41 units minimum)* | |
| *BMC Depth Total (Total of all units on this page) (42 units minimum)* | |
| *Engineering (Fundamentals + Depth) Units (see note 2) (40 units minimum)* | |

## Program Approvals

*Advisor*
Printed Name: _____ Date: _____
Signature: _____

*Departmental*
Printed Name: _____ Date: _____
Signature: _____

*School of Engineering (signature not required prior to graduation)*
Printed Name: _____ Date: _____
Signature: _____

**NOTES (continued from page 1)**

( 2 ) 40 units of engineering courses are required, to be met through the Engr Fundamentals and BMC Depth courses.

( 3 ) Students must complete 6 units of BMC research in any department, with project approval from BMC program coordinators. Research can satisfy WIM if student enrolls in CS191W or E199W. See bmc.stanford.edu for details.

( 4 ) The list of electives is continually updated to include all applicable courses. For the current list of electives, please visit http://bmc.stanford.edu. Electives may only be listed once on program sheet; no double-counting.

# CHEMICAL ENGINEERING

## — ABET ACCREDITATION CRITERIA APPLY —

Chemical Engineering is a discipline that relates to numerous areas of technology. In broad terms, chemical engineers are responsible for the conception and design of processes for the purpose of production, transformation, and transport of biochemicals, chemicals, energy, and materials. More recently, chemical engineers are increasingly involved in the design of new products that are enabled by emerging process technologies. These activities begin with experimentation in the laboratory and are followed by implementation of the technology to full-scale production. The mission of the Chemical Engineering department at Stanford is to provide professional training, development, and education for the next generation of leaders in chemical sciences and engineering.

The large number of industries that depend on the synthesis and processing of chemicals and materials place the chemical engineer in great demand. In addition to traditional examples such as the chemical, energy and oil industries, opportunities in biotechnology, pharmaceuticals, electronic materials and device fabrication, and environmental engineering are increasing. The unique training of the chemical engineer becomes essential in these areas whenever processes involve the chemical or physical transformation of matter. For example, chemical engineers working in the chemical industry investigate the creation of new polymeric materials with important electrical, optical, or mechanical properties. This requires attention not only to the synthesis of the polymer, but also to the flow and forming processes necessary to create a final product. In biotechnology, chemical engineers have responsibilities in the design of production processes and facilities to use microorganisms and enzymes to synthesize new drugs. Chemical engineers also solve environmental problems by developing technology and processes, such as catalytic converters and effluent treatment facilities, to minimize the release of products harmful to the environment.

To carry out these activities, the chemical engineer requires a complete and quantitative understanding of both the scientific and engineering principles underlying these technological processes. This is reflected in the curriculum of the chemical engineering department, which includes the study of applied mathematics, material and energy balances, thermodynamics, fluid mechanics, energy and mass transfer, separations technologies, chemical reaction kinetics and

reactor design, biochemical engineering and process design. Courses are built on a foundation in the sciences of chemistry, physics, and biology.

The individual student's mathematics and science course preparation for the chemical engineering major depends on his or her previous background in these areas. Following are six sequences or 4-year plans. Each starts at a different point but all six plans conclude with the same in-the-major depth requirements.

*Programs with the recommended engineering math (CME) courses*:

#1A Little preparation in math and chemistry: This plan starts with MATH 19, 20, 21, and CHEM 31A & 31B.

#1B Little preparation in math; strong chemistry: This plan starts with MATH 19, 20, 21 and CHEM 31X.

#2 No AP math credits, prepared to start with MATH 40 series, then move to CME math series. Strong chemistry preparation; start with CHEM 31X.

#3 AP math credits, prepared to start with the CME math series, which is recommended instead of the MATH 50 series. Start with CHEM 31X.

#4 Same preparation as 3, but with a degree goal of a B.S. with Honors in Chemical Engineering. Honors Program by application only; see departmental student services. This plan is for students interested in an in-depth research experience in addition to the normal coursework for the major.

Alternative programs with MATH 50 series courses (require and additional 5 units of math):

#5 No AP math credits, starting with MATH 40 series and continuing preparation with MATH 50 series.

#6 AP math credits for MATH 40 series; start with MATH 50 series.

Our departmental website is at **http://cheme.stanford.edu/** and that of our student chapter of the American Institute of Chemical Engineers is at **http://www.stanford.edu/group/aiche/**. Our faculty, staff, and students would be glad to talk with you about majoring in Chemical Engineering. If you would like more information about this major, please contact our departmental student services staff in Keck Science Building, room 189. Alternatively, you may phone (650-723-1302) or email Jeanne Cosby at **cosby@stanford.edu**.

## OBJECTIVES AND OUTCOMES FOR CHEMICAL ENGINEERING

**Objectives:**

1. Principles and Skills: Provide a basic understanding of chemical engineering principles along with analytical problem-solving and communication skills necessary to succeed in diverse careers, including chemical engineering practice and academic research.
2. Preparation for Changing and Diverse Practice: Prepare students for successful practice in a field whose focus is constantly changing and growing with a long-term perspective that takes into account new tools, new means of dispersing and controlling information, new focus areas such as biotechnology and molecular engineering, and increasingly complex professional and societal expectations.
3. Preparation for Graduate Study: Prepare students for graduate study coupled with short-term and/or long-term career research in the chemical sciences and chemical engineering.
4. Preparation for Service: Prepare and develop students' skills, awareness, and background to become responsible citizens, employees, and leaders in our communities and in the field of chemical science.

**Outcomes:**

(a) A proficiency in and ability to apply knowledge of engineering, mathematics through differential equations, probability and statistics, and science including physics, chemistry, and biology.

(b) An ability to design and conduct experiments, as well as to analyze and interpret data

(c) An ability to design a system, component, or process to meet desired needs

(d) An ability to function on multi-disciplinary teams

(e) An ability to identify, formulate, and solve engineering problems

(f) An understanding of professional and ethical responsibility

(g) An ability to communicate effectively

(h) The broad education necessary to understand the impact of engineering solutions in a global and societal context

(i) A recognition of the need for, and an ability to engage in life-long learning

(j) A knowledge of contemporary issues

(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

(l) Background for admission to engineering or other professional graduate programs

# REQUIREMENTS: CHEMICAL ENGINEERING PROGRAM

| Course | Title | Engr. Sci. | Engr. Dsgn. | Expr. | Total | Qtr. | Year |
|---|---|---|---|---|---|---|---|
| **Mathematics and Science (47-53 Units)** | | | | | | | |
| MATH 41 | Single Variable Calculus | - | - | - | 5 | A | Fr |
| MATH 42 | Single Variable Calculus | - | - | - | 5 | A,W | Fr |
| CME 100* *or* Math 51 AND 52 | Vector Calculus for Engineers | | | | 5 | A | Fr, So |
| CME 102* *or* Math 53 | Ordinary Differential Eqs for Engineers | - | - | - | 5 | W, S | Fr, So |
| CME 104 *or*<br>CME 106<br>(1 of 2 req'd) | Linear Algebra & Partial Diff Eqs for ENGRs<br>Intro to Probability and Statistics for Engineers | | | | 5<br><br>4 | S<br><br>W | So/Jr<br><br>So/Jr |
| CHEM 31X or CHEM 31A & B | Chemical Principles (req'd) or Chemical Principles I & II | - | - | - | 4 | A<br>A&W | Fr |
| CHEM 33 | Structure and Reactivity (req'd) | - | - | - | 4 | W, S | Fr |
| CHEM 35 | Organic Monofunctional Compounds (req'd) | - | - | - | 4 | A, S | Fr |
| CHEM 36 | Organic Chemistry Laboratory I (req'd) | - | - | 2 | 3 | S | Fr |
| PHYS 41 | Mechanics (req'd) | - | - | - | 4 | W | So |
| PHYS 43 | Electricity & Magnetism (req'd) | - | - | - | 4 | S | So |
| ***CME 100 and 102 are the recommended math courses for ChemE majors* | | | | | | | |
| **Technology in Society (3-5 units) (select one course from the approved list; see Chap 3, Figure 3-3)** | | | | | | | |
| **Engineering Fundamentals (3 courses minimum)** | | | | | | | |
| ENGR 20 | Introduction to Chemical Engineering | 2 | 1 | - | 3 | S | Fr/So |
| ENGR 25 | Biotechnology | 2 | 1 | - | 3 | S | Fr/So |
| *Plus one or more additional course(s) (see Chapter 3, Figure 3-4 for list)* | | | | | | | |
| **Engineering Depth (60 units; Note: Engr. Sci/Engr.Design units, that is, columns 1 & 2 from Fundamentals and Depth combined, must equal a minimum of 68 units in order to meet ABET graduation requirements)** | | | | | | | |
| CHEMENG 10 | The Chemical Engineering Profession | - | - | - | 1 | A | Sr |
| CHEMENG 100 | Chem. Process Modeling, Dynamics | 3 | - | - | 3 | A | Jr |
| CHEMENG 110 | Equilibrium Thermodynamics (03-04: Spr) | 3 | - | - | 3 | W | Jr |
| CHEMENG 120A | Fluid Mechanics | 3 | 1 | - | 4 | W | Jr |
| CHEMENG 120B | Energy & Mass Transport | 3 | 1 | - | 4 | S | Jr |
| CHEMENG 130 | Separation Processes | 2 | 1 | - | 3 | S | Jr |
| CHEMENG 150 | Biochemical Engineering | 2 | 1 | - | 3 | A | Sr |
| CHEMENG 140<br>*and/or* CHEMENG 160<br>*Or either*<br>CHEMENG 174 *or*<br>CHEMENG 183<br>*2 of 3 options req'd* | Micro & Nanoscale Fabrication Engineering<br>Polymer Science & Engineering<br><br>Environmental Microbiology I<br>Biochemistry II | 2<br>2<br>-<br>2<br>3 | 1<br>1<br>-<br>1<br>- | -<br>-<br>-<br>-<br>- | 3<br>3<br>-<br>3<br>3 | S<br>W<br>-<br>A<br>S | Sr<br><br><br>Sr<br>Jr |
| CHEMENG 170 | Kinetics and Reactor Design | 2 | 1 | - | 3 | A | Sr |
| CHEMENG 180 | Chemical Engineering Plant Design | - | 3 | - | 3 | S | Sr |
| CHEMENG 181 | Biochemistry I | 3 | 0 | 0 | 3 | W | Jr |
| CHEMENG 185A | Chem Engr Lab A (*satisfies WIM)* | 2 | 2 | 4 | 4 | A | Sr |
| CHEMENG 185B | Chemical Engineering Lab B | 2 | 2 | 4 | 4 | W | Sr |
| CHEM 130 | Organic Chemistry Laboratory II | 4 | - | 4 | 4 | A,W | So |
| CHEM 131 | Organic Polyfunctional Compounds | 2 | - | 1 | 3 | A,W | So |
| CHEM 171 | Physical Chemistry – Chemical Thermodynamics | 3 | - | - | 3 | A | Jr |
| CHEM 173 | Physical Chemistry – Quantum Chemistry | 3 | - | - | 3 | W | Jr |
| CHEM 175 | Physical Chemistry – Kinetic Theory & Statistical Mechanics | 3 | - | - | 3 | S | Jr |

# INSTRUCTIONS FOR FINDING OUT MORE ABOUT THE DEPARTMENT OF CHEMICAL ENGINEERING

1. Contact Chemical Engineering Student Services. To make an appointment, with the student services manager, send an email to Jeanne Cosby, **cosby@Stanford.edu**. Alternatively, drop-in visits are encouraged, especially between 2:00 and 4:00 p.m. in Keck Science Building, room 189. We encourage you to let the department know that you are considering the major so we can give you an opportunity to ask questions and get more information about chemical engineering, our advising program, internship and research opportunities, and so forth.
2. Participate in the annual ChemE advising workshop the first week of classes, autumn quarter.
3. Attend quarterly departmental advising sessions.
4. Meet one-on-one with chemical engineering faculty and/or students.

# Chemical Engineering

*4-Year Plan #1A: CHEM 31A & B (instead of CHEM 31X) and MATH 19, 20, 21 series. Then CME 100, 102, and CME 104 or 106.*
**** Note: Final Program MUST have 68 ABET units for Engineering Science and Engineering Design. ****

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 19 | 3 | - | - | MATH 20 | 3 | - | - | MATH 21 | 4 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | GER | - | - | 3 | Writing | - | - | 4 | CHEM 33 | 4 | - | - |
| | CHEM 31A* | 4 | - | - | CHEM 31B* | 4 | - | - | CHEM 36 | 3 | - | - |
| | *Subtotals* | *7* | *0* | *7* | *Subtotals* | *7* | *0* | *8* | *Subtotals* | *11* | *0* | *4* |
| | Total | | | 14 | Total | | | 15 | Total | | | 15 |
| *Sophomore* | CME 100 | 5 | - | - | CME 102 | 5 | - | - | ENGR 20 ** | - | 3 | - |
| | TIS (alt.) *** | - | - | - | Engr. Fund. | - | 4 | - | ENGR 25 ** | - | 3 | - |
| | CHEM 35 | 4 | - | - | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | CHEM 130 | 4 | - | - | Writing | - | - | 4 | ENGR math elec | 5 | - | - |
| | *Subtotals* | *13* | *0* | *0* | *Subtotals* | *9* | *4* | *4* | *Subtotals* | *9* | *6* | *0* |
| | Total | | | 13 | Total | | | 17 | Total | | | 15 |
| *Junior* | CHEMENG 100 | - | 3 | - | CHEMENG 110 | - | 3 | - | CHEMENG 130 | - | 3 | - |
| | CHEM 131 | - | 3 | - | CHEMENG 120A | - | 4 | - | CHEMENG 120B | - | 4 | - |
| | CHEM 171 | - | 3 | - | CHEM 173 | - | 3 | - | CHEM 175 | - | 3 | - |
| | TIS *** (alt.) | | | | CHEMENG 181 | - | 3 | - | CHEMENG 183 | - | 3 | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | | | | | ENGR math elec | | | | | | | |
| | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *0* | *13* | *5* | *Subtotals* | *0* | *13* | *5* |
| | Total | | | 14 | Total | | | 18 | Total | | | 18 |
| *Senior* | CHEMENG 150 | - | 3 | - | CHEMENG 160 | - | 3 | - | CHEMENG 140 | - | 3 | - |
| | CHEMENG 170 | - | 3 | - | GER | - | - | 3 | CHEMENG 180 | - | 3 | |
| | CHEMENG 185A | - | 4 | - | CHEMENG 185B | - | 3 | - | GER | - | - | 5 |
| | CHEMENG 10 | - | 1 | - | GER | - | - | 3 | GER | - | - | 3 |
| | TIS course *** | - | - | 4 | TIS *** (alt.) | - | - | - | | | | |
| | CHEMENG 174 | - | - | - | | | | | | | | |
| | *Subtotals* | *0* | *11* | *4* | *Subtotals* | *0* | *6* | *6* | *Subtotals* | *0* | *6* | *8* |
| | Total | | | 15 | Total | | | 12 | Total | | | 14 |

| | |
|---|---|
| AP Math Units: | 0 |
| UG Math & Science Units: | 56 |
| Total Engineering Units: | 68 |
| Total Other Units: | 56 |
| Total Units: | 180 |

*Notes:*

*CHEMENG 181 (formerly 188) required (Win)*
*CHEMENG 150 (Aut) required*
*Both CHEMENG 185A and 185B required*

* If prepared, take CHEM 31X (Aut), CHEM 33 (Win), and CHEM 35, 36 (Spr)

** ENGR/CHEMENG 20 "Introduction to Chemical Engineering" and ENGR/CHEMENG 25 "Biotechnology"

*** TIS course in 2nd, 3rd, or 4th year

- ENGR math elective, one of two: CME 104 (5 units) or CME 106 (4 units).
- ChE elective, two of three choices: CHEMENG 140 (Spr.) and/or 160 (Win.) and/or either 174 (Aut) or 183 (Win)
- Students' choices for Math elective, 3rd Engineering Fundamental, and CHEMENG electives affect choices, units, and scheduling of GER courses and other courses not required for the ChemE major.

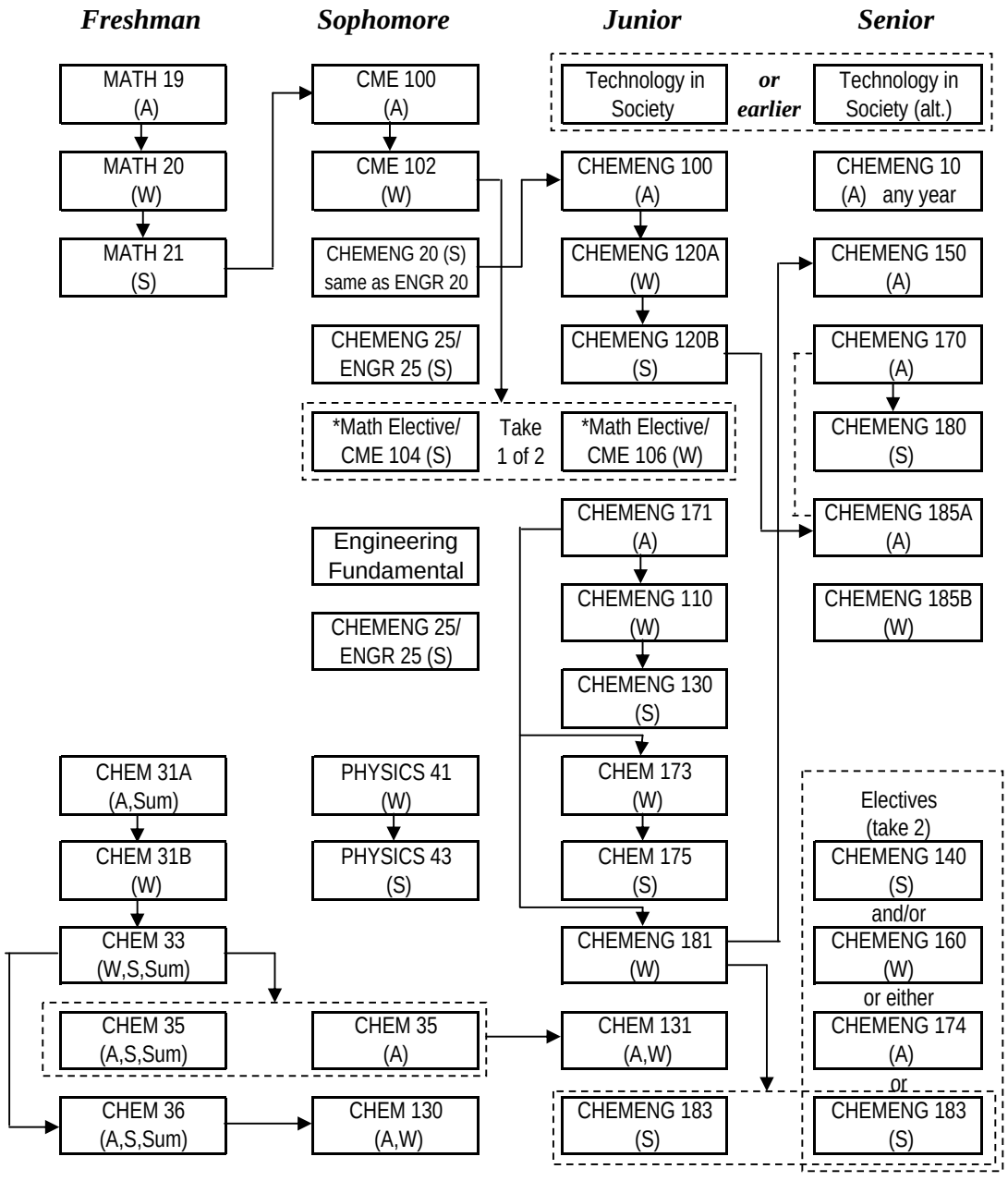
# Chemical Engineering

*Typical Sequence of Courses*

4-Year Plan # 1-A

MATH 19, 29, 21 series; then CME 100, 102, and Engineering Math Elective (CME 104 or CME 106)

Plan 1-A = CHEM 31A and CHEM 31B, instead of CHEM 31X




* Solid arrows represent direct prerequisites.
* Dashed lines represent co-requisites.
* Dashed-line boxes enclose alternatives.These may indicate years in which to take a given course or different courses that may fulfill a degree requirement.

# Chemical Engineering

*4-Year Plan # 1-B: CHEM 31X (instead of CHEM 31A & B) and MATH 19, 20, 21 series. Then CME 100, 102, and 104 or 106*

**** Note: Final Program MUST have 68 ABET units for Engineering Science and Engineering Design. ****

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 19 | 3 | - | - | MATH 20 | 3 | - | - | MATH 21 | 4 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | GER | - | - | 3 | Writing | - | - | 4 | CHEM 35 | 4 | - | - |
| | CHEM 31X | 4 | | | CHEM 33 | 4 | - | - | CHEM 36 | 3 | - | - |
| | *Subtotals* | *7* | *0* | *7* | *Subtotals* | *7* | *0* | *8* | *Subtotals* | *11* | *0* | *4* |
| | Total | | | 14 | Total | | | 15 | Total | | | 15 |
| *Sophomore* | CME 100 | 5 | - | - | CME 102 | 5 | - | - | ENGR 20 ** | | 3 | - |
| | TIS *** (alt.) | | | | Writing | - | - | 4 | ENGR 25 ** | | 3 | - |
| | CHEM 130 | - | 4 | - | PHYSICS 41 | 4 | | - | PHYSICS 43 | 4 | - | - |
| | Engr. Fund. | | 4 | - | GER | - | - | 3 | ENGR math elec | 5 | | - |
| | *Subtotals* | *5* | *8* | *0* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *6* | *0* |
| | Total | | | 13 | Total | | | 16 | Total | | | 15 |
| *Junior* | CHEMENG 100 | - | 3 | - | CHEMENG 110 | - | 3 | - | CHEMENG 130 | - | 3 | - |
| | CHEM 131 | - | 3 | - | CHEMENG 120A | - | 4 | - | CHEMENG 120B | - | 4 | - |
| | CHEM 171 | - | 3 | - | CHEM 173 | - | 3 | - | CHEM 175 | - | 3 | - |
| | TIS *** (alt) | | | | CHEMENG 181 | - | 3 | | CHEMENG 183 | - | 3 | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | | - | - | - | ENGR math elec | - | - | - | Elective | - | - | - |
| | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *0* | *13* | *5* | *Subtotals* | *0* | *13* | *5* |
| | Total | | | 14 | Total | | | 18 | Total | | | 18 |
| *Senior* | CHEMENG 150 | - | 3 | - | CHEMENG 160 | - | 3 | - | CHEMENG 140 | - | 3 | - |
| | CHEMENG 170 | - | 3 | - | GER | - | - | 3 | CHEMENG 180 | - | 3 | |
| | CHEMENG 185A | - | 4 | - | CHEMENG 185B | - | 4 | | GER | - | - | 5 |
| | CHEMENG 10 | - | 1 | - | GER | - | - | 3 | Elective | - | - | 3 |
| | TIS course *** | - | - | 4 | TIS *** (alt) | - | - | - | | | | |
| | CHEMENG 174 | | | | | | | | | | | |
| | *Subtotals* | *0* | *11* | *4* | *Subtotals* | *0* | *7* | *6* | *Subtotals* | *0* | *6* | *8* |
| | Total | | | 15 | Total | | | 13 | Total | | | 14 |

| | |
|---|---|
| AP Math Units: | 0 |
| UG Math & Science Units: | 48 |
| Total Engineering Units: | 73 |
| Total Other Units: | 59 |
| Total Units: | 180 |

*Notes:*

*CHEMENG 181 (formerly 188) required (Win)*

*CHEMENG 150 (Aut) required*

*Both CHEMENG 185A and 185B required*

** ENGR/CHEMENG 20 "Introduction to Chemical Engineering" and ENGR/CHEMENG 25 "Biotechnology"

*** TIS course in 2nd, 3rd, or 4th year

- ENGR math elective, one of two: CME 104 (5 units) or CME 106 (4 units).
- ChE elective, two of three choices: CHEMENG 140 (Spr.) and/or 160 (Win.) and/or either 174 (Aut) or 183 (Win)
- Students' choices for Math elective, 3rd Engineering Fundamental, and CHEMENG electives affect choices, units, and scheduling of GER courses and other courses not required for the ChemE major.

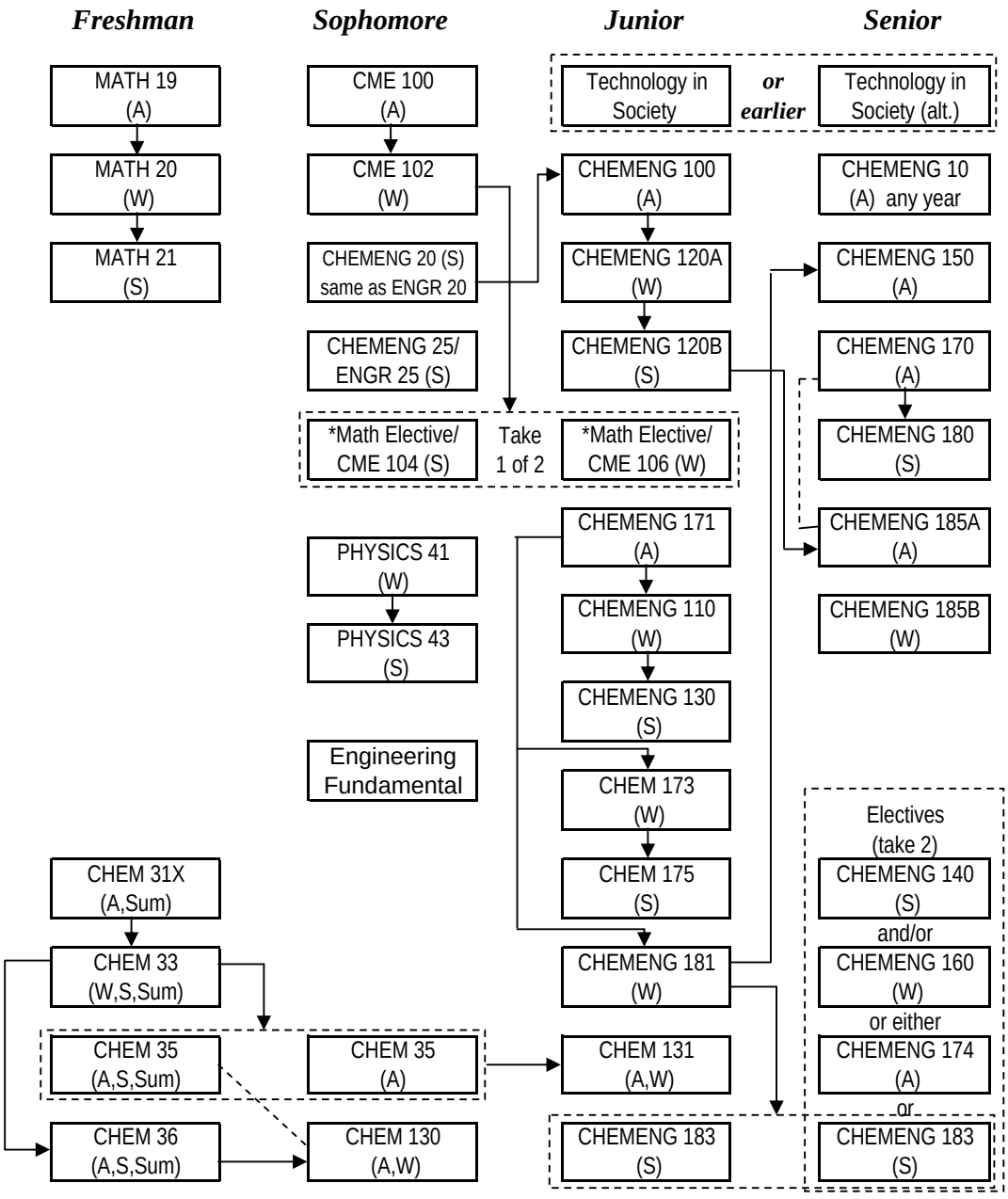
# Chemical Engineering

*Typical Sequence of Courses*

4-Year Plan # 1-B

MATH 19, 29, 21 series; then CME 100, 102, and Engineering Math Elective (CME 104 or CME 106)

Plan 1-B = CHEM 31X instead of CHEM 31A and CHEM 31B




* Solid arrows represent direct prerequisites.
* Dashed lines represent co-requisites.
* Dashed-line boxes enclose alternatives.These may indicate years in which to take a given course or different courses that may fulfill a degree requirement.

# Chemical Engineering

*4-Year Plan # 2 — A RECOMMENDED PLAN — MATH 40 series; then CME 100 and 102. Then CME 104 or 106*

**** Note: Final Program MUST have 68 ABET units for Engineering Science and Engineering Design. ****

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | ENGR 20 ** | - | 3 | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | ENGR 25 ** | - | - | - |
| | CHEM 31X | 4 | | | CHEM 33 | 4 | - | - | IHUM | - | - | 4 |
| | | | | | Writing | - | - | 4 | CHEM 35 | 4 | | |
| | | | | | | | | | CHEM 36 | 3 | - | - |
| | *Subtotals* | *9* | *0* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *7* | *3* | *4* |
| | Total | | | 13 | Total | | | 17 | Total | | | 14 |
| *Sophomore* | CME 100 | 5 | - | - | CME 102 | 5 | - | - | ENGR 20 ** | - | - | - |
| | CHEM 130 | - | 4 | - | Writing | - | - | 4 | ENGR 25 ** | - | 3 | - |
| | Engr. Fund. | | 4 | - | PHYSICS 41 | 4 | | - | PHYSICS 43 | 4 | - | - |
| | GER | - | - | 3 | GER | - | - | 3 | ENGR math elec | 5 | - | - |
| | TIS *** (alt.) | | | | | | | | GER | - | - | 3 |
| | *Subtotals* | *5* | *8* | *3* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *3* | *3* |
| | Total | | | 16 | Total | | | 16 | Total | | | 15 |
| *Junior* | CHEMENG 100 | - | 3 | - | CHEMENG 110 | - | 3 | - | CHEMENG 130 | - | 3 | - |
| | CHEM 131 | - | 3 | - | CHEMENG 120A | - | 4 | - | CHEMENG 120B | - | 4 | - |
| | CHEM 171 | - | 3 | - | CHEM 173 | - | 3 | - | CHEM 175 | - | 3 | - |
| | TIS *** | - | - | 3 | CHEMENG 181 | - | 3 | | CHEMENG 183 | - | 3 | |
| | | | | | ENGR math elec | - | - | - | GER | - | - | 3 |
| | *Subtotals* | *0* | *9* | *3* | *Subtotals* | *0* | *13* | *0* | *Subtotals* | *0* | *13* | *3* |
| | Total | | | 12 | Total | | | 13 | Total | | | 16 |
| *Senior* | CHEMENG 150 | - | 3 | - | CHEMENG 160 | - | 3 | - | CHEMENG 140 | - | 3 | - |
| | CHEMENG 170 | - | 3 | - | GER | - | - | 5 | CHEMENG 180 | - | 3 | |
| | CHEMENG 185A | - | 4 | - | CHEMENG 185B | - | 4 | | Elective | - | - | 0 |
| | CHEMENG 10 | - | 1 | - | TIS *** (alt.) | - | - | - | Elective | - | - | 5 |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CHEMENG 174 | - | - | - | | | | | | | | |
| | *Subtotals* | *0* | *11* | *5* | *Subtotals* | *0* | *7* | *10* | *Subtotals* | *0* | *6* | *10* |
| | Total | | | 16 | Total | | | 17 | Total | | | 16 |

| | |
|---|---|
| AP Math Units: | 0 |
| UG Math & Science Units: | 48 |
| Total Engineering Units: | 73 |
| Total Other Units: | 60 |
| Total Units: | 181 |

*Notes:*

*CHEMENG 181 (formerly 188) required (Win)*

*CHEMENG 150 (Aut) required*

*Both CHEMENG 185A and 185B required*

** ENGR/CHEMENG 20 "Intro to ChemE" and ENGR/CHEMENG 25 "Biotechnology"

*** TIS course in 2nd, 3rd, or 4th year

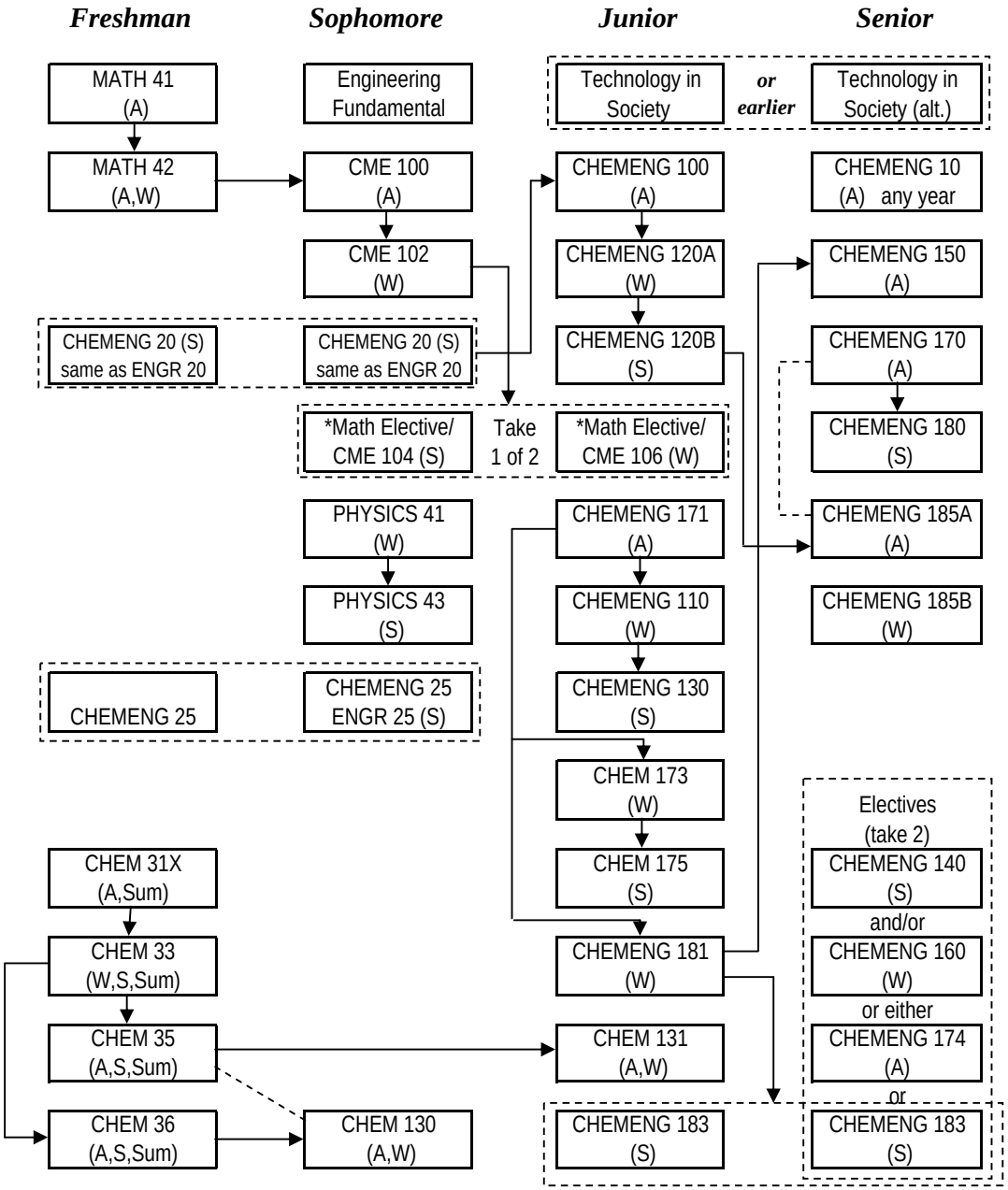
- ENGR math elective, one of two: CME 104 (5 units) or CME 106 (4 units).
- ChE elective, 2 of 3 choices: CHEMENG 140 (Spr.) and/ or 160 (Win.) and/or (either 174 (Aut) or 183 (Spr)
- Students' choices for Math elective, 3rd Engineering Fundamental, and CHEMENG electives affect choices, units, and scheduling of GER courses and other courses not required for the ChemE major.

# Chemical Engineering

*Typical Sequence of Courses*

4-Year Plan # 2 — RECOMMENDED

MATH 40 series, then CME 100, 102 then CME 104 or 106




* Solid arrows represent direct prerequisites.
* Dashed lines represent co-requisites.
* Dashed-line boxes enclose alternatives.These may indicate years in which to take a given course or different courses that may fulfill a degree requirement.

# Chemical Engineering

*4-Year Plan # 3 — A RECOMMENDED PLAN — CME 100 and 102, then CME 104 or 106*

*(AP credit for MATH 40 series; start with CME 100, 102 instead of MATH 51 series)*

**** Note: Final Program MUST have 68 ABET units for Engineering Science and Engineering Design*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | CME 100 | 5 | - | - | CME 102 | 5 | - | - | ENGR 20 ** | - | 3 | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | ENGR 25 ** | - | - | - |
| | CHEM 31X | 4 | - | - | CHEM 33 | 4 | - | - | IHUM | - | - | 4 |
| | | | | | Writing | - | - | 4 | CHEM 35 | 4 | - | - |
| | | | | | | | | | CHEM 36 | 3 | - | - |
| | *Subtotals* | *9* | *0* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *7* | *3* | *4* |
| | Total | | | 13 | Total | | | 17 | Total | | | 14 |
| *Sophomore* | CHEM 130 | - | 4 | - | CME math elec | 4 | - | - | CME math elec | - | - | - |
| | TIS *** (alt.) | - | - | - | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | Engr. Fund | - | 4 | | Writing | - | - | 4 | ENGR 20 ** | - | - | - |
| | GER | - | - | 3 | CME math elec | - | - | - | ENGR 25 ** | - | 3 | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | *Subtotals* | *0* | *8* | *8* | *Subtotals* | *8* | *0* | *9* | *Subtotals* | *4* | *3* | *5* |
| | Total | | | 16 | Total | | | 17 | Total | | | 12 |
| *Junior* | CHEMENG 100 | - | 3 | - | CHEMENG 110 | - | 3 | - | CHEMENG 130 | - | 3 | - |
| | CHEM 131 | - | 3 | - | CHEMENG 120A | | 4 | | CHEMENG 120B | - | 4 | - |
| | CHEM 171 | - | 3 | - | CHEM 173 | - | 3 | - | CHEM 175 | - | 3 | - |
| | GER | - | - | 3 | CHEMENG 181 | - | 3 | - | CHEMENG 183 | - | 3 | - |
| | *Subtotals* | *0* | *9* | *3* | *Subtotals* | *0* | *13* | *0* | *Subtotals* | *0* | *13* | *0* |
| | Total | | | 12 | Total | | | 13 | Total | | | 13 |
| *Senior* | CHEMENG150 | - | 3 | - | CHEMENG 160 | - | - | - | CHEMENG 140 | - | 3 | - |
| | CHEMENG 170 | - | 3 | - | GER | - | - | 5 | CHEMENG 180 | - | 3 | |
| | CHEMENG 185A | - | 4 | - | CHEMENG 185B | - | 4 | | Elective | - | - | 3 |
| | CHEMENG 10 | - | 1 | - | GER | - | - | 4 | GER | - | - | 3 |
| | TIS course *** | - | - | 4 | Elective | - | - | 4 | TIS ***(alt.) | - | - | - |
| | CHEMENG 174 | - | - | - | | | | | | | | |
| | *Subtotals* | *0* | *11* | *4* | *Subtotals* | *0* | *4* | *13* | *Subtotals* | *0* | *6* | *6* |
| | Total | | | 15 | Total | | | 17 | Total | | | 12 |

| | |
|---|---|
| AP Math Units: | 10 |
| UG Math & Science Units: | 37 |
| Total Engineering Units: | 70 |
| Total Other Units: | 64 |
| Total Units: | 181 |

*Notes:*

*CHEMENG 181 (formerly 188) required (Win)*

*CHEMENG 150 (Aut) required*

*Both CHEMENG 185A and 185B required*

** ENGR/CHEMENG 20 "introduction to Chemical Engineering" and ENGR/CHEMENG 25 "Biotechnology"

*** TIS course in 2nd, 3rd, or 4th year

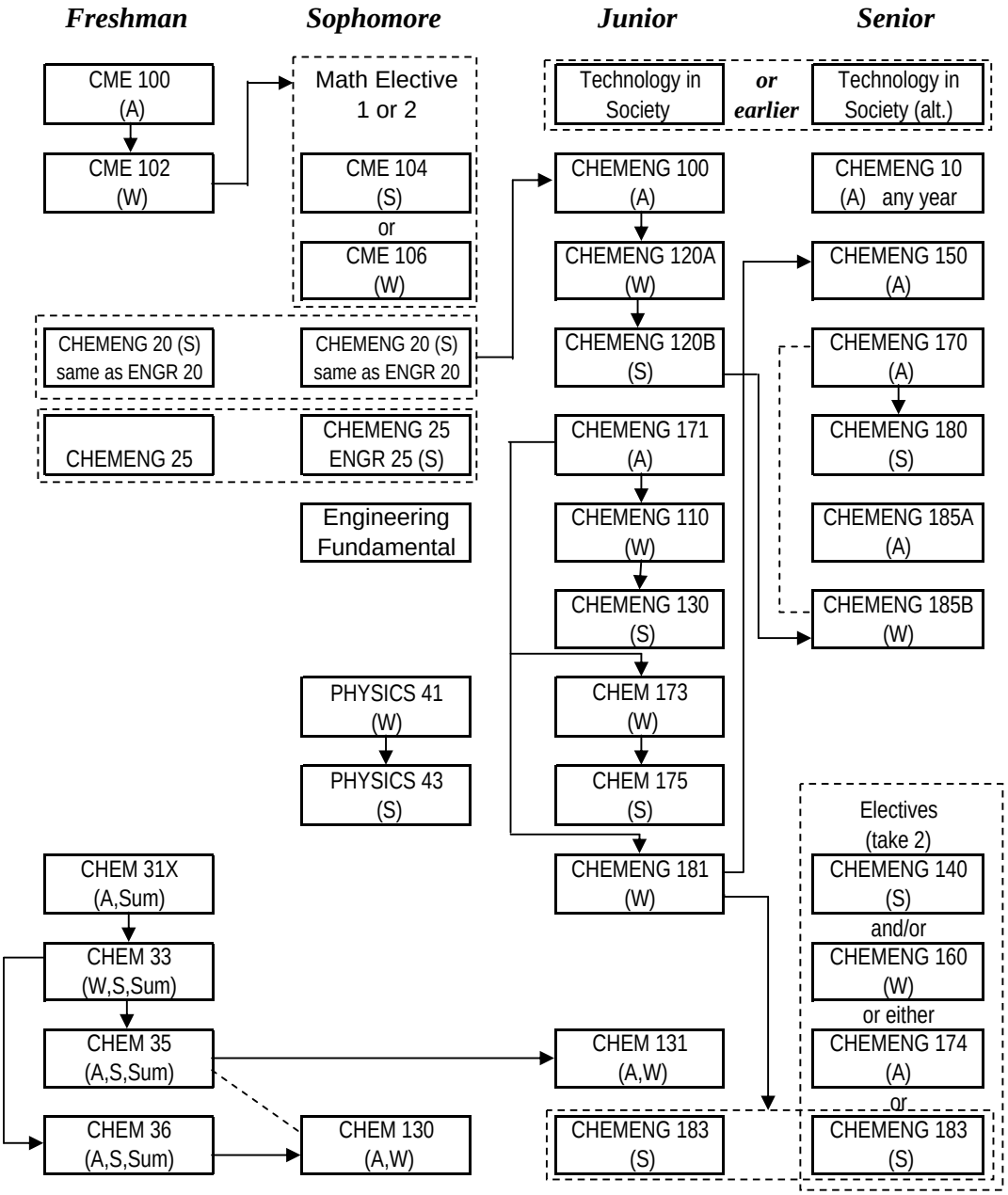
- ENGR math elective, one of two: CME 104 (5 units) or CME 106 (4 units).
- ChE elective, two of three choices: CHEMENG 140 (Spr.) and/or 160 (Win.) and/or (either 174 (Aut) or 183 (Spr).
- Students' choices for Math elective, 3rd Engineering Fundamental, and CHEMENG electives affect choices, units, and scheduling of GER courses and other courses not required for the ChemE major.

# Chemical Engineering

*Typical Sequence of Courses*

4-Year Plan # 3 — RECOMMENDED

AP credit for MATH 40 series; start with CME 100, 102 (instead of MATH 51 series); then CME 104 or 106




* Solid arrows represent direct prerequisites.
* Dashed lines represent co-requisites.
* Dashed-line boxes enclose alternatives.These may indicate years in which to take a given course or different courses that may fulfill a degree requirement.

# Chemical Engineering WITH HONORS

Honors requires additional departmental application with research proposal; min. 3.5 GPA; min. of 9 units of 190H during min. of 3 quarters + min. of 3 units of 191H

*4-Year Plan # 4 — A RECOMMENDED PLAN — CME 100, 102, then CME 104 or 106. (AP credit for MATH 40 series. CME instead of MATH 51 series)*

**** Note: Final Program MUST have 68 ABET units for Engineering Science and Engineering Design. ****

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | CME 100 | 5 | - | - | CME 102 | 5 | - | - | ENGR 20 ** | - | 3 | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | ENGR 25 ** | - | - | - |
| | CHEM 31X | 4 | - | - | CHEM 33 | 4 | - | - | IHUM | - | - | 4 |
| | | | | | Writing | - | - | 4 | CHEM 35 | 4 | - | - |
| | | | | | | | | | CHEM 36 | 3 | - | - |
| | *Subtotals* | *9* | *0* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *7* | *3* | *4* |
| | Total | | | 13 | Total | | | 17 | Total | | | 14 |
| *Sophomore* | CHEM 130 | - | 4 | - | CME math elec | - | - | - | CME math elec | 5 | - | - |
| | TIS *** (alt.) | - | - | - | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | GER | - | - | 4 | Engr. Fund | - | 4 | - | ENGR 20 ** | - | - | - |
| | GER | - | - | 4 | Writing | - | - | 4 | ENGR 25 ** | - | 3 | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | *Subtotals* | *0* | *4* | *13* | *Subtotals* | *4* | *4* | *9* | *Subtotals* | *9* | *3* | *5* |
| | Total | | | 17 | Total | | | 17 | Total | | | 17 |
| *Junior* | CHEMENG 100 | - | 3 | - | CHEMENG 110 | - | 3 | - | CHEMENG 130 | - | 3 | - |
| | CHEM 131 | - | 3 | - | CHEMENG 120A | - | 4 | - | CHEMENG 120B | - | 4 | - |
| | CHEM 171 | - | 3 | - | CHEM 173 | - | 3 | - | CHEM 175 | - | 3 | - |
| | GER | - | 3 | | CHEMENG 181 | - | 3 | - | CHEMENG 183 | - | 3 | - |
| | TIS ** (alt.) | | | | GER | - | - | 3 | CHEMENG 190H | | 3 | |
| | | | | | | | | | CHEMENG 191H | | 1 | |
| | *Subtotals* | *0* | *12* | *0* | *Subtotals* | *0* | *13* | *3* | *Subtotals* | *0* | *17* | *0* |
| | Total | | | 12 | Total | | | 16 | Total | | | 17 |
| *Senior* | CHEMENG150 | - | 3 | - | CHEMENG 160 | - | - | - | CHEMENG 140 | - | 3 | - |
| | CHEMENG 170 | - | 3 | - | TIS | - | - | 4 | CHEMENG 180 | - | 3 | |
| | CHEMENG 185A | - | 4 | - | CHEMENG 185B | - | 3 | - | GER | - | - | 4 |
| | CHEMENG 10 | - | 1 | - | TIS course ** | - | - | 4 | Elective | - | - | 3 |
| | CHEMENG 190H | - | 3 | - | CHEMENG 190H | - | 3 | - | TIS** (alt.) | | | |
| | CHEMENG 191H | | 1 | | CHEMENG 191H | | 1 | | | | | |
| | CHEMENG 174 | - | - | - | | | | | | | | |
| | *Subtotals* | *0* | *15* | *0* | *Subtotals* | *0* | *7* | *8* | *Subtotals* | *0* | *6* | *7* |
| | Total | | | 15 | Total | | | 15 | Total | | | 13 |

*Notes:*

*CHEMENG 181 (formerly 188) required (Win)*

*CHEMENG 150 (Aut) required*

*Both CHEMENG 185A and 185B required*

** ENGR/CHEMENG 20 "Introduction to Chemical Engineering"
ENGR/CHEMENG 25 "Biotechnology"

*** TIS course in 2nd, 3rd, or 4th year

- ENGR math elective, one of two: CME 104 (5 units) or CME 106 (4 units).
- ChE elective, two of three choices: CHEMENG 140 (Spr.) and/or, 160 (Win.) and/or (either 174 (Aut) or 183 (Spr)
- Students' choices for Math elective, 3rd Engineering Fundamental, and CHEMENG electives affect choices, units, and scheduling of GER courses and other courses not required for the ChemE major.

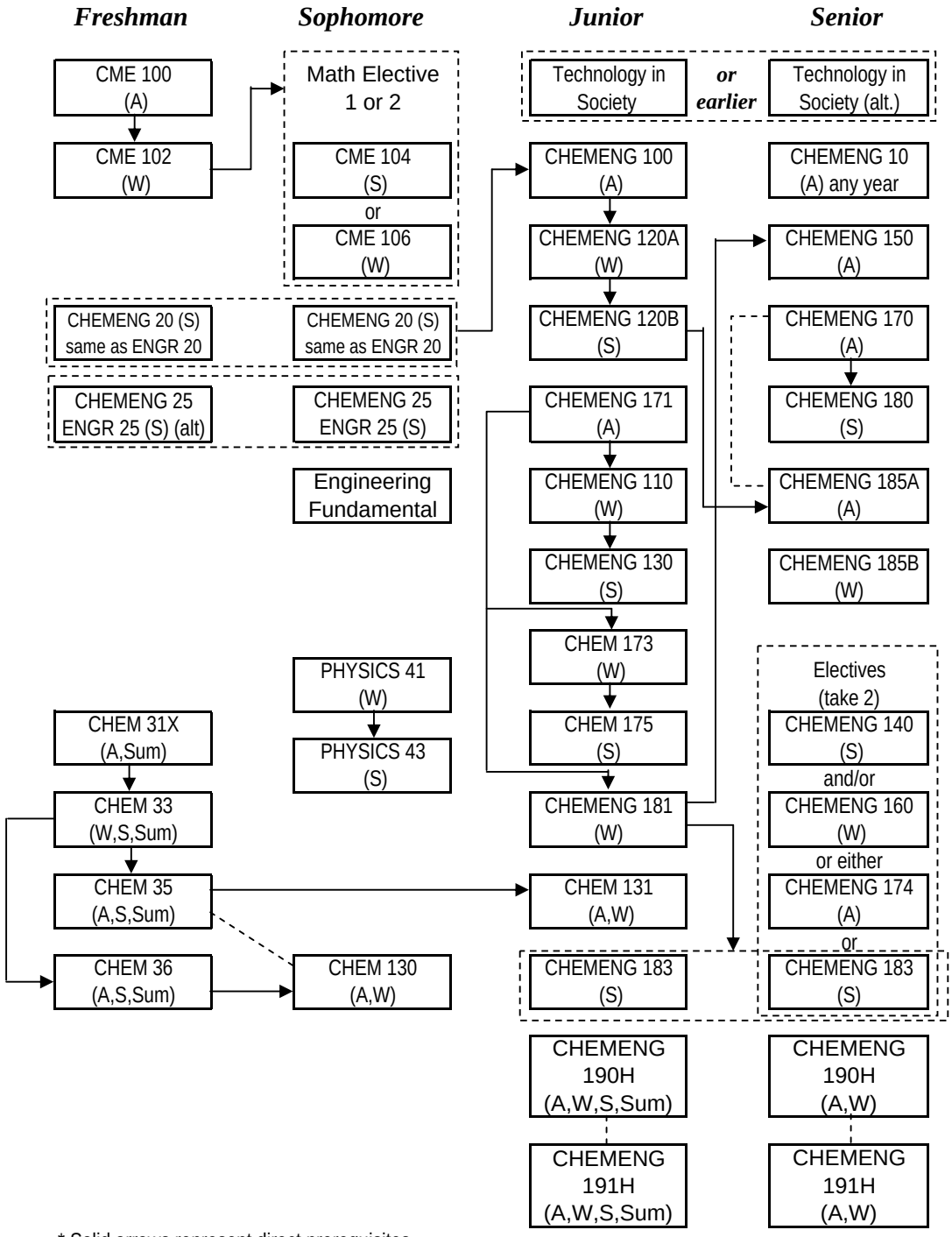
| | |
|---|---|
| AP Math Units: | 10 |
| UG Math & Science Units: | 38 |
| Total Engineering Units: | 84 |
| Total Other Units: | 61 |
| **Total Units:** | 193 |

# Chemical Engineering with Honors Research

*Typical Sequence of Courses*

4-Year Plan # 4 — RECOMMENDED

AP credit for MATH 40 series; start with CME 100, 102, instead of MATH 51 series




* Solid arrows represent direct prerequisites.
* Dashed lines represent co-requisites.
* Dashed-line boxes enclose alternatives.These may indicate years in which to take a given course or different courses that may fulfill a degree requirement.

# Chemical Engineering

*4-Year Plan # 5 — A PLAN that starts with MATH 41 & 42, then the MATH 51 series, followed by CME 104 or 106.*
**** Note: Final Program MUST have 68 ABET units for Engineering Science and Engineering Design. ****

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | CHEM 31X | 4 | - | - | CHEM 33 | 4 | - | - | CHEM 35 | 4 | - | - |
| | GER | - | - | 3 | Writing | - | - | 4 | CHEM 36 | 3 | - | - |
| | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *12* | *0* | *4* |
| | Total | | | 16 | Total | | | 17 | Total | | | 16 |
| *Sophomore* | MATH 52 | 5 | - | - | MATH 53 | 5 | - | - | ENGR math elec | 5 | - | - |
| | CHEM 130 | - | 4 | - | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | Engr. Fund | - | 4 | 0 | Writing | - | 0 | 4 | ENGR 20 ** | - | 3 | - |
| | GER | - | - | 3 | GER | - | - | 3 | ENGR 25 ** | | 3 | |
| | TIS *** (alt.) | - | - | - | | | | | | | | |
| | *Subtotals* | *5* | *8* | *3* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *6* | *0* |
| | Total | | | 16 | Total | | | 16 | Total | | | 15 |
| *Junior* | CHEMENG 100 | - | 3 | - | CHEMENG 110 | - | 3 | - | CHEMENG 130 | - | 3 | - |
| | CHEM 131 | - | 3 | - | CHEMENG 120A | - | 4 | - | CHEMENG 120B | - | 4 | - |
| | CHEM 171 | - | 3 | - | CHEM 173 | - | 3 | - | CHEM 175 | - | 3 | - |
| | TIS *** (alt) | - | - | - | CHEMENG 181 | - | 3 | | CHEMENG 183 | - | - | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | | | | | ENGR math elec | - | - | | | | | |
| | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *0* | *13* | *5* | *Subtotals* | *0* | *10* | *5* |
| | Total | | | 14 | Total | | | 18 | Total | | | 15 |
| *Senior* | CHEMENG 150 | - | 3 | - | CHEMENG 160 | - | 3 | - | CHEMENG 140 | - | 3 | - |
| | CHEMENG 170 | - | 3 | - | GER | - | - | 3 | CHEMENG 180 | - | 3 | |
| | CHEMENG 185A | - | 4 | - | CHEMENG 185B | - | 4 | - | Elective | - | - | 3 |
| | CHEMENG 10 | - | 1 | - | TIS course *** | - | 4 | - | Elective | - | - | 3 |
| | CHEMENG 174 | - | - | - | | | | | | | | |
| | GER | - | - | 3 | | | | | | | | |
| | *Subtotals* | *0* | *11* | *3* | *Subtotals* | *0* | *11* | *3* | *Subtotals* | *0* | *6* | *6* |
| | Total | | | 14 | Total | | | 14 | Total | | | 12 |

| | |
|---|---|
| AP Math Units: | 0 |
| UG Math & Science Units: | 53 |
| Total Engineering Units: | 74 |
| Total Other Units: | 56 |
| Total Units: | 183 |

*Notes:*

*CHEMENG 181 (formerly 188) required (Win)*

*CHEMENG 150 (Aut) required*

*Both CHEMENG 185A and 185B required*

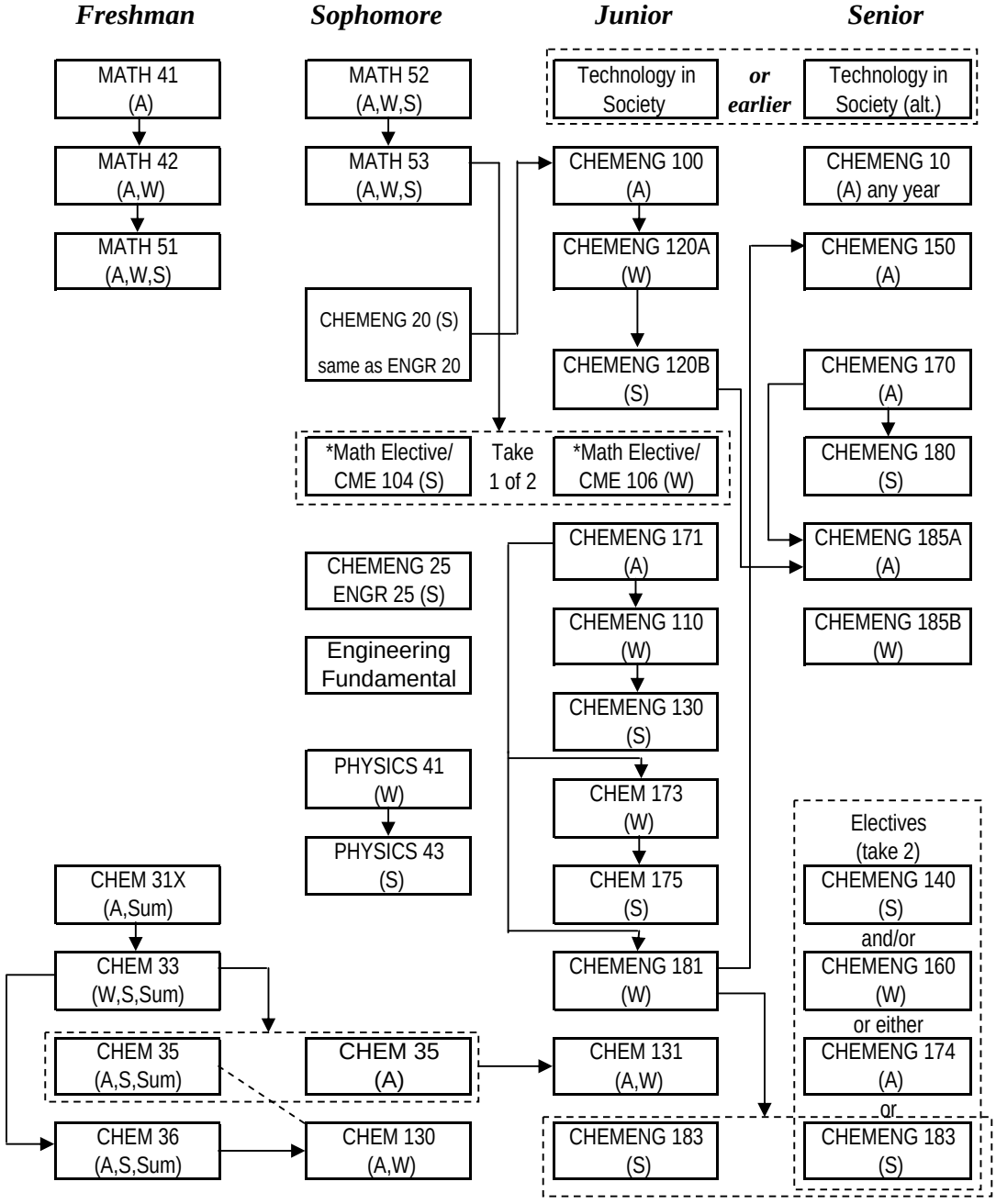
** ENGR/CHEMENG 20 "Introduction to Chemical Engineering" and ENGR/CHEMENG 25 "Biotechnology"

*** TIS course in 2nd, 3rd, or 4th year

- ENGR math elective, one of two: CME 104 (5 units) or CME 106 (4 units).
- ChE elective, 2 of 3 choices: CHEMENG 140 (Spr.) and/or 160 (Win.) and/or (either 174 (Aut) or 183 (07-08: Win, then 08-09: Spr)
- Students' choices for Math elective, 3rd Engineering Fundamental, and CHEMENG electives affect choices, units, and scheduling of GER courses and other courses not required for the ChemE major.

# Chemical Engineering

*Typical Sequence of Courses*
4-Year Plan # 5
MATH 40 series, then MATH 50 series, then CME 104 or 106




* Solid arrows represent direct prerequisites.
* Dashed lines represent co-requisites.
* Dashed-line boxes enclose alternatives.These may indicate years in which to take a given course or different courses that may fulfill a degree requirement.

# Chemical Engineering

*4-Year Plan # 6 — A PLAN with AP credit for the MATH 41 series, then the MATH 51 series, followed by CME 104 or 106*

**** Note: Final Program MUST have 68 ABET units for Engineering Science and Engineering Design. ****

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 51 | 5 | - | - | MATH 52 | 5 | - | - | MATH 53 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | CHEM 31X | 4 | - | - | CHEM 33 | 4 | - | - | CHEM 35 | 4 | - | - |
| | GER | - | - | - | Writing | - | - | 4 | CHEM 36 | 3 | - | - |
| | *Subtotals* | *9* | *0* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *12* | *0* | *4* |
| | Total | | | 13 | Total | | | 17 | Total | | | 16 |
| *Sophomore* | CHEM 130 | - | 4 | - | CME 104 | 5 | - | - | ENGR math elec | 5 | - | - |
| | TIS course *** | - | - | 4 | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | ENGR math elec | - | - | 4 | Engr. Fundamental | - | 4 | - | ENGR 20 ** | - | 3 | - |
| | GER | | | 4 | Writing | - | - | 4 | ENGR 25 ** | - | 3 | - |
| | *Subtotals* | *0* | *4* | *12* | *Subtotals* | *9* | *4* | *4* | *Subtotals* | *9* | *6* | *0* |
| | Total | | | 16 | Total | | | 17 | Total | | | 15 |
| *Junior* | CHEMENG 100 | - | 3 | - | CHEMENG 110 | - | 3 | - | CHEMENG 130 | - | 3 | - |
| | CHEM 131 | - | 3 | - | CHEMENG 120A | - | 4 | - | CHEMENG 120B | - | 4 | - |
| | CHEM 171 | - | 3 | - | CHEM 173 | - | 3 | - | CHEM 175 | - | 3 | - |
| | TIS *** (alt.) | - | - | - | CHEMENG 181 | - | 3 | - | CHEMENG 183 | - | 3 | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *0* | *13* | *5* | *Subtotals* | *0* | *13* | *5* |
| | Total | | | 14 | Total | | | 18 | Total | | | 18 |
| *Senior* | CHEMENG 150 | - | 3 | - | CHEMENG 160 | - | 3 | - | CHEMENG 140 | - | 3 | - |
| | CHEMENG 170 | - | 3 | - | GER | - | - | 4 | CHEMENG 180 | - | 3 | - |
| | CHEMENG 185A | - | 4 | - | CHEMENG 185B | - | 4 | - | GER | - | - | 3 |
| | CHEMENG 10 | - | 1 | - | Elective | - | - | 3 | Elective | - | - | - |
| | CHEMENG 174 | - | - | - | | | | | TIS *** (alt.) | - | - | - |
| | GER | - | - | 3 | | | | | | | | |
| | *Subtotals* | *0* | *11* | *3* | *Subtotals* | *0* | *7* | *7* | *Subtotals* | *0* | *6* | *3* |
| | Total | | | 14 | Total | | | 14 | Total | | | 9 |

| | |
|---|---|
| AP Math Units: | 10 |
| UG Math & Science Units: | 48 |
| Total Engineering Units: | 73 |
| Total Other Units: | 60 |
| Total Units: | 191 |

*Notes:*

*CHEMENG 181 (formerly 188) required (08-09: Win)*

*CHEMENG 150 (Aut) required*

*Both CHEMENG 185A and 185B required*

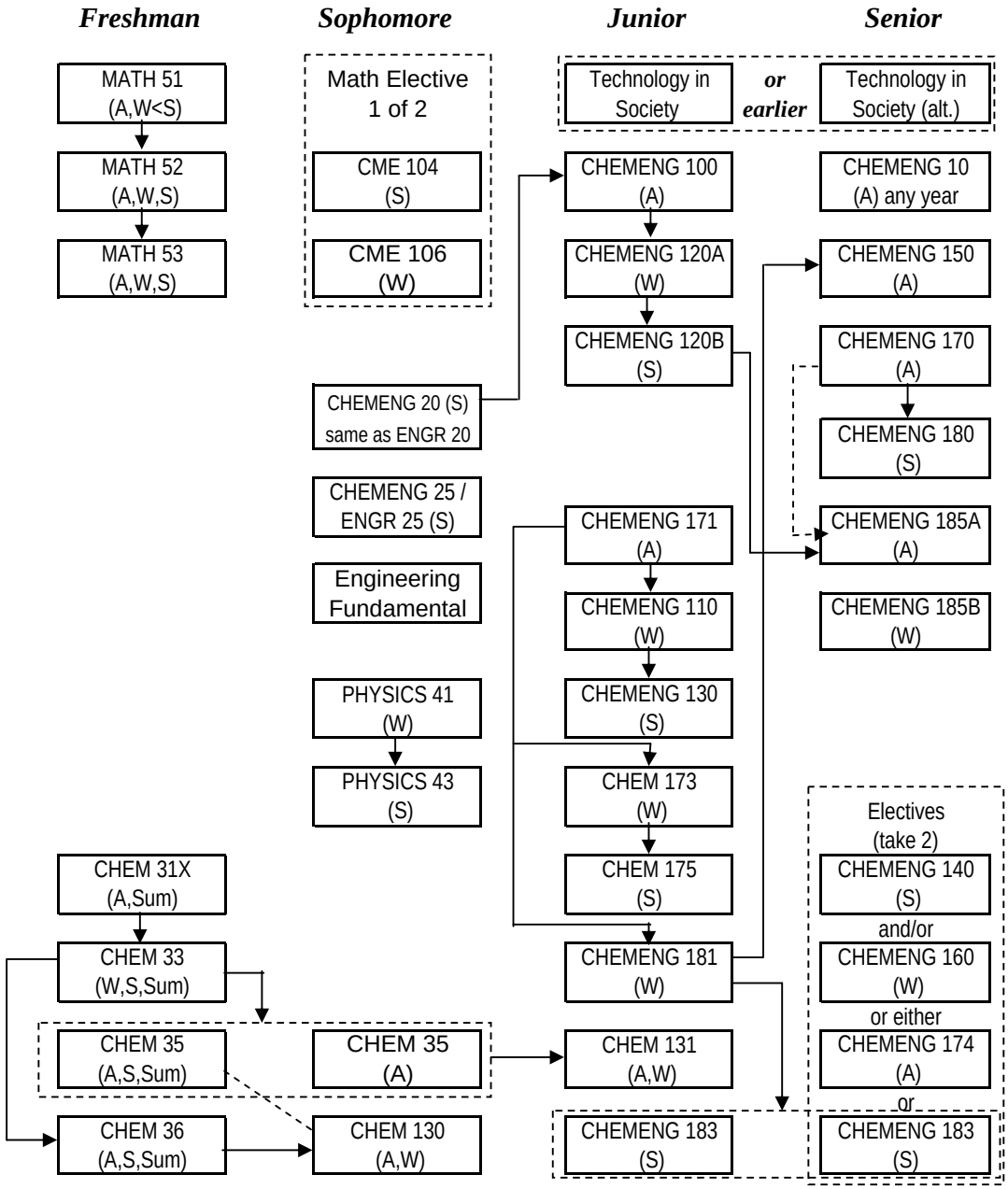
** ENGR/CHEMENG 20 "Introduction to Chemical Engineering" and ENGR/CHEMENG 25 "Biotechnology"

*** TIS course in 2nd, 3rd, or 4th year

- ENGR math elective, one of two: CME 104 (5 units) or CME 106 (4 units).
- ChE elective, two of three choices: CHEMENG 140 (Spr.) and/or 160 (Win.) and/or (either 174 (Aut) or 183 (Spr)
- Students' choices for Math elective, 3rd Engineering Fundamental, and CHEMENG electives affect choices, units, and scheduling of GER courses and other courses not required for the ChemE major.

# Chemical Engineering

*Typical Sequence of Courses*
4-Year Plan # 6
AP credit for MATH 40 series; MATH 50 series ; then CME 104 or 106




* Solid arrows represent direct prerequisites.
* Dashed lines represent co-requisites.
* Dashed-line boxes enclose alternatives.These may indicate years in which to take a given course or different courses that may fulfill a degree requirement.

# INSTRUCTIONS FOR DECLARING A MAJOR IN CHEMICAL ENGINEERING (BS: CHEMENG)

1. Log on to Axess and request to major in Chemical Engineering.
2. Print your unofficial Stanford transcript from Axess.
3. Download a Chemical Engineering Program Sheet from the School of Engineering web site: **`http://ughb.stanford.edu`** and complete it electronically. Enter "AP" instead of a course grade for any course waived due to AP credit.
4. Save the electronic file for your records. Print your Program Sheet.
5. Take your unofficial transcript and completed Program Sheet to Jeanne Cosby, Student Services Manager, in Keck Science Building, room 189. She is most available during daily drop-in hours: 2 to 3:45pm.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download the online CHEMENG program sheet from **`ughb.stanford.edu`** to ensure you are using an accurate major plan.

**Stanford University's School of Engineering**

# Chemical Engineering

# 2009–2010 Program Sheet

**– ABET Acceditation Criteria Apply —**

***Follow all requirements as stated for the year of the Program Sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirement** *(45 units minimum)*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if | Initials | Date | Total | | | | |
| *Mathematics* | | | Transfer | | | | | Engr Sci | Engr Des | Experiment |
| MATH | 41 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 42 | Calculus (req'd) | | | | 5 | | | | |
| CME | 100 | Vector Calculus for Engineers (req'd; note 1) | | | | 5 | | | | |
| CME | 102 | ODE for Engineers (req'd; note 1) | | | | 5 | | | | |
| CME 104 or | | Linear Algebra & PDE for Engineers *OR* | | | | 5 | | | | |
| CME 106 | | Intro. to Probability & Stats for Engineers (Req'd) | | | | 4 | | | | |
| | | | | | Mathmatics Unit Total | | | | | |
| *Science* | | | | | | | | | | |
| PHYSICS | 41 | Mechanics (req'd) | | | | 4 | | | | 0 |
| PHYSICS | 43 | Electricity & Magnetism (req'd) | | | | 4 | | | | 0 |
| CHEM | 31X | Chemical Principles (req'd) (*or CHEM 31A+B)* | | | | 4 | | | | 0 |
| CHEM | 33 | Structure and Reactivity (req'd) | | | | 4 | | | | 0 |
| CHEM | 35 | Organic Monofunctional Compounds (req'd) | | | | 4 | | | | 0 |
| CHEM | 36 | Organic Chemistry Laboratory I (req'd) | | | | 3 | | | | 2 |
| | | | | | | | | | | |
| | | | | | Science Unit Total | | | | | |
| | | | | | Math & Science Unit Total (45 units minimum) | | | | | |

**Technology in Society Requirement** (1 course required; see UGHB Fig. 3-3 for SoE approved list)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |

**NOTES**

* ABETunits in Engineering Science, Engineering Design, and Experimentation do not apply to shaded areas.
* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to Eng majors.
* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink. Delete courses not taken.
* All courses listed on this form must be taken for a letter grade if offered by the instructor.
* Minimum Combined Grade Point Average for all courses in Engineering Topics (Engineering Science and Engineering Design courses) is 2.0.
* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.
* All courses listed on this form must only be included under one category; no double-counting. Delete courses not taken.

( 1 ) CME 100, 102 strongly recommended; however MATH 51 and 52 may be substituted for CME 100; MATH 53 may be substituted for CME 102.

*program sheet continues on page 2*

# Chemical Engineering Program Sheet (continued)

**Engineering Topics (Engr Science + Engr Design combined) must equal 68 units**; see note 2

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Engineering Fundamentals (3 courses required)* | | | | | | | | | | |
| ENGR | 25 | Introduction to Biotechnology | | | | 3 | | 2 | 1 | 0 |
| ENGR | 20 | Introduction to Chemical Engineering | | | | 3 | | 2 | 1 | 0 |
| ENGR | | *Fundamentals Elective (see Note 2)* | | | | | | | | |
| | | | | | *Engineering Fundamentals Unit Total* | | | | | |
| *Engineering Depth (Delete courses not taken)* | | | | | | | | | | |
| CHEMENG | 10 | The Chemical Engineering Profession | | | | 1 | | 0 | 0 | 0 |
| CHEMENG | 100 | Chem. Proc. Modeling, Dyn. & Control | | | | 3 | | 3 | 0 | 0 |
| CHEMENG | 110 | Equilibrium Thermodynamics | | | | 3 | | 3 | 0 | 0 |
| CHEMENG | 120A | Fluid Mechanics | | | | 4 | | 3 | 1 | 0 |
| CHEMENG | 120B | Energy and Mass Transport | | | | 4 | | 3 | 1 | 0 |
| CHEMENG | 130 | Separation Processes | | | | 3 | | 2 | 1 | 0 |
| CHEMENG | 140 | Micro & Nanoscale Fabrication Engineering (see note 3) | | | | 3 | | 2 | 1 | 0 |
| CHEMENG | 150 | Biochemical Engineering (see note 3) | | | | 3 | | 2 | 1 | 0 |
| CHEMENG | 160 | Polymer Science & Engineering (see note 3) | | | | 3 | | 2 | 1 | 0 |
| CHEMENG | 170 | Kinetics and Reactor Design | | | | 3 | | 2 | 1 | 0 |
| CHEMENG | 174 | Environmental Microbiology (see Note 3 ) | | | | 3 | | 2 | 1 | 0 |
| CHEMENG | 180 | Chemical Engineering Plant Design | | | | 3 | | 0 | 3 | 0 |
| CHEMENG | 181 | Biochemistry I (formerly 188)(see Note 3) | | | | 3 | | 3 | 0 | 0 |
| CHEMENG | 183 | Biochemistry II (formerly 189) (see note 3) | | | | 3 | | 3 | 0 | 0 |
| CHEMENG | 185A | Chemical Engineering Lab A (WIM) | | | | 4 | | 2 | 2 | 4 |
| CHEMENG | 185B | Chemical Engineering Lab B | | | | 4 | | 2 | 2 | 4 |
| CHEM | 130 | Organic Chemistry Laboratory II | | | | 4 | | 4 | 1 | 4 |
| CHEM | 131 | Organic Polyfunctional Compounds | | | | 3 | | 2 | 0 | 1 |
| CHEM | 171 | Physical Chemistry - Chem. Thermo. | | | | 3 | | 3 | 0 | 0 |
| CHEM | 173 | Physical Chemistry - Quantum Chem. | | | | 3 | | 3 | 0 | 0 |
| CHEM | 175 | Physical Chem - Kin. Th. & Stat. Mech. | | | | 3 | | 3 | 0 | 0 |
| | | | | | *Depth/Engr Science/Engr Design/Experiment Unit Totals* | | | | | |

**Program Totals (ABET Requirements) See note 4**

*Mathematics and Science* *(45 units minimum)*

*Engineering Topics (Engr Science + Engr Design)* *(68 units minimum)*

*Experimentation* *(8 units minimum)*

## Program Approvals

*Advisor*
Printed Name: _____ Date: _____
Signature: _____

*Student Services/Departmental*
Printed Name: _____
Signature: _____ Date: _____

*School of Engineering (signature not required prior to graduation)*
Printed Name: _____ Date: _____
Signature: _____

**NOTES (continued from page 1)**

( 2 ) Third ENGR Fund course required. See SoE-approved 09-10 list in the UGHB, Chap 3, Fig.3-4.

( 3 ) CHEMENG 150 and CHEMENG 181 required, plus two of the following: 140, 160 or (either 174 or 183)

( 4 ) In order to satisfy ABET requirements for graduation, the ChemE major must take enough courses so that the combined Engineering Science and Design units from Fundamentals and Depth courses add up to a minimum of 68 units.

# CIVIL ENGINEERING

— ABET ACCREDITATION CRITERIA APPLY —

The civil engineering profession is concerned with the built environment. Civil engineers plan, design, and construct and sustain major facilities including transportation and utility lifeline systems, energy and industrial facilities, ports and waterways, buildings, and bridges. Civil engineers help manage our air, water, and energy resources and help protect society from natural catastrophes, such as earthquakes, as well as dealing with the hazards society itself generates in the form of toxic wastes.

Because these functions are often crucial to the day-to-day lives of most people and the facilities involved are physically substantial, civil engineers bear an important responsibility to the public. Their role is often more than just technical, requiring also a high degree of communicative skills and an ability to deal with people.

Civil engineering is a profession with a long and respected history. We marvel today at the works of our ingenious predecessors and the impact they had on their societies. The irrigation systems of Egypt and China, the Inca and Mayan temples and cities, the water supply tunnels of the Greeks, and the roads and aqueducts of Rome are examples. Through these many years, civil engineering has evolved into a broadly based discipline that deals with the technical as well as the socio-economic aspects of our built environment.

The mission of the Civil and Environmental Engineering department is to educate the next generation of societal, industrial, and academic leaders and discover knowledge that advances the state of the profession.

## THE CURRICULUM

The undergraduate civil engineering curriculum includes a core, to be taken by all declared majors, that provides a broad introduction to the major areas of civil engineering. Two tracks then allow students to take additional specialized course work in either *Environmental and Water Studies* or *Structures and Construction*

Those undergraduates potentially interested in the *Environmental and Water Studies* specialization of the Civil Engineering major may want to examine the Environmental

Engineering major as a possible alternative; a comparison of these two alternative majors is presented in the section on the Environmental Engineering degree.

For more information on Civil & Environmental Engineering, students are encouraged to visit the CEE website at **http://cee.stanford.edu**, talk to a CEE faculty member, or contact the CEE Student Services Specialist, Sandra Wetzel, in room 316 of the Jerry Yang and Akiko Yamazaki Environment & Energy (Y2E2) Building..

# DECLARING A CIVIL ENGINEERING MAJOR

Instructions on how to declare CE as a major appear at the end of this section, or link to *Prospective Students>Undergraduate Students>Majoring in CEE* at the website **http://cee.stanford.edu**.

### OBJECTIVES AND OUTCOMES FOR CIVIL ENGINEERING

**Objectives:**

1. *Principles and Skills:* Provide an understanding of engineering principles along with analytical, problem-solving, design, and communication skills to continue succeeding and learning in diverse careers.
2. *Preparation for Practice:* Prepare for successful engineering practice with a longer-term perspective that takes into account new tools, such as advanced information technology and biotechnology, and increasingly complex professional and societal expectations.
3. *Preparation for Graduate Study:* Prepare for possible graduate study in engineering or other fields.
4. *Preparation for Service:* Develop the awareness, background, and skills to become responsible citizens and leaders in service to society.

**Outcomes:**

(a) A proficiency in and ability to apply knowledge of engineering, mathematics through differential equations, probability and statistics, and science including physics and chemistry
(b) An ability to design and conduct experiments, as well as to analyze and interpret data
(c) An ability to design a system, component, or process to meet desired needs
(d) An ability to function on multi-disciplinary teams
(e) An ability to identify, formulate, and solve engineering problems
(f) An understanding of professional and ethical responsibility
(g) An ability to communicate effectively
(h) The broad education necessary to understand the impact of engineering solutions in a global and societal context
(i) A recognition of the need for, and an ability to engage in life-long learning
(j) A knowledge of contemporary issues
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(l) Background for admission to engineering or other professional graduate programs

# RESEARCH EXPERIENCE FOR UNDERGRADUATES

The department of Civil and Environmental Engineering welcomes student participation in the VPUE Undergraduate Research Programs. Interested students are encouraged to check the VPUE website (**http://www.stanford.edu/dept/undergrad/vpue/**) and the CEE website **(http://cee.stanford.edu/)** for announcements regarding the application procedures. Annual program announcements typically appear in January with application due dates in February.

# EXPLORING CIVIL ENGINEERING AS A MAJOR

Are you wondering whether a Civil Engineering major is for you? If so, here is some advice on courses accessible early in your undergraduate career that will help you assess your interest in our major. If you end up joining our program, this early start on fulfilling requirements will pay off by giving you more flexibility in class scheduling for your junior and senior years.

1. For an introduction to Civil Engineering, classes required for all of our declared majors which are readily accessible to you are
   CEE 70: Environmental Science & Technology (S)
   CEE100: Managing Sustainable Building Projects (S)(WIM)

2. For electives providing additional exposure to the two tracks within our major, look at
   **STRUCTURES AND CONSTRUCTION TRACK:**
   CEE 31Q: Accessing Architecture through Drawing (W; Sophomore seminar)
   CEE 46Q: Fail Your Way to Success (S; Sophomore. seminar)
   CEE 80N: The Art of Structural Engineering (W; Freshman seminar)
   CEE 115: Goals and Methods of Sustainable Building Projects (S)
   CEE 131A: Introduction to the Design Profession (S)

   **ENVIRONMENTAL AND WATER STUDIES TRACK:**
   CEE 63: Weather and Storms (A)
   CEE 64: Air Pollution: from Urban Smog to Global Change (W)
   CEE 166D: Water Resources and Water Hazards Field Trips (W)
   CEE173A: Energy Resources (A)

3. For any Engineering major, three Engineering Fundamentals must be taken; see Fig. 3-4 for a list of courses offered. Early on, you should consider taking
   ENGR 14: Applied Mechanics: Statics (A,S, req'd for both CE tracks)
   ENGR 60: Engineering Economy (A, W, Su; req'd for both CE tracks)
   ENGR 50/50M: Introduction to Materials Science (W, S; req'd for Structures/Constr. Track)
   ENGR 30: Engineering Thermodynamics (A,W; req'd for Environ./Water track)

4. The following Science/Math classes are required for almost all majors within the School of Engineering
   CHEM 31A *or* CHEM 31X or ENGR 31: Chemical Principles I (A)

PHYSICS 41: Mechanics (W) [co-requisite: MATH 41] or 4 units AP Physics C
MATH 51: Linear Algebra and Differential Calculus (A,W,S,Sum) or CME 100: Vector Calculus (A), [prerequisite: MATH 41/42 or 10 units AP Calculus]

5 Finally, there are additional Science/Math classes required for students majoring in Civil Engineering which can readily be taken early on:
GES 1A, 1B or 1C: Introduction to Geology (A,W, S; one course req'd for both CE tracks)
STATS 110 (or STATS 60 or GES160 or CME 106): Statistics (A, W, S: req'd for both CE tracks)

# REQUIREMENTS: 2009-2010 CIVIL ENGINEERING MAJOR

**MATHEMATICS AND SCIENCE (45 UNITS MINIMUM), INCLUDING:**

| Course | Title | Units | Qtr |
|---|---|---|---|
| MATH 41/42 | Calculus | 10 | A/A,W |
| CME 100 & 102 | Math/Computational Methods for Engineers (or Math 51 & 53) | 10 | A,W |
| PHYSICS 41 | Mechanics (or 4 units AP Physics C) | 4 | W |
| CHEM 31A or X or ENGR 31 | Chemical Principles (note 1) | 4 | A |
| CHEM/PHYS | Chemistry and/or Physics proficiency (Note 2) | 7-8 | A,W,S |
| GES 1A *or* B *or* C | Intro to Geology (different topic each quarter; count only one) | 4-5 | A,W,S |
| STAT 110 | Statistical Methods (*or* STAT 60 *or* GES 160 *or* CEE 203 *or* CME 106) | 3-5 | A,W, S |

(1) The chemical principles requirement may be satisfied by taking either CHEM 31A, CHEM 31X, OR ENGR 31. If used to satisfy the Science requirement, ENGR 31 may not count towards the Engineering Fundamentals requirement.

(2) To achieve proficiency in Chemistry/Physics, students in the Environmental and Water Studies track are required to take CHEM 33 and one additional chemistry or physics course. (Note that CHEM 35 or CHEM 135 are recommended for students intending to pursue environmental graduate studies.) Students in the Structures and Construction track are required to take PHYSICS 43 or 45 and one additional chemistry or physics course. CHEM 31B may count as the additional chemistry course for students who take CHEM 31A to satisfy the Chemical Principles requirement.

**ENGINEERING FUNDAMENTALS (SEE FIGURE 3-4 FOR APPROVED LIST):**
(Three courses minimum, the two following, plus at least one additional course chosen by the student)

| Course | Title | Units | Qtr |
|---|---|---|---|
| ENGR 14 | Applied Mechanics | 3 | A, S |
| ENGR 60 | Engineering Economy | 3 | A,W |
| | Fundamentals Elective | 3-5 | |

### Technology in Society: (One course required)

See Chap 3, Figure 3-3 for courses that fulfill the TIS requirement for Civil Engineering majors.

### Experimentation:

At least eight units of experimentation are required. With careful planning, no additional courses beyond those taken to meet the science, fundamentals, and depth requirements will be necessary.

**CIVIL ENGINEERING DEPTH:** Fundamentals + Depth must equal 68 Units Minimum of Engineering Science and Design. Note: The units of "Engineering Science" plus "Engineering Design" assigned to a course do not always sum to the course unit total. Thus, more than 68 units

of engineering courses may be required – see chart at end of this section for applicable course units.

**Core: (19 units)**

| Course | Title | Units | Qtr |
|---|---|---|---|
| CEE 70 | Environmental Science and Technology | 3 | S |
| CEE100* | Managing Sustainable Building Projects | 4 | A |
| CEE101A | Mechanics of Materials | 4 | W |
| CEE101B | Mechanics of Fluids | 4 | S |
| CEE101C | Geotechnical Engineering (including lab) | 4 | A |

*CEE 100 meets the Writing in the Major requirement.

### Specialty Courses

Students choose a specialty in either (1) Structures and Construction or (2) Environmental and Water Studies; each is described below.

## CE SPECIALTY IN STRUCTURES AND CONSTRUCTION

The structures and construction option provides students with courses in structural analysis and design, construction, building systems, and other courses related to structural engineering and construction management. A specific requirement of an ABET-accredited Civil Engineering major is participation in a major engineering design experience. This is fulfilled by taking CEE183 (and its prerequisites).

**REQUIRED SPECIALTY COURSES: (27 UNITS)**

| Course | Title | Units | Qtr |
|---|---|---|---|
| ENGR 50 or | Introduction to Materials Science, Nanotechnology Emphasis | 4 | W,S |
| ENGR 50M+ | Introduction to Materials Science, Biomaterials Emphasis | 4 | A |
| CEE 102 | Legal Aspects of Engineering and Construction | 3 | W |
| CEE 156 | Building Systems Design | 4 | S |
| CEE 180 ◦ | Structural Analysis | 4 | A |
| CEE 181 | Design of Steel Structures | 4 | A |
| CEE 182 | Design of Reinforced Concrete Structures | 4 | W |
| CEE 183 | Integrated Building Design | 4 | S |

+ Can count as a required Engineering Fundamental instead, if desired.
◦ CEE 180 is a prerequisite to or corequisite for CEE 181, CEE 182, and CEE 183.

**SPECIALTY ELECTIVE COURSES: (AT LEAST 12 UNITS)**

| Course | Title | Units | Qtr |
|---|---|---|---|
| ENGR 15 | Dynamics | 3 | A,S |
| CME 104 | Linear Algebra and Partial Differential Equations for Engineers | 5 | S |
| CEE 101D* | Computations in CEE | 3 | A |
| CEE 111 | Multidisciplinary Modeling and Analysis | 4 | W |
| CEE 115 | Goals and Methods of Sustainable Building Projects | 3 | S |
| CEE130, 131A, 134B,or 135A (only one can apply as a Specialty Elective) | | 2-5 | |
| CEE 122A/B | Computer Integrated Architecture/Engineering/Construction | 2 | W,S |
| CEE 140 | Field Surveying Laboratory | 3 | S |
| CEE 142A | Creating Sustainable Development | 3 | W |

| | | | |
|---|---|---|---|
| CEE 147 | Cases in Personality, Leadership, & Negotiation | 3 | S |
| CEE 151 | Negotiation | 3 | A,S |
| CEE 154 | Cases in Estimating Cost | 3 | A |
| CEE 160 | Mechanics of Fluids Laboratory | 2 | S |
| CEE 161A | Rivers, Streams, and Canals | 3-4 | A |
| CEE 171 | Environmental Planning Methods | 3 | W |
| CEE 176A | Energy Efficient Buildings | 3-4 | W |
| CEE 176B | Electric Power: Renewables and Efficiency | 3-4 | S |
| CEE 195A/B | Structural Geology | 3 | A,W |
| CEE 196 | Engineering Geology Practice (alt. years) | 3 | S |
| CEE 199 | Undergrad. Research in Civil and Environmental Engineering | 1-4 | any |
| CEE 203* | Probabilistic Models in Civil Engineering | 3-4 | A |

* Can count either towards the Math+Science requirement, or as elective engineering units.

**Other Elective Courses:**

Choose additional courses from within the School of Engineering to reach a total of 68 units of Engineering Science and Design. Students may need up to 2 more experimentation units to reach the minimum of 8 units (see chart on nest page). **Total Engineering Science and Engineering Design units for engineering fundamentals plus core (required courses, and electives) must be at least 68 units;** see chart on next page for applicable course units. Students may need up to 4 more units of Engineering Science and Design.

# CE SPECIALTY IN ENVIRONMENTAL AND WATER STUDIES

The environmental and water studies option focuses on environmental engineering and science, water resources, and environmental planning. A specific requirement of an ABET-accredited Civil Engineering major is participation in a major engineering design experience. This is fulfilled by taking CEE169, CEE 179B, or CEE179C.

**REQUIRED SPECIALTY COURSES: (36 UNITS)**

| Course | Title | Units | Qtr |
|---|---|---|---|
| ENGR 30+ | Engineering Thermodynamics | 3 | A,W |
| CEE 101D* | Computations in CEE | 3 | A |
| CEE 160 | Mechanics of Fluids Laboratory | 2 | S |
| CEE 161A | Rivers, Streams and Canals | 4 | A |
| CEE 166A | Watersheds and Wetlands | 3 | A |
| CEE 166B | Floods and Droughts, Dams and Aqueducts | 3 | W |
| CEE 171 | Environmental Planning Methods | 3 | W |
| CEE 172 | Air Quality Management | 3 | W |
| CEE 177 | Aquatic Chemistry and Biology | 4 | A |
| CEE 179A | Water Chemistry Laboratory | 3 | W |
| *Design Experience: Choose CEE169, CEE 179B, or CEE 179C.* | | 5 | S |

+ Can count as a required Engineering Fundamental instead, if desired.

* Can count either towards the Math+Science requirement, or as engineering units.

**SPECIALTY ELECTIVE COURSES: (at least six additional units from the following list)**

| Course | Title | Units | Qtr |
|---|---|---|---|
| CEE 63* | Weather and Storms | 3 | A |
| CEE 64* | Air Pollution: From Urban Smog to Global Change | 3 | W |
| CEE 164 | Introduction to Physical Oceanography | 4 | W |
| CEE 165D | Water and Sanitation in Developing Countries | 3 | W |
| CEE 166D | Water Resources and Water Hazards Field Trips | 2 | W |
| CEE 169 | Environmental and Water Resources: Design (alt. years) | 5 | S |
| CEE 172A | Indoor Air Quality (alt. years) | 2-3 | S |
| CEE 173A | Energy Resources | 4-5 | A |
| CEE 176A | Energy Efficient Buildings | 3-4 | W |
| CEE 176B | Electric Power: Renewables and Efficiency | 3-4 | S |
| CEE 178 | Introduction to Human Exposure Analysis | 3 | Sum |
| CEE 179B | Process Design for Environmental Biotechnology | 5 | S |
| CEE 179C | Environmental Engineering Design (alt. years) | 5 | S |
| CEE 199 | Undergrad. Research in Civil & Environmental Engineering | 1-4 | any |

* Can count either towards the Math+Science requirement, or as engineering units.

### Other Elective Courses:

Choose additional courses from within the School of Engineering to reach a total of 68 units of Engineering Science and Engineering Design. .**Total Engineering Science+Design units for engineering fundamentals plus core (required courses, and electives) must be at least 68 units** (see chart below for applicable course units)**.** Students may need up to 4 additional units of Engineering Science and Design.

## ENGINEERING SCIENCE, ENGINEERING DESIGN, AND EXPERIMENTATION UNITS

**SCHOOL OF ENGINEERING COURSES**

| Course | Title | Engr Sci | Engr Dsgn | Expr | Total |
|---|---|---|---|---|---|
| ENGR 10 | Introduction to Engineering Analysis | 4 | - | - | 4 |
| ENGR 14 | Applied Mechanics | 2 | 1 | - | 3 |
| ENGR 15 | Dynamics | 2 | 1 | - | 3 |
| ENGR 20 | Introduction to Chemical Engineering | 2 | 1 | - | 3 |
| ENGR 30 | Engineering Thermodynamics | 3 | - | - | 3 |
| ENGR 40 | Introductory Electronics | 3 | 2 | 2 | 5 |
| ENGR 50/50M | Introduction to Materials Science | 4 | - | - | 4 |
| ENGR 60 | Engineering Economy | 3 | - | - | 3 |
| ENGR 70 | Programming Methodology or Abstractions | 3 | 2 | - | 5 |
| ENGR 80 | Introduction to Bioengineering | 3 | - | - | 3 |

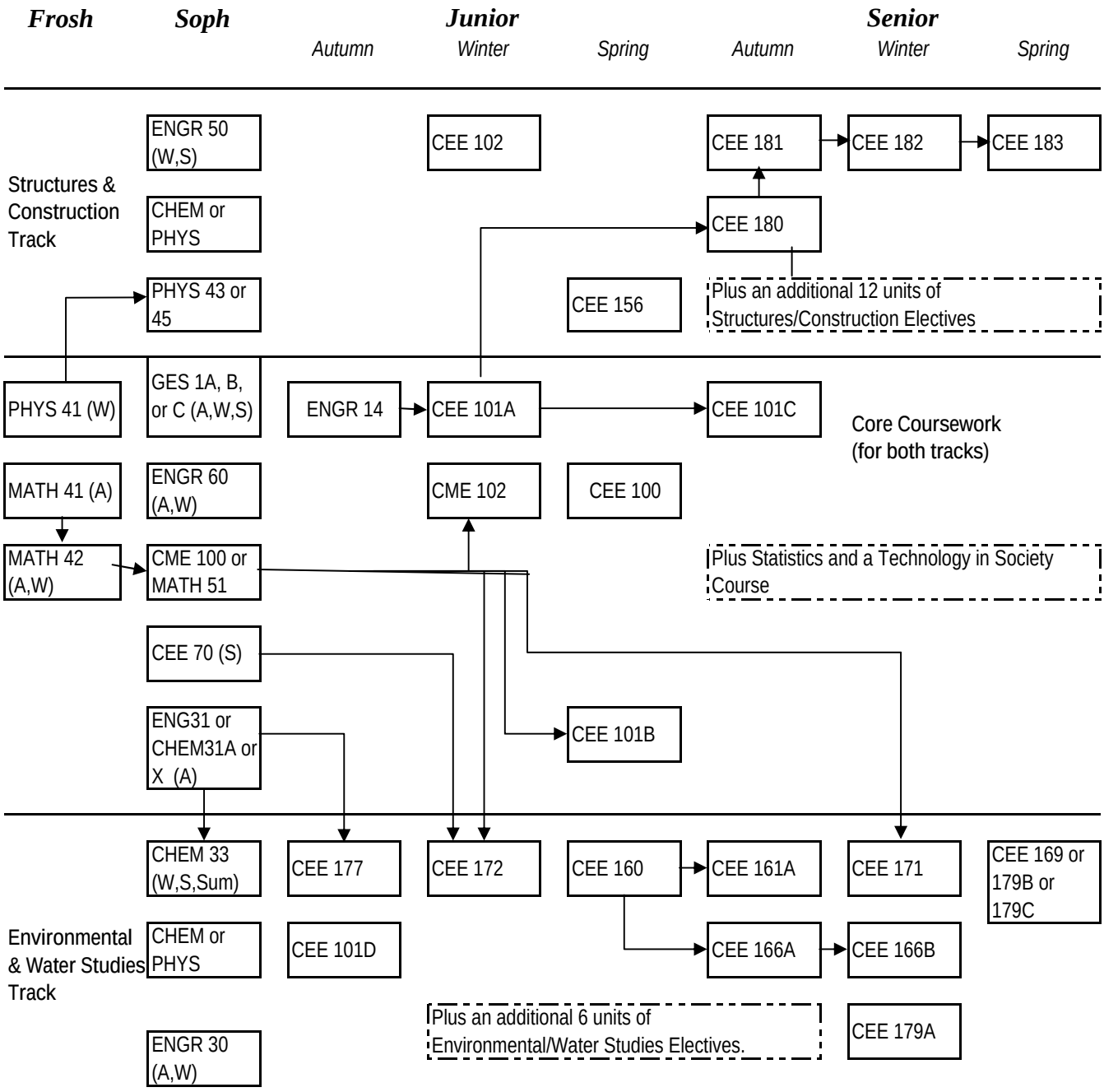
## DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING COURSES

| Course | Title | Engr Sci | Engr Dsgn | Expr | Total |
|---|---|---|---|---|---|
| CEE 31Q | Accessing Architecture through Drawing | 1 | 3 | - | 4 |
| CEE 44Q | Critical Thinking and Career Skills | 1 | 0 | 0 | 3 |
| CEE 46Q | Fail Your Way to Success | 2 | 1 | - | 3 |
| CEE 48Q/N | Organizing Global Projects | 2 | 2 | - | 4 |
| CEE 63 | Weather & Storms | 3 | 0 | - | 3 |
| CEE 64 | Air Pollution: Urban Smog to Global Change | 3 | 0 | - | 3 |
| CEE 70 | Environmental Science & Technology | 2 | 1 | - | 3 |
| CEE 80N | The Art of Structural Engineering | 2 | 2 | - | 4 |
| CEE 100 | Managing Sustainable Building Projects | 2.5 | 1.5 | 1 | 4 |
| CEE 101A | Mechanics of Materials | 3 | 1 | 1 | 4 |
| CEE 101B | Mechanics of Fluids | 3 | 1 | - | 4 |
| CEE 101C | Geotechnical Engineering | 2.5-3 | 0.5-1 | 0-1 | 3-4 |
| CEE 101D | Computations in CEE (for 3 units) | 2 | 1 | - | 3 |
| CEE 102 | Legal Aspects of Engineering and Construction | 2 | 1 | - | 3 |
| CEE 110 | Building Information Modeling | 2 | 2 | 1 | 4 |
| CEE 111 | Multidisciplinary Modeling & Analysis | 1 | 3 | 1 | 4 |
| CEE 115 | Goals & Methods for Projects | 2 | 1 | - | 3 |
| CEE122A/B | Computer Integrated A/E/C | 0 | 2 | - | 2 |
| CEE 129 | Climate Impacts on Ports | 2-4 | 0 | 0 | 2-4 |
| CEE 130 | Arch. Design: 3D Modeling, Method., & Process | 1 | 3 | - | 4 |
| CEE 131A | Introduction to the Design Profession | 0 | 2 | - | 2 |
| CEE 134B | Architectural Studio: Special Topic | 2 | 2 | | 4 |
| CEE 135A | Parametric Design | 2 | 2 | - | 4 |
| CEE 136 | Green Architecture | 2 | 2 | 0 | 4 |
| CEE 137B | Intermediate Architecture Studio | 0 | 5 | - | 5 |
| CEE 138A | Contemporary Architecture | 0 | 3 | - | 3 |
| CEE 139 | Design Portfolio Methods | 0 | 2 | - | 2 |
| CEE 141A | Infrastructure Project Development | 2 | 1 | - | 3 |
| CEE 142A | Creating Sustainable Development | 2 | 1 | - | 3 |
| CEE 147 | Cases in Personality, Leadership & Negotiat. | 3 | 0 | 1 | 3 |
| CEE 151 | Negotiation | 3 | 0 | - | 3 |
| CEE 154 | Cases in Estimating Cost | 1 | 2 | - | 3 |
| CEE 156 | Building Systems | 2 | 2 | - | 4 |
| CEE 159 | Career Skills Seminar | 0 | 0 | - | 2 |
| CEE 160 | Mechanics of Fluids Laboratory | 1 | 1 | 2 | 2 |
| CEE 161A | Rivers, Streams and Canals (for 3 units) | 1.5 | 1.5 | - | 3 |
| CEE 161A | Rivers, Streams and Canals (for 4 units) | 2 | 2 | 1 | 4 |
| CEE 164 | Intro to Physical Oceanography | 4 | 0 | - | 4 |
| CEE 165D | Water & Sanitation in Developing Countries | 2 | 1 | - | 3 |
| CEE 166A | Watersheds and Wetlands | 2 | 1 | - | 3 |
| CEE 166B | Floods & Droughts, Dams & Aqueducts | 2 | 1 | - | 3 |
| CEE 166D | Water Resources & Water Hazards Field Trips | 1 | 1 | - | 2 |
| CEE 169 | Environ & Water Resources: Design | 0 | 5 | - | 5 |
| CEE 171 | Environmental Planning Methods | 2 | 1 | - | 3 |
| CEE 172 | Air Quality Management | 2 | 1 | - | 3 |
| CEE 172A | Indoor Air Quality | 1-2 | 1 | - | 2-3 |
| CEE 172P | Grid Integration of Renewables | 2-3 | 1 | 0 | 3-4 |
| CEE 173A | Energy Resources | 4-5 | 0 | - | 4-5 |
| CEE 175A | CA Coast: Science, Policy, and Law | 1 | 0 | - | 3-4 |
| CEE 176A | Energy Efficient Buildings | 2 | 1-2 | 0-1 | 3-4 |
| CEE 176B | Electric Power: Renewables and Efficiency | 2 | 1-2 | 0-1 | 3-4 |

| | | | | | |
|---|---|---|---|---|---|
| CEE 176F | Energy Systems Field Trips | 0.5-1 | 0.5-1 | 0 | 1-2 |
| CEE 177 | Aquatic Chemistry and Biology | 3 | 1 | - | 4 |
| CEE 178 | Introduction to Human Exposure Analysis | 2 | 1 | 1 | 3 |
| CEE 179A | Water Chemistry Laboratory | 3 | 0 | 3 | 3 |
| CEE 179C | Environmental Engineering Design | 0 | 5 | 0 | 5 |
| CEE 180 | Structural Analysis | 3 | 1 | - | 4 |
| CEE 181 | Design of Steel Structures | 0 | 4 | - | 4 |
| CEE 182 | Design of Reinforced Concrete Structures | 0 | 4 | 1 | 4 |
| CEE 183 | Integrated Building Design | 0 | 4 | 1 | 4 |
| CEE 195A/B | Structural Geology | 2 | 1 | 1 | 3 |
| CEE 196 | Engineering Geology Practice | 2 | 1 | 1 | 3 |
| CEE 199 | Undergraduate Research in CEE | varies | varies | 0-4 | 1-4 |

# Civil Engineering

*Typical Sequence of Courses*




* Arrows represent direct prerequisites
* Dashed lines represent co-requisites.
* Dashed-line boxes enclose alternates. These may indicate alternate years in which to take a given course, and/or alternate courses that may be taken at a given time.

# Civil Engineering

*Environmental (Wet) Track, Early Start Program*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | Engr Elctv^ | - | 3 | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | CHEM 31A+ | 4 | - | - | CHEM 31B+ | 4 | - | - | CHEM 33 | 4 | - | - |
| | Unrstr Elctv # | - | - | 3 | Unrstr Elctv # | - | - | 3 | Writing | - | - | 4 |
| | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *4* | *3* | *8* |
| | Total | | | 16 | Total | | | 16 | Total | | | 15 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CME 100^^ | 5 | - | - | CME 102^^ | 5 | - | - | CEE 70 | - | 3 | - |
| | CEE 101D | - | 3 | - | PHYSICS 41 | 4 | - | - | ENGR 14 | - | 3 | - |
| | ENGR 60 | - | 3 | - | CE/Wet Elctv | - | 3 | - | Writing | - | - | 4 |
| | *Subtotals* | *5* | *6* | *5* | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *0* | *6* | *9* |
| | Total | | | 16 | Total | | | 17 | Total | | | 15 |
| *Junior* | CEE 177 | - | 4 | - | STAT 60 | 5 | - | - | CEE 101B* | - | 4 | - |
| | ENGR 30* | - | 3 | - | CEE 101A | - | 4 | - | CEE 160 | - | 2 | - |
| | GES 1 | 5 | - | - | CEE 172* | - | 3 | - | CEE 100 | - | 4 | - |
| | GER | - | - | 4 | GER | - | - | 4 | TIS Course | - | - | 4 |
| | *Subtotals* | *4* | *7* | *4* | *Subtotals* | *5* | *7* | *4* | *Subtotals* | *0* | *10* | *4* |
| | Total | | | 15 | Total | | | 16 | Total | | | 14 |
| *Senior* | CEE166A | - | 3 | - | CEE166B | - | 3 | - | CEE 169** | - | 5 | - |
| | CEE161A* | - | 4 | - | CEE 171 | - | 3 | - | CE/Wet Elctv | - | 3 | - |
| | CEE101C | - | 4 | - | CEE 179A | - | 3 | - | GER | - | - | 5 |
| | Unrstr Elctv | - | - | 3 | GER | - | - | 4 | | | | |
| | *Subtotals* | *0* | *11* | *3* | *Subtotals* | *0* | *9* | *4* | *Subtotals* | *0* | *8* | *5* |
| | Total | | | 14 | Total | | | 13 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 45 |
| Total Engineering Units: | 70 |
| Total Other Units: | 65 |
| Total Units: | 180 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter. (E60 is offered A or W)

\# Students should explore majors of interest to them using these unrestricted electives.Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Can take Math 51 and 53 instead of CME 100 and 102, if desired.

\+ If Chem 31X or Engr 31 is substituted for Chem 31A, then replace Chem 31B with another chem or physics class.

* These classes all are typically offered MWF10.

** In alternate years, when CEE169 is not offered, take CEE179B or C in the spring to fulfill the capstone design experience.

# Civil Engineering

*Environmental (Wet) Track, Regular Program*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | STAT 60 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv # | - | - | 3 | PHYSICS 41 | 4 | - | - | GER | - | - | 4 |
| | Writing | - | - | 4 | Unrstr Elctv # | - | - | 3 | Unrstr Elctv # | - | - | 3 |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *5* | *0* | *11* |
| | Total | | | 16 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CHEM 31A+ | 4 | - | - | CHEM 31B+ | 4 | - | - | CHEM 33 | 4 | - | - |
| | MATH 51^^ | 5 | - | - | MATH 53^^ | 5 | - | - | CEE 70 | - | 3 | - |
| | Writing | - | - | 4 | ENGR 60 | - | 3 | - | Engr Elctv^ | - | 3 | - |
| | *Subtotals* | *9* | *0* | *9* | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *4* | *6* | *5* |
| | Total | | | 18 | Total | | | 17 | Total | | | 15 |
| *Junior* | ENGR 14 | - | 3 | - | CEE101A | - | 4 | - | CEE 101B* | - | 4 | - |
| | CEE 177 | - | 4 | - | CEE 172* | - | 3 | - | CEE 160 | - | 2 | - |
| | CEE 101D | - | 3 | - | CE/Wet Elctv | - | 3 | - | CEE 100 | - | 4 | - |
| | GER | - | - | 5 | GER | - | - | 4 | GES 1 | 4 | - | - |
| | *Subtotals* | *0* | *10* | *5* | *Subtotals* | *0* | *10* | *4* | *Subtotals* | *4* | *10* | *0* |
| | Total | | | 15 | Total | | | 14 | Total | | | 14 |
| *Senior* | CEE101C | - | 4 | - | CEE 166B | - | 3 | - | CEE 169** | - | 5 | - |
| | CEE 161A* | - | 4 | - | CEE 171 | - | 3 | - | CE/Wet Elctv | - | 3 | - |
| | CEE 166A | - | 3 | - | CEE 179A | - | 3 | - | TIS Course | - | - | 4 |
| | GER | - | - | 4 | ENGR 30* | - | 3 | - | | | | |
| | *Subtotals* | *0* | *11* | *4* | *Subtotals* | *0* | *12* | *0* | *Subtotals* | *0* | *8* | *4* |
| | Total | | | 15 | Total | | | 12 | Total | | | 12 |

| | |
|---|---|
| Total Math & Science Units: | 45 |
| Total Engineering Units: | 70 |
| Total Other Units: | 65 |
| Total Units: | 180 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter. (E60 is offered A or W)

\# Students should explore majors of interest to them using these unrestricted electives.Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Can take CME 100 and 102 instead of Math 51 and 53, if desired.

\+ If Chem 31X or Engr 31 is substituted for Chem 31A, then replace Chem 31B with another chem or physics class.

* These classes all are typically offered MWF10.

** In alternate years, when CEE169 is not offered, take CEE179B or C in the spring to fulfill the capstone design experience.

# Civil Engineering

*Typical 4 Year Plan*

*Structures/Construction (Dry) Track, Early Start Program*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | STAT 60 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv # | - | - | 3 | PHYSICS 41 | 4 | - | - | PHYSICS 43+ | 4 | - | - |
| | Writing | - | - | 4 | Unrstr Elctv # | - | - | 3 | Engr Elctv^ | - | 3 | - |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *3* | *4* |
| | Total | | | 16 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CME 100^^ | 5 | - | - | CME 102^^ | 5 | - | - | CEE 100 | - | 4 | - |
| | PHYSICS 45+ | 4 | - | - | ENGR 50 | - | 4 | - | CEE 156 | - | 4 | - |
| | Writing | - | - | 4 | Unrstr Elctv # | - | - | 3 | Engr Elctv^ | - | 3 | - |
| | *Subtotals* | *9* | *0* | *9* | *Subtotals* | *5* | *4* | *8* | *Subtotals* | *0* | *11* | *5* |
| | Total | | | 18 | Total | | | 17 | Total | | | 16 |
| *Junior* | ENGR 14 | - | 3 | - | CEE 101A | - | 4 | - | CEE 101B | - | 4 | - |
| | CE/Dry Elctv | - | 3 | - | CEE 102 | - | 3 | - | CE/Dry Elctv | - | 3 | - |
| | GES 1 | 5 | - | - | ENGR 60 | - | 3 | - | CEE 70 | - | 3 | - |
| | ENGR 31 | 4 | - | - | GER | - | - | 4 | GER | - | - | 4 |
| | *Subtotals* | *8* | *6* | *0* | *Subtotals* | *0* | *10* | *4* | *Subtotals* | *0* | *10* | *4* |
| | Total | | | 14 | Total | | | 14 | Total | | | 14 |
| *Senior* | CEE 101C | - | 4 | - | CE/Dry Elctv | - | 3 | - | CE/Dry Elctv | - | 3 | - |
| | CEE 180 | - | 4 | - | CEE 182 | - | 4 | - | CEE183 | - | 4 | - |
| | CEE 181 | - | 4 | - | TIS Course | - | - | 4 | GER | - | - | 5 |
| | | | | | GER | - | - | 4 | | | | |
| | *Subtotals* | *0* | *12* | *0* | *Subtotals* | *0* | *7* | *8* | *Subtotals* | *0* | *7* | *5* |
| | Total | | | 12 | Total | | | 15 | Total | | | 12 |

| | |
|---|---|
| Total Math & Science Units: | 45 |
| Total Engineering Units: | 70 |
| Total Other Units: | 65 |
| Total Units: | 180 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter.

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Can take Math 51 and 53 instead of CME 100 and 102, if desired.

\+ Can replace either Phys 43 or Phys 45 with a second chemistry class.

# Civil Engineering

*Typical 4 Year Plan*

*Structures/Construction (Dry) Track, Regular Program*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | STAT 60 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv # | - | - | 3 | GER | - | - | 4 | GER | - | - | 4 |
| | Writing | - | - | 4 | Unrstr Elctv # | - | - | 3 | Unrstr Elctv # | - | - | 3 |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *5* | *0* | *11* |
| | Total | | | 16 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | Engr Elctv^ | - | 3 | - | PHYSICS 41 | 4 | - | - | PHYSICS 43+ | 4 | - | - |
| | MATH 51^^ | 5 | - | - | MATH 53^^ | 5 | - | - | CEE 100 | - | 4 | - |
| | Writing | - | - | 4 | Engr Elctv^ | - | 3 | - | GES 1 | 4 | - | - |
| | *Subtotals* | *5* | *3* | *9* | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *8* | *4* | *5* |
| | Total | | | 17 | Total | | | 17 | Total | | | 17 |
| *Junior* | ENGR 14 | - | 3 | - | CEE 101A | - | 4 | - | CEE 101B | - | 4 | - |
| | CE/Dry Elctv | - | 3 | - | ENGR 50 | - | 4 | - | CEE 156 | - | 4 | - |
| | PHYSICS 45+ | 4 | - | - | CEE 102 | - | 3 | - | CEE 70 | - | 3 | - |
| | ENGR 31 | 4 | - | - | CE/Dry Elctv | - | 3 | - | GER | - | - | 4 |
| | *Subtotals* | *8* | *6* | *0* | *Subtotals* | *0* | *14* | *0* | *Subtotals* | *0* | *11* | *4* |
| | Total | | | 14 | Total | | | 14 | Total | | | 15 |
| *Senior* | CEE 101C | - | 4 | - | CE/Dry Elctv | - | 3 | - | CE/Dry Elctv | - | 3 | - |
| | CEE 180 | - | 4 | - | CEE 182 | - | 4 | - | CEE183 | - | 4 | - |
| | CEE 181 | - | 4 | - | ENGR 60 | - | 3 | - | GER | - | - | 5 |
| | | | | | TIS Course | - | - | 4 | | | | |
| | *Subtotals* | *0* | *12* | *0* | *Subtotals* | *0* | *10* | *4* | *Subtotals* | *0* | *7* | *5* |
| | Total | | | 12 | Total | | | 14 | Total | | | 12 |

| | |
|---|---|
| Total Math & Science Units: | 45 |
| Total Engineering Units: | 70 |
| Total Other Units: | 65 |
| Total Units: | 180 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter.

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Can take CME 100 and 102 instead of Math 51 and 53, if desired.

\+ Can replace either Phys 43 or Phys 45 with a second chemistry class.

# Civil Engineering

*Typical 4 Year Plan*

*Structures/Construction (Dry) Track, Autumn Quarter Junior Year Abroad*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv # | - | - | 3 | PHYSICS 41 | 4 | - | - | GER^^ | - | - | 4 |
| | Writing | - | - | 4 | Unrstr Elctv # | - | - | 3 | Engr Elctv #^ | - | 3 | - |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *5* | *3* | *8* |
| | Total | | | 16 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | ENGR 31 | 4 | - | - | MATH 53 | 5 | - | - | CEE 100 | - | 4 | - |
| | PHYSICS 45+ | 4 | - | - | ENGR 60 | - | 3 | - | PHYSICS 43+ | 4 | - | - |
| | Writing | - | - | 4 | Engr Elctv^ | - | 3 | - | ENGR 14++ | - | 3 | - |
| | *Subtotals* | *8* | *0* | *9* | *Subtotals* | *5* | *6* | *5* | *Subtotals* | *4* | *7* | *5* |
| | Total | | | 17 | Total | | | 16 | Total | | | 16 |
| *Junior* | GER^^ | - | - | 5 | CEE 101A | - | 4 | - | CEE 101B | - | 4 | - |
| | GER^^ | - | - | 4 | STAT 60 | 5 | - | - | CEE 156 | - | 4 | - |
| | Unrstr Elctv | - | - | 3 | ENGR 50^^ | - | 4 | - | CEE 70 | - | 3 | - |
| | *--- Autumn Quarter Abroad ---* | | | ++ | CE/Dry Elctv | - | 3 | - | GES 1 | 4 | - | - |
| | *Subtotals* | *0* | *0* | *12* | *Subtotals* | *5* | *11* | *0* | *Subtotals* | *4* | *11* | *0* |
| | Total | | | 12 | Total | | | 16 | Total | | | 15 |
| *Senior* | CEE 101C | - | 4 | - | CEE 102 | - | 3 | - | GER | - | - | 4 |
| | CEE 180 | - | 4 | - | CEE 182 | - | 4 | - | CEE 183 | - | 4 | - |
| | CEE 181 | - | 4 | - | TIS Course | - | - | 4 | CE/Dry Elctv | - | 3 | - |
| | CE/Dry Elctv | - | 3 | - | CE/Dry Elctv | - | 3 | - | | | | |
| | *Subtotals* | *0* | *15* | *0* | *Subtotals* | *0* | *10* | *4* | *Subtotals* | *0* | *7* | *4* |
| | Total | | | 15 | Total | | | 14 | Total | | | 11 |

| | |
|---|---|
| Total Math & Science Units: | 45 |
| Total Engineering Units: | 70 |
| Total Other Units: | 65 |
| Total Units: | 180 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter. (E14 is offered A or S)

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Most Overseas programs offer Classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter. Some Overseas programs also offer Engr 40 and/or 50.

\+ Can replace either Phys 43 or Phys 45 with a second chemistry class.

++ Engr 14 must be taken in sophomore year to do Autumn quarter overseas.

# Civil Engineering

*Typical 4 Year Plan*

*Structures/Construction (Dry) Track, Winter Quarter Junior Year Abroad*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv# | - | - | 3 | PHYSICS 41 | 4 | - | - | GER^^ | - | - | 4 |
| | Writing | - | - | 4 | Unrstr Elctv# | - | - | 3 | Engr Elctv #^ | - | 3 | - |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *5* | *3* | *8* |
| | Total | | | 16 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | ENGR 14++ | - | 3 | - | CEE 101A++ | - | 4 | - | CEE 100 | - | 4 | - |
| | PHYSICS 45+ | 4 | - | - | MATH 53 | 5 | - | - | PHYSICS 43+ | 4 | - | - |
| | Writing | - | - | 4 | Engr Elctv^ | - | 3 | - | GES 1 | 4 | - | - |
| | *Subtotals* | *4* | *3* | *9* | *Subtotals* | *5* | *7* | *5* | *Subtotals* | *8* | *4* | *5* |
| | Total | | | 16 | Total | | | 17 | Total | | | 17 |
| *Junior* | STAT 60 | 5 | - | - | GER^^ | - | - | 5 | CEE 101B | - | 4 | - |
| | ENGR 31 | 4 | - | - | GER^^ | - | - | 4 | CEE 156 | - | 4 | - |
| | TIS Course | - | - | 4 | Unrstr Elctv | - | - | 3 | CEE 70 | - | 3 | - |
| | CE/Dry Elctv | - | 3 | - | *--- Winter Quarter Abroad ---* | | | ++ | ENGR 50^^ | - | 4 | - |
| | *Subtotals* | *9* | *3* | *4* | *Subtotals* | *0* | *0* | *12* | *Subtotals* | *0* | *15* | *0* |
| | Total | | | 16 | Total | | | 12 | Total | | | 15 |
| *Senior* | CEE 101C | - | 4 | - | ENGR 60 | - | 3 | - | GER | - | - | 4 |
| | CEE 180 | - | 4 | - | CEE 182 | - | 4 | - | CEE183 | - | 4 | - |
| | CEE 181 | - | 4 | - | CEE 102 | - | 3 | - | CE/Dry Elctv | - | 3 | - |
| | CE/Dry Elctv | - | 3 | - | CE/Dry Elctv | - | 3 | - | | | | |
| | *Subtotals* | *0* | *15* | *0* | *Subtotals* | *0* | *13* | *0* | *Subtotals* | *0* | *7* | *4* |
| | Total | | | 15 | Total | | | 13 | Total | | | 11 |

| | |
|---|---|
| Total Math & Science Units: | 45 |
| Total Engineering Units: | 70 |
| Total Other Units: | 65 |
| Total Units: | 180 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter.

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Most Overseas programs offer Classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter. Some Overseas programs also offer Engr 40 and/or 50.

\+ Can replace either Phys 43 or Phys 45 with a second chemistry class.

++ The sequence of E14 and CEE101A must be taken in Aut/Win of sophomore year to do Winter quarter overseas.

# Civil Engineering

*Typical 4 Year Plan*

*Structures/Construction (Dry) Track, Spring Quarter Junior Year Abroad*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv# | - | - | 4 | PHYSICS 41 | 4 | - | - | GER^^ | - | - | 4 |
| | Writing | - | - | 3 | Unrstr Elctv# | - | - | 3 | Engr Elctv #^ | - | 3 | - |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *5* | *3* | *8* |
| | Total | | | 16 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | Engr Elctv^ | - | 3 | - | TIS Course | - | - | 4 | CEE 100++ | - | 4 | - |
| | GES 1 | 5 | - | - | MATH 53 | 5 | - | - | PHYSICS 43+ | 4 | - | - |
| | Writing | - | - | 4 | ENGR 60 | - | 3 | - | CE/Dry Elctv | - | 3 | - |
| | *Subtotals* | *5* | *3* | *9* | *Subtotals* | *5* | *3* | *9* | *Subtotals* | *4* | *7* | *5* |
| | Total | | | 17 | Total | | | 17 | Total | | | 16 |
| *Junior* | ENGR 14 | - | 3 | - | CEE 101A | - | 4 | - | GER^^ | - | - | 5 |
| | ENGR 31 | 4 | - | - | CEE 102 | - | 3 | - | GER^^ | - | - | 4 |
| | PHYSICS 45+ | 4 | - | - | STAT 60 | 5 | - | - | Unrstr Elctv | - | - | 3 |
| | CE/Dry Elctv | - | 3 | - | CE/Dry Elctv | - | 3 | - | *--- Spring Quarter Abroad ---* | | ++ | |
| | *Subtotals* | *8* | *6* | *0* | *Subtotals* | *5* | *10* | *0* | *Subtotals* | *0* | *0* | *12* |
| | Total | | | 14 | Total | | | 15 | Total | | | 12 |
| *Senior* | CEE 101C | - | 4 | - | ENGR 50^^ | - | 4 | - | CEE 101B | - | 4 | - |
| | CEE 180 | - | 4 | - | CEE 182 | - | 4 | - | CEE 183 | - | 4 | - |
| | CEE 181 | - | 4 | - | GER | - | - | 4 | CEE 70 | - | 3 | - |
| | | | | | CE/Dry Elctv | - | 3 | - | CEE 156 | - | 4 | - |
| | *Subtotals* | *0* | *12* | *0* | *Subtotals* | *0* | *11* | *4* | *Subtotals* | *0* | *15* | *0* |
| | Total | | | 12 | Total | | | 15 | Total | | | 15 |

| | |
|---|---|
| Total Math & Science Units: | 46 |
| Total Engineering Units: | 70 |
| Total Other Units: | 65 |
| Total Units: | 181 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter. (E60 is offered A or W)

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Most Overseas programs offer Classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter. Some Overseas programs also offer Engr 40 and/or 50.

\+ Can replace either Phys 43 or Phys 45 with a second chemistry class.

++ CEE100 (or CEE70, 101B or 156) must be taken by Spring of Sophomore year to avoid overload in Spring of Senior year.

# Civil Engineering

*Environmental (Wet) Track, Autumn Quarter Junior Year Abroad*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv# | - | - | 3 | PHYSICS 41 | 4 | - | - | CEE 70 | - | 3 | - |
| | Writing | - | - | 4 | Engr Elctv #^ | - | 3 | - | Unrstr Elctv# | - | - | 3 |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *3* | *4* | *Subtotals* | *5* | *3* | *7* |
| | Total | | | 16 | Total | | | 16 | Total | | | 15 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CHEM 31A+ | 4 | - | - | CHEM 31B+ | 4 | - | - | CHEM 33 | 4 | - | - |
| | CEE 101D++ | - | 3 | - | ENGR 60 | - | 3 | - | ENGR 14++ | - | 3 | - |
| | Writing | - | - | 4 | MATH 53 | 5 | - | - | GES 1 | 4 | - | - |
| | *Subtotals* | *4* | *3* | *9* | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *8* | *3* | *5* |
| | Total | | | 16 | Total | | | 17 | Total | | | 16 |
| *Junior* | GER^^ | - | - | 5 | CEE101A | - | 4 | - | CEE 101B* | - | 4 | - |
| | GER^^ | - | - | 4 | CEE 172* | - | 3 | - | CEE 160 | - | 2 | - |
| | Unrstr Elctv | - | - | 3 | STAT 60 | 5 | - | - | CEE 100 | - | 4 | - |
| | *--- Autumn Quarter Abroad ---* | | | ++ | CE/Wet Elctv | - | 3 | - | GER | - | - | 4 |
| | *Subtotals* | *0* | *0* | *12* | *Subtotals* | *5* | *10* | *0* | *Subtotals* | *0* | *10* | *4* |
| | Total | | | 12 | Total | | | 15 | Total | | | 14 |
| *Senior* | CEE101C | - | 4 | - | CEE 166B | - | 3 | - | CEE 169** | - | 5 | - |
| | CEE 161A* | - | 4 | - | CEE 171 | - | 3 | - | TIS Course | - | - | 4 |
| | CEE 166A | - | 3 | - | CEE 179A | - | 3 | - | CE/Wet Elctv | - | 3 | - |
| | CEE 177 | - | 4 | - | ENGR 30* | - | 3 | - | GER | - | - | 4 |
| | *Subtotals* | *0* | *15* | *0* | *Subtotals* | *0* | *12* | *0* | *Subtotals* | *0* | *8* | *8* |
| | Total | | | 15 | Total | | | 12 | Total | | | 16 |

| | |
|---|---|
| Total Math & Science Units: | 45 |
| Total Engineering Units: | 70 |
| Total Other Units: | 65 |
| Total Units: | 180 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter.

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Most Overseas programs offer classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter. Some Overseas programs also offer Engr 40 or 50.

\+ If Chem 31X or Engr 31 is substituted for Chem 31A, then replace Chem 31B with another chem or physics class.

++ Engr 14 must be taken in sophomore year to do Autumn quarter overseas. CEE101D (or 177) must be taken in Autumn of sophomore year, to avoid overcrowding in Autumn of senior year.

* These classes all are typically offered MWF10.

** In alternate years, when CEE169 is not offered, take CEE179B or C in the spring to fulfill design experience.

# Civil Engineering

*Environmental (Wet) Track, Winter Quarter Junior Year Abroad*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv # | - | - | 3 | PHYSICS 41 | 4 | - | - | CEE 70 | - | 3 | - |
| | Writing | - | - | 4 | Engr Elctv #^ | - | 3 | - | Unrstr Elctv # | - | - | 3 |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *3* | *4* | *Subtotals* | *5* | *3* | *7* |
| | Total | | | 16 | Total | | | 16 | Total | | | 15 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CHEM 31A | 4 | - | - | CHEM 31B | 4 | - | - | CHEM 33 | 4 | - | - |
| | ENGR 14++ | - | 3 | - | CEE101A++ | - | 4 | - | CEE 100 | - | 4 | - |
| | Writing | - | - | 4 | MATH 53 | 5 | - | - | GES 1 | 4 | - | - |
| | *Subtotals* | *4* | *3* | *9* | *Subtotals* | *9* | *4* | *5* | *Subtotals* | *8* | *4* | *5* |
| | Total | | | 16 | Total | | | 18 | Total | | | 17 |
| *Junior* | CE/Wet Elctv | - | 3 | - | GER^^ | - | - | 5 | CEE 101B* | - | 4 | - |
| | CEE 177 | - | 4 | - | GER^^ | - | - | 4 | CEE 160 | - | 2 | - |
| | ENGR 30* | - | 3 | - | Unrstr Elctv | - | - | 3 | STAT 60 | 5 | - | - |
| | CEE 101D | - | 3 | - | *--- Winter Quarter Abroad ---* | | | ++ | GER | - | - | 4 |
| | *Subtotals* | *0* | *13* | *0* | *Subtotals* | *0* | *0* | *12* | *Subtotals* | *5* | *6* | *4* |
| | Total | | | 13 | Total | | | 12 | Total | | | 15 |
| *Senior* | ENGR 60 | - | 3 | - | CEE 171 | - | 3 | - | CEE 169** | - | 5 | - |
| | CEE101C | - | 4 | - | CEE 172* | - | 3 | - | CE/Wet Elctv | - | 3 | - |
| | CEE 161A* | - | 4 | - | CEE 179A | - | 3 | - | TIS Course | - | - | 4 |
| | CEE 166A | - | 3 | - | CEE 166B | - | 3 | - | GER | - | - | 4 |
| | *Subtotals* | *0* | *14* | *0* | *Subtotals* | *0* | *12* | *0* | *Subtotals* | *0* | *8* | *8* |
| | Total | | | 14 | Total | | | 12 | Total | | | 16 |

| | |
|---|---|
| Total Math & Science Units: | 45 |
| Total Engineering Units: | 70 |
| Total Other Units: | 65 |
| Total Units: | 180 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter.

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Most Overseas programs offer classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter. Some Overseas programs also offer Engr 40 and/or 50.

\+ If Chem 31X or Engr 31 is substituted for Chem 31A, then replace Chem 31B with another chem or physics class.

++ The sequence of E14 and CEE101A must be taken in Aut/Win of sophomore year to do Winter quarter overseas as a Junior.

* These classes all are typically offered MWF10.

** In alternate years, when CEE169 is not offered, take CEE179B or C in the spring to fulfill design experience.

# Civil Engineering

*Environmental (Wet) Track, Spring Quarter Junior Year Abroad*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv # | - | - | 3 | PHYSICS 41 | 4 | - | - | CEE 70 | - | 3 | - |
| | Writing | - | - | 4 | Engr Elctv #^ | - | 3 | - | GER ^^ | - | - | 4 |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *3* | *4* | *Subtotals* | *5* | *3* | *8* |
| | Total | | | 16 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CHEM 31A+ | 4 | - | - | CHEM 31B+ | 4 | - | - | CEE 101B++ | - | 4 | - |
| | CEE 101D | - | 3 | - | ENGR 30* | - | 3 | - | CEE 160++ | - | 2 | - |
| | Writing | - | - | 4 | MATH 53 | 5 | - | - | STAT 60 | 5 | - | - |
| | *Subtotals* | *4* | *3* | *9* | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *5* | *6* | *5* |
| | Total | | | 16 | Total | | | 17 | Total | | | 16 |
| *Junior* | ENGR 14 | - | 3 | - | CEE 101A | - | 4 | - | GER^^ | - | - | 5 |
| | CEE 177 | - | 4 | - | CEE 172* | - | 3 | - | GER^^ | - | - | 4 |
| | CE/Wet Elctv | - | 3 | - | ENGR 60 | - | 3 | - | Unrstr Elctv | - | - | 3 |
| | GES 1 | 5 | - | - | CHEM 33 | 4 | - | - | *--- Spring Quarter Abroad ---* | | | ++ |
| | *Subtotals* | *5* | *10* | *0* | *Subtotals* | *4* | *10* | *0* | *Subtotals* | *0* | *0* | *12* |
| | Total | | | 15 | Total | | | 14 | Total | | | 12 |
| *Senior* | CEE101C | - | 4 | - | CEE 166B | - | 3 | - | CEE 169** | - | 5 | - |
| | CEE 161A* | - | 4 | - | CEE 171 | - | 3 | - | CE/Wet Elctv | - | 3 | - |
| | CEE 166A | - | 3 | - | CEE 179A | - | 3 | - | CEE 100 | - | 4 | - |
| | GER | - | - | 4 | TIS Course | - | - | 4 | Unrstr Elctv | - | - | 3 |
| | *Subtotals* | *0* | *11* | *4* | *Subtotals* | *0* | *9* | *4* | *Subtotals* | *0* | *12* | *3* |
| | Total | | | 15 | Total | | | 13 | Total | | | 15 |

| | |
|---|---|
| Total Math & Science Units: | 46 |
| Total Engineering Units: | 70 |
| Total Other Units: | 65 |
| Total Units: | 181 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter.

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Most Overseas programs offer classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter. Some Overseas programs also offer Engr 40 and/or 50.

\+ If Chem 31X or Engr 31 is substituted for Chem 31A, then replace Chem 31B with another chem or physics class.

++ CEE101B and CEE160 must be taken in spring of Sophomore year to do a Spring quarter overseas as a Junior.

* These classes all are typically offered MWF10.

** In alternate years, when CEE169 is not offered, take CEE179B or C in the spring to fulfill design experience.

# INSTRUCTIONS FOR DECLARING MAJOR IN CIVIL ENGINEERING

1. Enter your major declaration as Civil Engineering in Axess
2. Pick up your academic folder from your freshman/sophomore adviser and print out your Stanford transcript (unofficial is fine) from Axess.
3. Download and complete your major Program Sheet, which you can obtain from the UGHB website at **http://ughb.stanford.edu/**. Be sure to fill in all courses that you have taken and those which you plan to take. You will have the opportunity to revise this later, so please fill in as many courses as you can.
4. Bring your academic folder, transcript and completed program sheet to the CEE Student Services office in Room 316 of the Jerry Yang and Akiko Yamazaki Environment & Energy (Y2E2) Building and request to have a CEE advisor assigned to you. You may request a specific advisor if you wish. Office hours are10:00 am to noon and 2:00 to 4:00 pm, Monday through Friday.
5. Meet with your CEE undergraduate advisor and have him/her review and sign your program sheet.
6. Return your signed program sheet to the CEE Student Services Specialist, who upon receiving your signed sheet will approve your major declaration in Axess.
7. You are encouraged to meet with your CEE undergraduate adviser at least once a quarter to review your academic progress. Changes to your program sheet can be made by printing out a revised sheet, obtaining your undergraduate adviser's signature, and returning the approved sheet to the CEE Student Services Office.
   NOTE –*Confirm that your program sheet is up to date at least one quarter prior to graduation.*

Other information:

- Procedures for requesting transfer credits and program deviations are described in detail in at the beginning of Chapter 4: "Policies and Procedures." The relevant forms are in the back of the Handbook in the "Forms" section, or on the UGHB site under the "Petitions" link. The online forms may be filled out electronically. If you are requesting transfer credits or program deviations, you should bring your completed petition form with your transcript to the CEE Student Services office. Attach your program sheet on file in CEE.
- Check with the CEE Student Services Office to make sure that you are on the CEE UG student email list for important announcements about department events and activities.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download the online CE program sheet from **ughb.stanford.edu** to ensure you are using an accurate major plan.

**Stanford University ♦ School of Engineering**

# Civil Engineering

# 2009–2010 Program Sheet

**— ABET Accreditation Criteria Apply —**

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Mathematics* | | | | | | | | | | |
| MATH | 41 | Calculus | | | | 5 | | | | |
| MATH | 42 | Calculus | | | | 5 | | | | |
| CME | 100 | Vector Calculus for Eng. (req'd) (note 1) | | | | 5 | | | | |
| CME | 102 | Math/Comp. Methods for Eng. (req'd) (note 1) | | | | 5 | | | | |
| STATS | | Statistical Methods (STATS 60, 110, GES 160, CEE 203 *or* CME 106) | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Mathematics Unit total* | | | | | |
| *Science* | | | | | | | | | | |
| PHYS | 41 | Mechanics (req'd) | | | | 4 | | | | 0 |
| CHEM | 31 | Chemical Principles (req'd; see note 2) | | | | 4 | | | | 0 |
| GES | 1A/B/C | Intro to Geology (1 course req'd) | | | | 4 to 5 | | | | 1 |
| | | First addl qtr of physics or chemistry (req'd; see note 3) | | | | 4 | | | | |
| | | Second addl qtr of physics or chemistry, 3-4 units (req'd; see note 3) | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Science Unit Total* | | | | | |
| | | | | | *Mathematics and Science Unit Total (45 units minimum)* | | | | | |

**Technology in Society Requirement** (1 course req'd; see UGHB, Fig. 3-3 for approved list)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |

**NOTES**

* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to Engr majors.
* Engineering Science, Design, and Experimentation units do not apply to shaded areas.
* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.
* All courses listed on this form must be taken for a letter grade if offered by the instructor.
* Minimum Combined GPA for all courses in Engineering Topics (Engineering Science and Engineering Design courses) is 2.0.
* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.
* Any course listed on this form must only be included under one category. Delete courses not taken.

( 1 ) Either CME 100 & 102 OR Math 51 & 53 are required.

( 2 ) Either CHEM 31A, CHEM 31X, or ENGR 31 is requried.

( 3 ) Students in Environmental/Water Studies Track must take CHEM 33 and one additional chemsitry or physics course. Students in the Structures/Construction Track must take PHYS 43 or 45 and one additional chemistry or physics course.

# Civil Engineering Program Sheet (continued)

**Engineering Topics** (68 Engineering Science + Engineering Design units = ABET req't. See note 4)

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Engineering Fundamentals (3 courses required)* | | | | | | | | | | |
| ENGR | 14 | Applied Mechanics: Statics (req'd) | | | | 3 | | 2 | 1 | 0 |
| ENGR | 60 | Engineering Economy (req'd) | | | | 3 | | 3 | 0 | 0 |
| | | | | | | | | | | |
| | | | | | *Engr. Fundamentals Unit Total* | | | | | |
| *Engineering Depth* | | | | | | | | | | |
| CEE | 70 | Environ. Science & Technology (req'd) | | | | 3 | | 2 | 1 | 0 |
| CEE | 100 | Managing Sust. Bldg Proj (req'd); WIM (see note 5) | | | | 4 | | 2.5 | 1.5 | 1 |
| CEE | 101A | Mechanics of Materials (req'd) | | | | 4 | | 3 | 1 | 1 |
| CEE | 101B | Mechanics of Fluids (req'd) | | | | 4 | | 3 | 1 | 0 |
| CEE | 101C | Geotechnical Engineering (req'd) | | | | 4 | | 3 | 1 | 1 |
| | | | | | | | | | | |
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| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Depth/Engr Science/Engr Design/Experiment Unit Totals* | | | | | |

**Program Totals (ABET Requirements)**

| | | |
|---|---|---|
| *Mathematics and Science* | *(45 units minimum)* | |
| *Engineering Topics (Engr Science + Engr Design)* | *(68 units minimum)* | |
| *Experimentation* | *(8 units minimum)* | |

**Program Approvals**

*Advisor*
Printed Name: _____ Date: _____
Signature: _____

*Departmental*
Printed Name: _____ Date: _____
Signature: _____

*School of Engineering (signature not required prior to graduation)*
Printed Name: _____ Date: _____
Signature: _____

**NOTES (continued from page 1)**

( 4 ) In order to satisfy ABET requirements for graduation, the CE major must take enough courses so that the combined Engineering Science and Design units from Fundamentals and Depth courses add up to a minimum of 68 units. See Unit Allocation list at ughb.stanford.edu to assess the number of assigned Science/Design units for unlisted courses.

( 5 ) Fulfills the "Writing in the Major" requirement.

# COMPUTER SCIENCE

Looking at technology today, it is hard to believe that the first computers were developed only half a century ago. Computers are everywhere, and much of modern engineering involves the application of computer technology. The undergraduate major in computer science offers a broad and rigorous training for students interested in the science of computing. The track structure of the CS program also allows you to pursue the area(s) of CS you find most interesting while giving you a solid overall foundation in the field.

Many students obtaining a BS in CS will go on to work in industry or do graduate work in a branch of CS such as artificial intelligence, robotics, software design, graphics, theory, or hardware design. But CS is not just for future computer scientists. There is an increasing demand for people trained in CS and some other field. If you are interested in working as a manager of a high-tech company, a BS in CS along with an MBA is a great combination. If you want to work on court cases involving software piracy, you will be well served by a BS in CS combined with a JD. Similar opportunities exist for those who combine a BS in CS with an MD or other graduate degree.

The minimum major in computer science consists of 96 units, including 26 units of math, 11 units of science, 13 units of engineering fundamentals, one course in TIS (Technology in Society), and 43 units of core depth. After learning essential programming techniques in CS106 (via the CS106A/B/X courses) and the mathematical foundations of computer science in CS103, the computer science major offers coursework in areas such as artificial intelligence, biocomputation, graphics, human-computer interaction, information, systems, and theory.

The Computer Science Department also participates in three interdisciplinary majors: Computer Systems Engineering, Mathematical and Computational Sciences, and Symbolic Systems.

## UNDERGRADUATE RESEARCH OPPORTUNITIES

In addition to the honors program in CS (discussed later in this handbook), there are many opportunities for undergraduates to get involved in research. Here is a partial list:

### CURIS (Undergraduate Research in Computer Science)

Each summer undergraduates work with CS faculty through the summer research college. Interested students apply for positions during the winter quarter, and CURIS decisions are then made and offers sent out before spring quarter begins. These positions are fully-funded and provide invaluable experience in cutting-edge research. All CS and CSE students are notified via email of CURIS opportunities and the application process.

### Research Opportunities for Computer Science Undergraduates

At the beginning of each academic year CS faculty are asked to provide a list of ongoing research projects that are appropriate for undergraduate involvement. Descriptions of the projects are listed at `http://curis.stanford.edu/research.html` (don't let the 'curis' fool you; this is not the web site for the summer CURIS program).

### Research Tour/Lunch Series

Each year the CS department offers research lab tours and luncheons specifically geared toward undergraduates. These tours allow students to experience first-hand what goes on in a lab, and the luncheons provide an opportunity for students to discuss interests with research faculty. Past tours included the AI Robotics Lab, the IRoom and the Graphics Lab.

### Research Seminars and Talks

At various times throughout the year the CS department hosts talks and presentations on various research and technology topics. In addition to these one-time events, there are regularly scheduled seminars which are open to undergraduates. Many of these seminars are available as 1 unit, 500-level courses, but enrollment is not required for attendance.

### For students interested in Pursuing a Research-Oriented Undergraduate Program:

#### *Freshman and Sophomore Year*

Students interested in pursuing research should plan to finish the majority of the CS core (CS 103, 106, 107, 109, 110, and 161) by the end of the sophomore year. If you already have an idea of the area in CS you'd like to pursue, you may find these course suggestions useful:

| **If you're considering…** | **…make sure to take these freshman/sophomore year** |
|---|---|
| Possible AI courses | CS 109 |
| Possible graphics courses | Math 51 and/or Math 104 |
| Possible theory courses | CS 109, CS 154, or CS 161 |

Students doing summer research through CURIS should expect to take a course or two spring quarter to prepare them for their research project.

***Junior Year***

During the junior year students considering research can take one of the following sequences:

| Field of Interest | Fall | Winter | Spring |
|---|---|---|---|
| Artificial Intelligence | 221 | Any 22x | Coursework suggested by CURIS advisor |
| Databases | 145 | 245 | |
| Graphics | 148 | 248 | |
| Human-Computer Interaction | 147 | 247 | |
| Systems | 144 | 140 | |
| Theory | 157 and 161 | 256 or 259 | |

* Students should take Math 51 or Math 103 before taking CS 248.

Students doing summer research through CURIS should expect to take a course or two spring quarter to prepare them for their research project.

***Senior Year***

At the end of the junior year students who qualify are encouraged to apply for the CS honors program (see the Computer Science 'honors' section later in this handbook). Students who are accepted spend the senior year exploring a research topic in depth and writing an honors thesis. Alternatively, students may choose to take CS 294 if they do not have a specific project in mind but wish to contribute to active research.

*Note:* The above are meant to be taken only as suggestions. If you have questions, contact the CS course advisor at **advisor@cs.stanford.edu**.

# REQUIREMENTS

| Course | Title | Units | Quarter | Year |
|---|---|---|---|---|
| **Mathematics (26 units minimum)** | | | | |
| MATH 41 | Calculus[1] | 5 | A | Fr |
| MATH 42 | Calculus[1] | 5 | AW | Fr |
| CS 103 | Mathematical Foundations of Computing[2] | 5 | AS | Fr |
| CS 109 | Introduction to Probability for Computer Scientists[3] | 5 | WS | So |
| Mathematics electives[4] | | 6 | | |
| **Science (11 units minimum)** | | | | |
| PHYSICS 41 | Mechanics | 4 | W | Fr |
| PHYSICS 43 | Electricity and Magnetism | 4 | S | Fr |
| Science Elective[5] | | 3 | | So/Jr |
| **Engineering Fundamentals (13 units minimum)** | | | | |
| ENGR 40 | Introductory Electronics | 5 | AS | So |
| CS 106B *or*<br>CS 106X | Programming Abstractions<br>Programming Abstractions (Accelerated) | 5<br>5 | AWS<br>A | Fr/So<br>Fr/So |
| Fundamentals Elective (see list of approved courses in Fig. 3-4; may not be 106A, B or X) | | | | |
| **Technology in Society (One course, 3-5 units)** | | | | |
| *See list of approved courses in Figure 3-3.* | | | | |
| **Writing in the Major (One course)** | | | | |
| *CS 181, CS 191W, CS 194 and CS 294W fulfill the "Writing in the Major" requirement.* | | | | |
| **Core (14 units)** | | | | |
| CS 107 | Computer Organization and Systems[6] | 5 | AS | So |
| CS 110 | Principles of Computer Systems [7] | 5 | WS | So/Jr |
| CS 161 | Design and Analysis of Algorithms[8] | 4 | AW | So/Jr |
| **Senior Project***:* CS 191, 191W, 194, 210B, 294, or 294W [9] | | 5 | | Sr |
| **Depth: Choose one of the following tracks: minimum of 7 courses (26 units minimum required)** | | | | |
| ***Artificial Intelligence Track:***<br>a) CS 221<br>b) Any two of: CS 223A, 223B, 224M, 224N, 226, 227, 228, 229<br>c) One additional course from category (b) or the following: CS 124, 205A, 222, 224S, 224U, 225A 225B, 227B, 262, 276, 277, 279, 321, 326A, 327A, 329 (with advisor approval), 374, 379 (with advisor approval); EE 263, 376A; Eng 205, 209A; MS&E 251, 339, 351; Stat 315A, 315B<br>d) Track Electives: At least three additional courses selected from (b), (c), the general CS electives list[10], or the following: CS 275, 278; EE 364A, 364B; Econ 286; MS&E 252, 352, 355; Phil 152; Psych 202, 204A, 204B; Stat 200, 202, 205 | | | | |
| ***Biocomputation Track:*** *(see Biocomputation Track program sheet; Mathematics, Science, and Engineering Fundamentals requirements are non-standard)* | | | | |
| ***Graphics Track:***<br>a) CS 148, 248<br>b) Any one of[11]: CS 205A; CME 104, 108; Math 52, 113<br>c) Any two of: CS 164, 178, 205B, 223B, 268, 348A, 348B, 448<br>d) Track Electives: At least two additional courses selected from (b), (c), the general CS electives list[10], or the following: ArtStudio 60, 70, 179; CS 48N, 326A; CME 302, 306, 324; EE 262, 264, 278, 368; ME 101; Psych 30, 221; STS 144 | | | | |
| ***CS tracks continues on next page*** | | | | |

| |
|---|
| ***Human-Computer Interaction Track:***<br>a) CS 147, 247<br>b) Any one of: CS 148, 248, 376, 377, 378<br>c) Any one of: CS 108, 124140, 142, 221, 229, 249A<br>d) Any one of: PSYCH 55, 252; MS&E 184; ME 101, 115<br>e) Track Electives-At least two additional courses selected from (b)], (c), (d), the general CS electives list[10], or the following: ARTSTUD 60; COMM 269; CME 340; CS 447 (with permission of undergraduate advisor), 448B (with permission of undergraduate advisor); ME 115,;216A; PSYCH 205, 221 |
| ***Information Track:***<br>a) CS 124, 145<br>b) Two courses, which must be from different areas below:<br>i. Information-based AI applications: CS 224N, 224S, 229<br>ii.Database and Information Systems: CS 140, 240D, 245, 345, 346, 347<br>iii.Information Systems in Biology: CS262, 270, 274<br>iv.Information Systems on the Web: CS 276, 364B<br>c) At least three additional courses selected from (b) or the general CS electives list[10] |
| ***Systems Track:***<br>a) CS 140<br>b) One of: CS 143 or EE 108B<br>c) Two additional courses from category (b) or the following: CS 144, 145, 155, 240, 240C, 240D, 242, 243, 244, 245; EE 271, 282<br>d) Track Electives: At least three additional courses selected from (c), the general CS electives list[10], or the following: CS 240E, 240X, 244C, 244E, 315A, 315B, 343, 344, 344E, 345, 346, 347, 349 (with permission of undergraduate advisor), 448; EE 382A, 382C, 384A, 384B, 384C, 384S, 384X, 384Y |
| ***Theory Track:***<br>a) CS 154<br>b) Any one of: CS 164, 255, 258, 261, 268, 361A, 361B, 365<br>c) Two additional courses from category (b) or the following: CS 143, 155, 156, 157 or Phil 151, 205A, 228, 242, 256, 259, 262, 354, 355, 357, 358, 359 (with permission of undergraduate advisor), 364A, 364B, 369 (with permission of undergraduate advisor), 374; MS&E 310<br>d) Track Electives: At least three additional courses selected from (b), (c), the general CS electives list[10], or the following: CME 302, 305; Phil 152 |
| ***Unspecialized Track:***<br>a) CS 154<br>b) Any one of: CS 140, 143<br>c) One additional course from (b) or the following: CS 144, 155, 240D, 242, 244; EE 108B<br>d) Any one of: CS 121 or 221, 223A, 223B, 228, 229<br>e) Any one of: CS 145, 147, 148, 248, 262<br>f) At least two courses from the general CS electives list[10] |
| ***Individually Designed Track:*** Students may propose an individually designed track. Proposals should include a minimum of seven courses, at least four of which must be CS courses numbered 100 or above |

## Notes:

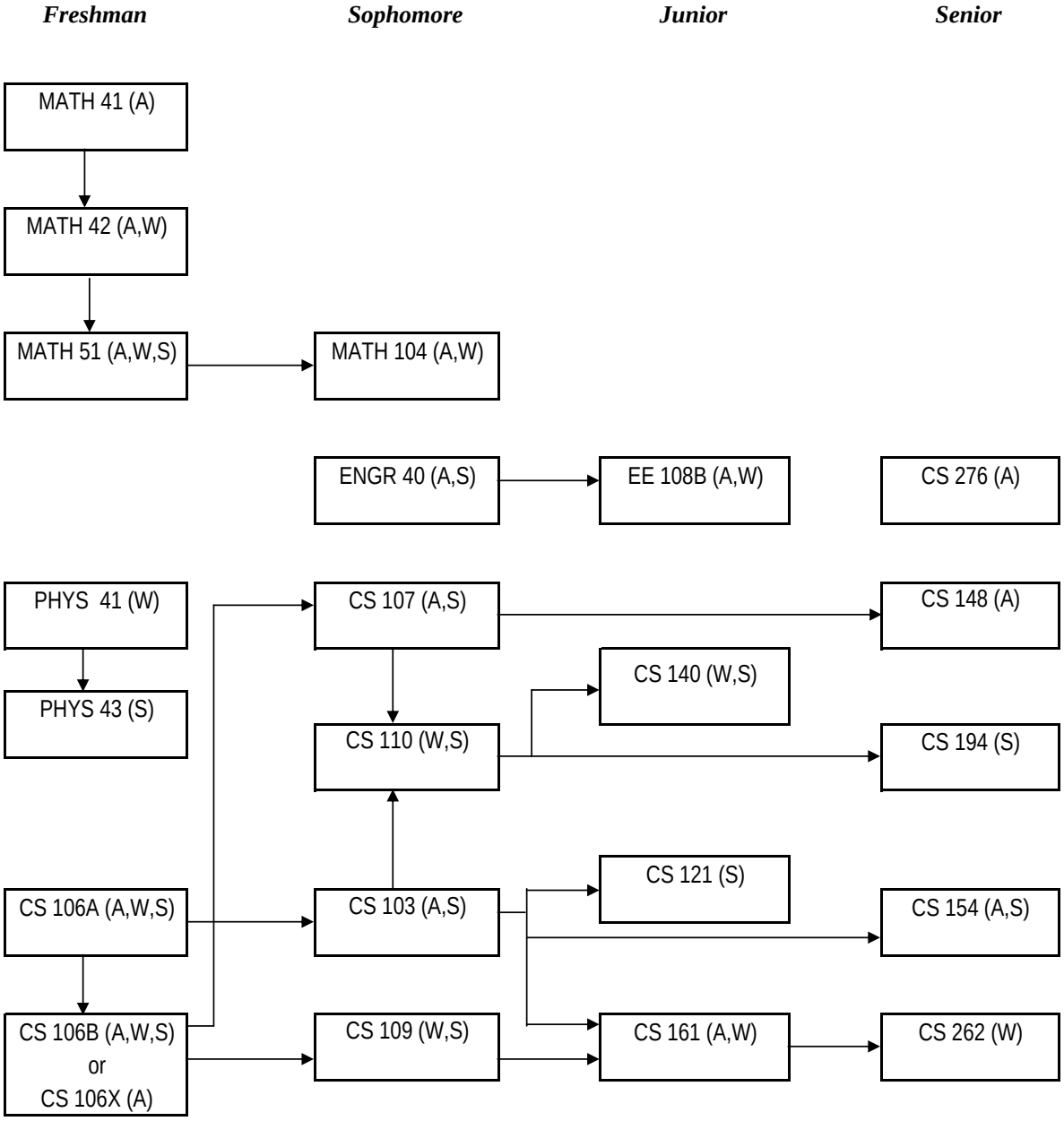
1. MATH 19, 20 and 21 may be taken instead of MATH 41 and 42, as long as at least 26 math units are taken.
2. Students who have taken either CS 103X or CS 103A, B are considered to have satisfied the CS 103 requirement. Students who took CS 103X are required to complete one additional unit in their track or elective courses (i.e., 26 total units for track and elective courses).
3. Students who complete STATS 116, MS&E 120, or CME 106 in *Winter 2008-09 or earlier* may count that course as satisfying the CS 109 requirement. These same courses taken in *Spring 2008-09 or later* cannot be used to satisfy the CS 109 requirement.

4. The Mathematics electives list consists of: Math 51, 103, 104, 108, 109, 110, 113; CS 156, 157, 205A; Phil 151; CME 100, 102, 104. Completion of Math 52 and 53 will (together) count as one Math elective.
   Restrictions: Math 51 and Math 103,, or Math 103 and Math 113, or CS 157 and Phil 151, may not be used in combination to satisfy the Math electives requirement. Students who have taken both Math 51 and 52 may not count CME 100 as an elective.
5. Any course of 3 or more units from the School of Engineering list of "Courses Approved for the Science Requirement" (Figure 3-2); PSYCH 30; PSYCH 55, or AP Chemistry credit may also be used. Either of the physics sequences 61/63 or 21/23 may be substituted for 41/43 as long as at least 11 science units are taken.
6. The name of CS 107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this requirement.
7. Students who complete CS 108 and either CS 140 or CS 143 by Winter Quarter 2008-09 or earlier may choose to count CS 108 as satisfying the CS 110 requirement. In such a case CS 108 may not also be counted as an elective and the student will be required to complete one additional unit in their track or elective courses (i.e., 26 total units for track and elective courses).
8. Students who took CS 161 for 4 units are required to complete one additional unit in their track or elective courses (i.e., 26 total units for track and elective courses)
9. CS 191 and 191W independent study projects require faculty sponsorship and must be approved, in advance, by the advisor, faculty sponsor, and the CS senior project advisor (Robert Plummer or Patrick Young). A form bearing these signatures, along with a brief description of the project, should be filed with the department representative in Gates 182 the quarter before work on the project is begun.
10. General CS Electives: CS 108, 121 or 221, 124, 140, 142, 143, 144, 145, 147, 148, 149, 154, 155, 156, 157 or Phil 151, 164, 205A, 205B, 210A, 222, 223A, 223B, 224M, 224N, 224S, 224U, 225A, 225B, 226, 227, 228, 228T, 229, 240, 241, 242, 243, 244, 244B, 245, 247, 249A, 249B, 255, 256, 257, 258, 261, 262, 270, 271, 272, 273A, 274, 276, 277, 295; CME 108; EE 108B, 282
11. Of the category (b) options for the Graphics track, CS 205A is strongly recommended as a preferred choice. Note that students taking CME 104 are also required to take its prerequisite course CME 102.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download an online CS program sheet from **`ughb.stanford.edu`** to ensure you are using an accurate major plan.

# Computer Science

*Typical Sequence of Courses*
*Unspecialized Track*



# Computer Science

*Artificial Intelligence Track*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | CS 103 | - | 5 | - |
| | CS 106A | - | 5 | - | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Writing | - | - | 4 | CS 106B | - | 5 | - | | | | |
| | *Subtotals* | *5* | *5* | *8* | *Subtotals* | *9* | *5* | *4* | *Subtotals* | *4* | *5* | *4* |
| | Total | | | 18 | Total | | | 18 | Total | | | 13 |
| *Sophomore* | CS 107 | - | 5 | - | CS 109 | - | 5 | - | CS elective | - | 4 | - |
| | Math elective | 5 | - | - | CS 110 | - | 5 | - | ENG 40 | - | 5 | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | Writing | - | - | 4 | | | | | Sci. elective | 3 | - | - |
| | *Subtotals* | *5* | *5* | *9* | *Subtotals* | *0* | *10* | *5* | *Subtotals* | *3* | *9* | *5* |
| | Total | | | 19 | Total | | | 15 | Total | | | 17 |
| *Junior* | CS 161 | - | 5 | - | CS elective | - | 4 | - | CS 224N | - | 4 | - |
| | CS elective | - | 4 | - | CS 124 | - | 4 | - | TIS course | - | - | 4 |
| | GER | - | - | 5 | GER | - | - | 5 | Elective | - | - | 4 |
| | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *0* | *8* | *5* | *Subtotals* | *0* | *4* | *8* |
| | Total | | | 14 | Total | | | 13 | Total | | | 12 |
| *Senior* | CS 221 | - | 4 | - | CS 228 | - | 3 | - | CS 194 | - | 3 | - |
| | GER | - | - | 5 | Math elective | 5 | - | - | GER | - | - | 4 |
| | Fund elective | - | 3 | - | Elective | - | - | 4 | Elective | - | - | 3 |
| | | | | | GER | - | - | 4 | Elective | - | - | 3 |
| | *Subtotals* | *0* | *7* | *5* | *Subtotals* | *5* | *3* | *8* | *Subtotals* | *0* | *3* | *10* |
| | Total | | | 12 | Total | | | 16 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 31 |
| Total Engineering Units: | 73 |
| Total Other Units: | 76 |
| Total Units: | 180 |

# Computer Science

*Biocomputation Track*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | CS 103 | - | 5 | - |
| | CS 106A | | 5 | - | CS 106B | - | 5 | - | Writing | - | - | 4 |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | CHEM 31A | 4 | - | - | CHEM 31B | 4 | - | - | CHEM 33 | 4 | - | - |
| | *Subtotals* | *9* | *5* | *4* | *Subtotals* | *9* | *5* | *4* | *Subtotals* | *4* | *5* | *8* |
| | Total | | | 18 | Total | | | 18 | Total | | | 17 |
| *Sophomore* | CS 107 | - | 5 | - | CS 109 | - | 5 | - | Fund elective | - | 3 | - |
| | BIO 41 | 5 | - | - | BIO 42 | 5 | - | - | GER | - | - | 4 |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | Elective | - | - | 3 | Elective | - | - | 4 | Writing | - | - | 4 |
| | *Subtotals* | *5* | *5* | *8* | *Subtotals* | *5* | *5* | *9* | *Subtotals* | *0* | *3* | *13* |
| | Total | | | 18 | Total | | | 19 | Total | | | 16 |
| *Junior* | CS 161 | - | 4 | - | STAT 215 | 3 | - | - | CS 110 | 3 | - | - |
| | CS145 | - | 4 | - | PHYS 41 | 4 | - | - | CS 121 | - | 3 | - |
| | GER | - | - | 4 | GER | - | - | 5 | GER | - | - | 4 |
| | | | | | | | | | TIS elective | - | - | 3 |
| | *Subtotals* | *0* | *8* | *4* | *Subtotals* | *7* | *0* | *5* | *Subtotals* | *3* | *3* | *7* |
| | Total | | | 12 | Total | | | 12 | Total | | | 13 |
| *Senior* | CS 273A | - | 3 | - | CS Elective | - | 4 | - | CS 274 | - | 4 | - |
| | CS 147 | - | 4 | - | HUM BIO 133 | - | 4 | - | CS 191W | - | 3 | - |
| | GER | - | - | 5 | Elective | - | - | 4 | Elective | - | - | 3 |
| | | | | | | | | | Elective | - | - | 3 |
| | *Subtotals* | *0* | *7* | *5* | *Subtotals* | *0* | *8* | *4* | *Subtotals* | *0* | *7* | *6* |
| | Total | | | 12 | Total | | | 12 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 42 |
| Total Engineering Units: | 61 |
| Total Other Units: | 77 |
| Total Units: | 180 |

# Computer Science

*Graphics Track*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | CS 103 | - | 5 | - |
| | CS 106A | - | 5 | - | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Writing | - | - | 4 | CS 106B | - | 5 | - | GER | - | - | 3 |
| | *Subtotals* | *5* | *5* | *8* | *Subtotals* | *9* | *5* | *4* | *Subtotals* | *4* | *5* | *7* |
| | Total | | | 18 | Total | | | 18 | Total | | | 16 |
| *Sophomore* | CS 107 | - | 5 | - | CS 110 | - | 5 | - | CS 109 | - | 5 | - |
| | MATH 51 | 5 | - | - | MATH 113 | 3 | - | - | ENG 40 | - | 5 | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | Writing | - | - | 4 | | | | | | | | |
| | *Subtotals* | *5* | *5* | *9* | *Subtotals* | *3* | *5* | *5* | *Subtotals* | *0* | *10* | *5* |
| | Total | | | 19 | Total | | | 13 | Total | | | 15 |
| *Junior* | CS elective | - | 4 | - | CS 161 | - | 5 | - | CS 164 | - | 3 | - |
| | CS 108 | - | 4 | | GER | - | - | 4 | Sci. elective | 3 | - | - |
| | CS 148 | - | 3 | - | Elective | - | - | 4 | GER | - | - | 4 |
| | Elective | - | - | 3 | Elective | - | - | 3 | Elective | | | 3 |
| | *Subtotals* | *0* | *11* | *3* | *Subtotals* | *0* | *5* | *11* | *Subtotals* | *3* | *3* | *7* |
| | Total | | | 14 | Total | | | 16 | Total | | | 13 |
| *Senior* | TIS course | - | - | 5 | CS248 | - | 5 | - | CS 194 | - | 3 | - |
| | CS 205A | - | 3 | - | Fund Elective | - | 3 | - | CS 178 | - | 5 | - |
| | GER | - | - | 4 | GER | - | - | 4 | Elective | - | - | 3 |
| | | | | | | | | | Elective | - | - | 3 |
| | *Subtotals* | *0* | *3* | *9* | *Subtotals* | *0* | *8* | *4* | *Subtotals* | *0* | *8* | *6* |
| | Total | | | 12 | Total | | | 12 | Total | | | 14 |

| | |
|---|---|
| Total Math & Science Units: | 29 |
| Total Engineering Units: | 73 |
| Total Other Units: | 78 |
| **Total Units:** | 180 |

# Computer Science

*Human-Computer Interaction Track*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 19 | 3 | - | - | MATH 20 | 3 | - | - | MATH 21 | 4 | - | - |
| | CS 106A | - | 5 | - | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Writing | - | - | 4 | CS 106B | - | 5 | - | CS 107 | - | 5 | - |
| | *Subtotals* | *3* | *5* | *8* | *Subtotals* | *7* | *5* | *4* | *Subtotals* | *8* | *5* | *4* |
| | Total | | | 16 | Total | | | 16 | Total | | | 17 |
| *Sophomore* | CS 103 | - | 5 | - | CS 109 | - | 5 | - | Math elective | 3 | - | - |
| | Fund Elect | - | 3 | - | CS 110 | - | 5 | - | ENG 40 | - | 5 | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | Writing | - | - | 4 | GER | - | - | 3 | | | | |
| | *Subtotals* | *0* | *8* | *9* | *Subtotals* | *0* | *10* | *8* | *Subtotals* | *3* | *5* | *5* |
| | Total | | | 17 | Total | | | 18 | Total | | | 13 |
| *Junior* | CS 147 | - | 4 | - | CS 247 | - | 4 | - | MS&E 184 | - | 3 | - |
| | CS 148 | - | 3 | - | CS 108 | - | 4 | - | CS Elective | - | 3 | - |
| | Math elective | 5 | - | - | GER | - | - | 5 | Elective | - | - | 4 |
| | | | | | | | | | GER | - | - | 5 |
| | *Subtotals* | *5* | *7* | *0* | *Subtotals* | *0* | *8* | *5* | *Subtotals* | *0* | *6* | *9* |
| | Total | | | 12 | Total | | | 13 | Total | | | 15 |
| *Senior* | CS elective | - | 4 | - | CS 161 | - | 5 | - | CS 194 | - | 3 | - |
| | Sci Elective | 3 | - | - | TIS course | - | - | 4 | GER | - | - | 3 |
| | GER | - | - | 4 | Elective | - | - | 4 | Elective | - | - | 4 |
| | Elective | - | - | 3 | Elective | - | - | 3 | Elective | - | - | 3 |
| | *Subtotals* | *3* | *4* | *7* | *Subtotals* | *0* | *5* | *11* | *Subtotals* | *0* | *3* | *10* |
| | Total | | | 14 | Total | | | 16 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 29 |
| Total Engineering Units: | 71 |
| Total Other Units: | 80 |
| **Total Units:** | 180 |

# Computer Science

*Information Track*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | CS 103 | - | 5 | - |
| | CS 106X | - | 5 | - | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Writing | - | - | 4 | GER | - | - | 5 | | | | |
| | *Subtotals* | *5* | *5* | *8* | *Subtotals* | *9* | *0* | *9* | *Subtotals* | *4* | *5* | *4* |
| | Total | | | 18 | Total | | | 18 | Total | | | 13 |
| *Sophomore* | CS 107 | - | 5 | - | CS 109 | - | 5 | - | CS elective | - | 3 | - |
| | Math elective | 5 | - | - | CS 110 | - | 5 | - | ENG 40 | - | 5 | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | Writing | - | - | 4 | | | | | | | | |
| | *Subtotals* | *5* | *5* | *9* | *Subtotals* | *0* | *10* | *5* | *Subtotals* | *0* | *8* | *5* |
| | Total | | | 19 | Total | | | 15 | Total | | | 13 |
| *Junior* | CS 161 | - | 5 | - | CS 124 | - | 4 | - | Fund elective | - | 3 | - |
| | CS elective | - | 4 | - | TIS course | - | - | 4 | Math elective | 5 | - | - |
| | GER | - | - | 5 | GER | - | - | 5 | CS elective | - | 5 | - |
| | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *0* | *4* | *9* | *Subtotals* | *5* | *8* | *0* |
| | Total | | | 14 | Total | | | 13 | Total | | | 13 |
| *Senior* | CS 145 | - | 4 | - | CS 245 | - | 3 | - | CS 210B | - | 3 | - |
| | CS 276 | - | 3 | - | Sci elective | 3 | - | - | GER | - | - | 5 |
| | GER | - | - | 5 | CS 210A | - | 3 | - | Elective | - | - | 4 |
| | Elective | - | - | 3 | Elective | - | - | 4 | Elective | - | - | 4 |
| | *Subtotals* | *0* | *7* | *8* | *Subtotals* | *3* | *6* | *4* | *Subtotals* | *0* | *3* | *13* |
| | Total | | | 15 | Total | | | 13 | Total | | | 16 |

| | |
|---|---|
| Total Math & Science Units: | 31 |
| Total Engineering Units: | 70 |
| Total Other Units: | 79 |
| **Total Units:** | 180 |

# Computer Science

*Systems Track*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | CS 103 | - | 5 | - |
| | CS 106A | - | 5 | - | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Writing | - | - | 4 | CS 106B | - | 5 | - | | | | |
| | *Subtotals* | *5* | *5* | *8* | *Subtotals* | *9* | *5* | *4* | *Subtotals* | *4* | *5* | *4* |
| | Total | | | 18 | Total | | | 18 | Total | | | 13 |
| *Sophomore* | CS 107 | - | 5 | - | CS 109 | - | 5 | - | CS elective | - | 4 | - |
| | Math elective | 5 | - | - | CS 110 | - | 5 | - | ENG 40 | - | 5 | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | Writing | - | - | 4 | | | | | | | | |
| | *Subtotals* | *5* | *5* | *9* | *Subtotals* | *0* | *10* | *5* | *Subtotals* | *0* | *9* | *5* |
| | Total | | | 19 | Total | | | 15 | Total | | | 14 |
| *Junior* | CS 161 | - | 5 | - | CS 140 | - | 4 | - | CS 155 | - | 3 | - |
| | CS 144 | - | 4 | - | Math elective | 5 | - | - | CS elective | | 4 | - |
| | GER | - | - | 5 | GER | - | - | 5 | GER | - | | 5 |
| | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *5* | *4* | *5* | *Subtotals* | *0* | *7* | *5* |
| | Total | | | 14 | Total | | | 14 | Total | | | 12 |
| *Senior* | CS 143 | - | 4 | - | CS 210A | - | 3 | - | CS 210 B | - | 3 | - |
| | CS elective | - | 4 | - | Fund eletive | - | 3 | - | GER | - | - | 4 |
| | TIS elective | - | - | 5 | GER | - | - | 5 | Elective | - | - | 3 |
| | Sci elective | 3 | - | - | Elective | - | - | 3 | Elective | - | - | 3 |
| | *Subtotals* | *3* | *8* | *5* | *Subtotals* | *0* | *6* | *8* | *Subtotals* | *0* | *3* | *10* |
| | Total | | | 16 | Total | | | 14 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 31 |
| Total Engineering Units: | 76 |
| Total Other Units: | 73 |
| **Total Units:** | 180 |

# Computer Science

*Theory Track*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | CS 103 | - | 5 | - |
| | CS 106X | - | 5 | - | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Writing | - | - | 4 | GER | - | - | 5 | | | | |
| | *Subtotals* | *5* | *5* | *8* | *Subtotals* | *9* | *0* | *9* | *Subtotals* | *4* | *5* | *4* |
| | Total | | | 18 | Total | | | 18 | Total | | | 13 |
| *Sophomore* | CS 107 | - | 5 | - | CS 109 | - | 5 | - | CS 154 | - | 4 | - |
| | Math elective | 5 | - | - | CS 110 | - | 5 | - | ENG 40 | - | 5 | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | Writing | - | - | 4 | | | | | | | | |
| | *Subtotals* | *5* | *5* | *9* | *Subtotals* | *0* | *10* | *5* | *Subtotals* | *0* | *9* | *5* |
| | Total | | | 19 | Total | | | 15 | Total | | | 14 |
| *Junior* | CS 161 | - | 5 | - | CS elective | - | 4 | - | CS164 | - | 3 | - |
| | CS elective | - | 4 | - | Math elective | 5 | - | - | CS elective | | 5 | - |
| | GER | - | - | 5 | GER | - | - | 5 | GER | - | | 5 |
| | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *5* | *4* | *5* | *Subtotals* | *0* | *8* | *5* |
| | Total | | | 14 | Total | | | 14 | Total | | | 13 |
| *Senior* | CS 157 | - | 3 | - | CS elective | - | 3 | - | CS 191W | - | 3 | - |
| | CS 242 | - | 3 | - | Fund eletive | - | 3 | - | GER | - | - | 4 |
| | TIS elective | - | - | 5 | Elective | - | - | 5 | Elective | - | - | 4 |
| | Sci elective | 3 | - | - | Elective | - | - | 3 | Elective | - | - | 3 |
| | *Subtotals* | *3* | *6* | *5* | *Subtotals* | *0* | *6* | *8* | *Subtotals* | *0* | *3* | *11* |
| | Total | | | 14 | Total | | | 14 | Total | | | 14 |

| | |
|---|---|
| Total Math & Science Units: | 31 |
| Total Engineering Units: | 70 |
| Total Other Units: | 79 |
| **Total Units:** | 180 |

# Computer Science

*Unspecialized Track*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | CS 103 | - | 5 | - |
| | CS 106A | - | 5 | - | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Writing | - | - | 4 | CS 106B | - | 5 | - | | | | |
| | *Subtotals* | *5* | *5* | *8* | *Subtotals* | *9* | *5* | *4* | *Subtotals* | *4* | *5* | *4* |
| | Total | | | 18 | Total | | | 18 | Total | | | 13 |
| *Sophomore* | CS 107 | - | 5 | - | CS 109 | - | 5 | - | CS elective | - | 4 | - |
| | Math elective | 5 | - | - | CS 110 | - | 5 | - | ENG 40 | - | 5 | - |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | Writing | - | - | 4 | | | | | | | | |
| | *Subtotals* | *5* | *5* | *9* | *Subtotals* | *0* | *10* | *5* | *Subtotals* | *0* | *9* | *5* |
| | Total | | | 19 | Total | | | 15 | Total | | | 14 |
| *Junior* | CS 161 | - | 5 | - | CS elective | - | 4 | - | CS 154 | - | 4 | - |
| | CS 147 | - | 4 | - | Math elective | 5 | - | - | Elective | | 4 | - |
| | GER | - | - | 5 | GER | - | - | 5 | GER | - | | 5 |
| | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *5* | *4* | *5* | *Subtotals* | *0* | *8* | *5* |
| | Total | | | 14 | Total | | | 14 | Total | | | 13 |
| *Senior* | CS 144 | - | 4 | - | CS 140 | - | 4 | - | CS 194 | - | 3 | - |
| | CS 221 | - | 4 | - | Fund eletive | - | 3 | - | GER | - | - | 3 |
| | TIS elective | - | - | 4 | GER | - | - | 5 | Elective | - | - | 3 |
| | Sci elective | 3 | - | - | Elective | - | - | 3 | Elective | - | - | 3 |
| | *Subtotals* | *3* | *8* | *4* | *Subtotals* | *0* | *7* | *8* | *Subtotals* | *0* | *3* | *9* |
| | Total | | | 15 | Total | | | 15 | Total | | | 12 |

| | |
|---|---|
| Total Math & Science Units: | 31 |
| Total Engineering Units: | 78 |
| Total Other Units: | 71 |
| **Total Units:** | 180 |

# INSTRUCTIONS FOR DECLARING MAJOR IN COMPUTER SCIENCE

## 1. Find an Advisor

For details see **http://csmajor.stanford.edu/ChoosingAdvisor.shtml**
Find a CS professor or lecturer who verbally agrees to be your advisor. See **http://csmajor/FacultyList.php** for a list of faculty members. You should meet with him or her in person, either in office hours or by appointment. Write your advisor's name here. If you prefer to have an advisor assigned to you by the department, write "any" in the space below

I have spoken to [ ] and he/she has agreed to be my advisor.

## 2. Collect Folder and Declare on Axess

Print out a copy of your unofficial transcript from Axess (Academics → View Unofficial Transcript). *Please don't staple it.*

❑ **My folder includes an unofficial transcript from this quarter.**

While you're on Axess, be sure to declare there. (Academics → Declare a Major/Minor).

❑ **I have declared on Axess.**

## 3. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| Full Name | First | Middle | | Last | |
| Name you go by: | | Birth date: | Month: | Day: | Year: |
| SUID # | | E-mail | @stanford.edu | | |
| Major | ❍ CS<br>❍ CSE | Expected graduation | ❍ 2012 ❍ 2011<br>❍ 2010 ❍ 2009 ❍ Other: | | |
| Date you came to see the Course Advisor: | | | | | |

## 4. See the Course Advisor in Gates 160

Bring this form to the Course Advisor's office hours in **Gates 160**. The current quarter's office hours are posted at **http://csmajor.stanford.edu/WhoToSee.shtml**.
NOTE: There are no office hours during finals week, break, or summer quarter. It may take up to a week for a declaration to go through, so please plan accordingly! Juniors should do this before winter quarter.

**Stanford University ♦ School of Engineering**

# Computer Science

## Artificial Intelligence Track

## 2009-2010 Program Sheet

*Final version of program sheet due to the department no later than one month prior to the last quarter of senior year.*

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirement** *(Delete courses and units not taken)*

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Mathematics (26 units minimum)* | | | | | | | |
| MATH | 41 | Calculus (see note 1) | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS | 103 | Mathematical Foundations of Computing (see note 2) | | | | 5 | |
| CS | 109 | Introduction to Probability for Computer Scientists (see note 3) | | | | 5 | |
| *Plus two electives (see note 4)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (26 units minimum)* | | |
| *Science 11 units minimum)* | | | | | | | |
| PHYS | 41 | Mechanics (or PHYS 21 or 61) | | | | 4 | |
| PHYS | 43 | Electricity and Magnetism (or PHYS 23 or 63) | | | | 4 | |
| | | Elective (see note 5) | | | | 3 to 5 | |
| | | | | | *Science Unit Total (11 units minimum)* | | |
| | | | | | *(37 units min. Math/Sci combined)* | | |
| **Technology in Society Requirement** *(1 course required; see UGHB Figure 3-3 for approved list; see note 14 )* | | | | | | | |
| | | | | | | | |
| **Engineering Fundamentals** (13 units minimum) | | | | | | | |
| CS | 106 | Programming Abstractions (B or X) | | | | 5 | |
| ENGR | 40 | Introductory Electronics | | | | 5 | |
| | | Elective (see note 6) | | | | 3 to 5 | |
| | | | | | *Engineering Fundamentals Total (13 units minimum)* | | |

**NOTES**

* This printed form must be signed by the departmental representative. Changes must be petitioned (see UGHB pg 27-29) and initialed in ink.

* All courses listed on this form must be taken for a letter grade (if offered) and can be included under only one category.

* Minimum Grade Point Average (GPA) for all courses in ENGR Fundamentals and CS Core, Depth, and Senior Project (combined) is 2.0.

( 1 ) Math 19, 20, 21 may be taken instead of Math 41& 42 as long as at least 26 math units are taken. AP Calculus must be approved by SoE.

( 2 ) Taking either CS 103X or CS 103A+B satisfies the CS 103 req't. Using CS 103X requires one add'l unit in depth ( 26 units min. track/electives).

( 3 ) Students who complete STATS 116, MS&E 120, or CME 106 in Winter 2008-09 or earlier may count that course as satisfying the CS 109 requirement. These same courses taken in Spring 2008-09 or later cannot be used to satisfy the CS 109 requirement.

( 4 ) Math electives: Math 51, 103, 104, 108, 109, 110, 113; CS 156, 157, 205A; PHIL 151; CME 100, 102, 104. Completion of Math 52 & 53 will (together) count as one Math elective. Restrictions: Math 51+ Math 103, Math 103 + Math 113, or CS 157+ Phil 151 may not be used in combination to satisfy the Math electives req't. Students who have taken both Math 51& 52 may not count CME 100 as an elective.

( 5 ) Any course of 3 or more units from the SoE Science List (Fig. 3-2 in the UGHB), PSYCH 30 or 55, or AP Chemistry may be used.

( 6 ) One course required; may not be CS 106A, B or X. See Engineering Fundamentals Fig. 3-4 in the UGHB for approved list.

*program sheet continues on page 2*

## CS Artificial Intelligence Program Sheet (continued)

**AI Track Core, Depth & Senior Project** *(43 units min) No course may be listed twice; no double counting.*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Core (15 units minimum)** | | | | | | | |
| CS | 107 | Computer Organization and Systems (see note 7) | | | | 5 | |
| CS | 110 | Principlets of Computer Systems (see note 8) | | | | 5 | |
| CS | 161 | Design and Analysis of Algorithms (see note 9) | | | | 5 | |
| **Depth; Track and Electives (25 units and seven courses minimum)** | | | | | | | |
| CS | 221 | AI: Principles and Techniques (Track Requirement A) | | | | 4 | |
| CS | | Track Requirement B (see note 10) | | | | 3 or 4 | |
| CS | | Track Requirement B (see note 10) | | | | 3 or 4 | |
| | | Track Requirement C (see note 11) | | | | 3 or 4 | |
| | | Elective (see note 12) | | | | 3 to 5 | |
| | | Elective (see note 12) | | | | 3 to 5 | |
| | | Elective (see note 12) | | | | 3 to 5 | |
| | | Optional Elective | | | | | |
| **Senior Project (1 course required)** | | | | | | | |
| CS | | At least 3 units of 191, 191W, 194, 210B, 294 or 294W *(see note 14)* | | | | 3 | |
| | | *Computer Science Core, Depth and Senior Project Total (43 units minimum)* | | | | | |

### Program Approvals

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 7 ) The name of CS 107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this requirement.

( 8 ) Students who complete CS108 & either CS 140 or CS 143 by Wtr Qtr 08-09 or earlier may choose to count CS 108 as satisfying the CS 110 req't. In this case CS 108 may not count as an elective and one add'l unit of depth must be taken (26 units min for track + electives).

( 9 ) Students who took CS161 for 4 units are required to complete one add'l unit in their depth (I.e., 26 units min. for track and elective courses)

( 10 ) Track Requirement B: Any two of CS 223A, 223B, 224M, 224N, 226, 227, 228, 229

( 11 ) Track Requirement C: One additional course from the Track Requirement B list, or from the following: CS124, 205A, 222, 224S, 224U, 225A, 225B, 227B, 262, 276, 277, 279, 321, 326A, 327A, 329 (with advisor approval), 374, 379 (with advisor approval); EE 263, 376A; ENGR 205, ENGR 209A; MS&E 251, 339, 351; STATS 315A, 315B

( 12 ) Track Electives: At least three add'l courses selected from the Track Req't B list, C list, the General CS Electives list (see Note 13) or the following: CS 275, 278; EE 364A, 364B; ECON 286; MS&E 252, 352, 355; PHIL 152; PSYCH 202, 204A, 204B; STATS 200, 202, 205

( 13 ) General CS Electives: CS 108, 124, 140, 142, 143, 144, 145, 147, 148,149, 154, 155, 156, 157 (or PHIL 151), 164, 205A, 205B,210A, 222, 223A, 223B, 224M, 224N, 224S, 224U, 225A, 225B, 226, 227, 228, 228T, 229, 240,241, 242, 243, 244, 244B, 245, 247, 248, 249A, 249B, 255, 256, 257, 258, 261, 262, 270, 271, 272, 273A, 274, 276, 277, 295; CME 108; EE 108B, 282

( 14 ) The WIM requirement for Freshmen and Transfer students entering Fall 96 or later may be met by taking CS 181 as a Technology in Society course or through the Senior Project course (CS 191W, 194, 210B, or 294W only).

**Stanford University ♦ School of Engineering**

# Computer Science

## Biocomputation Track

## 2009-2010 Program Sheet

***Final version of program sheet due to the department one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

### Mathematics and Science Requirement

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (23 units minimum)* | | | | | | | |
| MATH | 41 | Calculus (see note 1) | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS | 103 | Mathematical Foundations of Computing (see note 2) | | | | 5 | |
| CS | 109 | Introduction to Probability for Computer Scientists (see note 3) | | | | 5 | |
| STAT | | One of: Stat 141, 203, 205, 215, 225 | | | | 3 to 5 | |
| | | | | | *Mathematics Unit Total (23 units minimum)* | | |

*Science (22 units minimum)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PHYS | 41 | Mechanics | | | | 4 | |
| CHEM | 31A/B or X | Chemical Principles | | | | 4 or 8 | |
| CHEM | 33 | Structure and Reactivity | | | | 4 | |
| BIO *or* | 41, 42 *or* | Principles of Biology *or* | | | | 10 | |
| HUMBIO | 2A , 3A | Genetics, Evolution and Ecology/Cell and Dev Biology | | | | 10 | |
| | | | | | *Science Unit Total (22 units minimum)* | | |
| | | | | | *(45 units min. Math/Sci combined)* | | |

### Technology in Society Requirement *(1 course required; see UGHB Figure 3-3 for approved list; see note 12 )*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

### Engineering Fundamentals (8 units minimum)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CS | 106 | Programming Methodology (B or X) | | | | 5 | |
| | | Elective (see note 4) | | | | 3 to 5 | |
| | | | | | *Engineering Fundamentals Total (10 units minimum)* | | |

**NOTES**

* This printed form must be signed by the departmental representative. Changes must be petitioned (see UGHB pg 27-29) and initialed in ink.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Grade Point Average (GPA) for all courses in Engineering Fundamentals and Computer Science Depth (combined) is 2.0.

* Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's Office. Transfer credits in Computer Science Depth must be approved by the Computer Science undergraduate program office.

* All courses listed on this form may only be included under one category. Delete courses not taken.

(1) Math 19, 20 and 21 may be taken instead of Math 41 and 42 as long as at least 23 math units are taken.

(2) Students who have taken either CS 103X or CS 103A+ B are considered to have satisfied the CS 103 requirement. Students who took CS 103X are required to complete one additional unit in their track or elective courses (I.e., 22 units min. for track and elective courses).

(3) Students who complete STATS 116, MS&E 120, or CME 106 in *Winter 2008-09 or earlier* may count that course as satisfying the CS 109 requirement. These same courses taken in *Spring 2008-09 or later* cannot be used to satisfy the CS 109 requirement.

(4) One course required; may not be CS 106A, B or X. See Engineering Fundamentals Fig. 3-4 in the UGHB for approved list.

# CS Biocomputation Program Sheet cont.

**Biocomputation Track Core and Depth** *(39 units minimum)*.

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Core (15 units minimum)** | | | | | | | |
| CS | 107 | Computer Organization and Systems (see note 5) | | | | 5 | |
| CS | 110 | Principlets of Computer Systems (see note 6) | | | | 5 | |
| CS | 161 | Design and Analysis of Algorithms (see note 7) | | | | 5 | |
| **Depth (21 Units minimum)** | | | | | | | |
| CS | | One of: CS 121 or 221, 223B, 228, 229 | | | | 3 or 4 | |
| CS | | One of: CS 262, 270, 273A, 274, 275, 278, 279 | | | | 3 or 4 | |
| CS | | One of (if not selected above) CS 121 or 221, 223B, 228, 229, | | | | 3 to 5 | |
| | | 262, 270, 273A, 274, 275, 278, 279, 124, 145, 147, 148, 248 | | | | | |
| | | Restricted Elective (see note 8) | | | | 3 or 4 | |
| | | Restricted Elective (see note 9) | | | | 3 or 4 | |
| | | Restricted Elective (see note 10) | | | | 3 to 5 | |
| | | Restricted Elective (see note 11) | | | | 3 to 5 | |
| **Seior Project (1 course required)** | | | | | | | |
| CS | | At least 3 units of 191, 191W, 194, 210B, 294 or 294W *(see note 12)* | | | | 3 | |
| | | *Computer Science Core and Depth Total 39 units minimum)* | | | | | |

## Program Approvals

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to ENGR majors.

( 5 ) The name of CS 107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this requirement.

( 6 ) Students who complete CS108 and either CS 140 or CS 143 by Winter Quarter 2008-09 or earlier may choose to count CS 108 as satisfying the CS 110 requirement. In such a case CS 108 may not also be counted as an elective and the student will be required to to complete one additional unit in their track or elective courses (i.e., 23 units minimum for track and elective courses).

( 7 ) Students who took CS161 for 4 units are required to complete one additional unit in their depth courses (I.e., 22 units minimum for track and el

( 8 ) One course selected from either the Biomedical Computation (BMC) 'Informatics' electives list (go to http://bmc.stanford.edu and select Informatics from the elective options), or from the general CS electives list: 108, 121 or 221*, 124, 140, 142, 143, 144, 145, 147, 148, 149, 154, 155, 156, 157 (or PHIL 151), 164, 205A, 205B, 210A, 222, 223A, 223B, 224M, 224N, 224S, 224U, 225A, 225B, 226, 227, 228, 228T, 229, 240, 241, 242, 243, 244, 244B, 245, 247, 248, 249A, 249B, 255, 256, 257, 258, 261, 262, 270, 271, 272, 273A, 274, 276, 277, 295; CME 108; EE108B,282 *(Students may not count both CS 121 and 221 toward their major requirements.)

(9) One course selected from the BMC 'Informatics' electives list (go to http://bmc.stanford.edu).

(10) One course selected from either the BMC 'Informatics', 'Cellular/Molecular', or 'Organs/Organisms' electives lists.

(11) One course selected from either the BMC 'Cellular/Molecular' or 'Organs/Organisms' electives lists.

( 12 ) The WIM requirement for Freshmen and Transfer students entering Fall 96 or later may be met by taking CS 181 as a Technology in Society course or through the Senior Project course (191W, 194, 210B, or 294W only).

**Stanford University ♦ School of Engineering**

# Computer Science

## Graphics Track

## 2009-2010 Program Sheet

*Final version of program sheet due to the department no later than one month prior to the last quarter of senior year.*

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirement** *(Delete courses and units not taken)*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (26 units minimum)* | | | | | | | |
| MATH | 41 | Calculus (see note 1) | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS | 103 | Mathematical Foundations of Computing (see note 2) | | | | 5 | |
| CS | 109 | Introduction to Probability for Computer Scientists (see note 3) | | | | 5 | |
| *Plus two electives (see note 4)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (26 units minimum)* | | |
| *Science 11 units minimum)* | | | | | | | |
| PHYSIC | 41 | Mechanics (or PHYS 21 or PHYS 61) | | | | 4 | |
| PHYSIC | 43 | Electricity and Magnetism (or PHYS 23 or PHYS 63) | | | | 4 | |
| | | Elective (see note 5) | | | | 3 to 5 | |
| | | | | | *Science Unit Total (11 units minimum)* | | |
| | | | | | *(37 units min. Math/Sci combined)* | | |
| **Technology in Society Requirement** *(1 course required; see UGHB Figure 3-3 for approved list; see note 14 )* | | | | | | | |
| | | | | | | | |
| **Engineering Fundamentals** (13 units minimum) | | | | | | | |
| CS | 106 | Programming Abstractions (B or X) | | | | 5 | |
| ENGR | 40 | Introductory Electronics | | | | 5 | |
| | | Elective (see note 6) | | | | 3 to 5 | |
| | | | | | *Engineering Fundamentals Total (13 units minimum)* | | |

**NOTES**

- * This printed form must be signed by the departmental representative. Changes must be petitioned (see UGHB pg 27-29) and initialed in ink
- * All courses listed on this form must be taken for a letter grade (if offered) and can be included under only one catagory.
- * Minimum Grade Point Average (GPA) for all courses in Engineering Funds and CS Core, Depth, and Senior Project (combined) is 2.0.
- * Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's Office. Transfer credits in Computer Science Core, Depth and Senior Project must be approved by the Computer Science undergraduate program office.

( 1 ) Math 19, 20 and 21 may be taken instead of Math 41 and 42 as long as at least 26 math units are taken.

( 2 ) Students who have taken either CS 103X or CS 103A, B are considered to have satisfied the CS 103 requirement. Students who took CS 103X are required to complete one additional unit in their depth courses (I.e., 26 units minimum for track and elective courses).

( 3 ) Students who complete STATS 116, MS&E 120, or CME 106 in *Winter 2008-09 or earlier* may count that course as satisfying the CS 109 requirement. These same courses taken in *Spring 2008-09 or later* cannot be used to satisfy the CS 109 requirement.

( 4 ) Math electives: Math 51, 103, 104, 108, 109, 110, 113; CS 156, 157, 205A; PHIL 151; CME 100, 102, 104. Completion of Math 52 & 53 will (together) count as one Math elective. Restrictions: Math 51+ Math 103, Math 103 + Math 113, or CS 157+ Phil 151 may not be used in combination to satisfy the Math electives requirement.. Students who have taken both Math 51 and 52 may not count CME 100 as an elective.

( 5 ) Any course of 3 or more units from the SoE Science List (Fig. 3-2 in the UGHB), Psych 30 or 55, or AP Chem may be used.

( 6 ) One course required; may not be CS 106A, B or X. See Engineering Fundamentals Fig. 3-4 in the UGHB for approved list.

# CS Graphics Track Program Sheet (continued)

**Graphics Track Core, Depth and Senior Project** *(43 units minimum) Be advised, no course may be listed twice on the sheet. No double-counting.*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Core (15 units minimum)** | | | | | | | |
| CS | 107 | Computer Organization and Systems (see note 7) | | | | 5 | |
| CS | 110 | Principlets of Computer Systems (see note 8) | | | | 5 | |
| CS | 161 | Design and Analysis of Algorithms (see note 9) | | | | 5 | |
| **Depth; Track and Electives (25 units and seven courses minimum)** | | | | | | | |
| CS | 148 | Introduction to Computer Graphics (Track Requirement A) | | | | 3 | |
| CS | 248 | Three-Dimensional Computer Graphics (Track Requirement A) | | | | 5 | |
| | | Track Requirement B (see note 10) | | | | 3 to 5 | |
| CS | | Track Requirement C (see note 11) | | | | 3 or 4 | |
| CS | | Track Requirement C (see note 11) | | | | 3 or 4 | |
| | | Elective (see note 12) | | | | 3 to 5 | |
| | | Elective (see note 12) | | | | 3 to 5 | |
| | | Optional Elective | | | | | |
| **Senior Project (1 course required)** | | | | | | | |
| CS | | At least 3 units of 191, 191W, 194, 210B, 294 or 294W *(see note 14 )* | | | | 3 | |
| | | *Computer Science Core, Depth and Senior Project Total (43 units minimum)* | | | | | |

## Program Approvals

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 7 ) The name of CS 107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this requirement.

( 8 ) Students who complete CS108 and either CS 140 or CS 143 by Winter Quarter 2008-09 or earlier may choose to count CS 108 as satisfying the CS 110 requirement. In such a case CS 108 may not also be counted as an elective and the student will be required to complete one additional unit in their depth courses (i.e., 26 units minimum for track and elective courses).

( 9 ) Students who took CS 161 for 4 units are required to complete one add'l unit in depth req'ts (i.e., 26 units min for track and elective courses)

( 10 ) Track Requirement B: Any one of CS 205A; CME 104, 108; MATH 52, 113. (CS 205A is strongly recommended as a preferred choice.) Note that students taking CME 104 are also required to take its prerequisite course, CME 102.)

(11) Track Requirement C: Any two of CS 164, 178, 205B, 223B, 268, 348A, 348B, 448

(12) Track Electives: At least two add'l courses selected from the Track Requirement B list, C list, General CS Electives list (see note 13), or the following: ARTSTUD 60, 70, 179; CS 48N, 326A; CME 302, 306, 324; EE 262, 264, 278, 368; ME 101; PSYCH 30, 221; STS 144

( 13 ) General CS Electives: CS 108, 121 or 221*, 124, 140, 142, 143, 144, 145, 147, 149, 154, 155, 156, 157 (or PHIL 151), 164, 205A, 205B, 210A, 222, 223A, 223B, 224M, 224N, 224S, 224U, 225A, 225B, 226, 227, 228, 228T, 229, 240,241, 242, 243, 244, 244B, 245, 247, 249A, 249B, 255, 256, 257, 258, 261, 262, 270, 271, 272, 273A, 274, 276, 277, 295; CME 108; EE 108B, EE 282 *(Students may not count both CS 121 and 221 toward their major requirements.)

( 14 ) The WIM requirement for Freshmen and Transfer students entering Fall 96 or later may be met by taking CS 181 as a Technology in Society course or through the Senior Project course (191W, 194, 210B, or 294W only).

**Stanford University ♦ School of Engineering**

# Computer Science

## Human-Computer Interaction Track

## 2009-2010 Program Sheet

*Final version of program sheet due to the department no later than one month prior to the last quarter of senior year.*

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirement** *(Delete courses and units not taken)*

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Mathematics (26 units minimum)* | | | | | | | |
| MATH | 41 | Calculus (see note 1) | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS | 103 | Mathematical Foundations of Computing (see note 2) | | | | 5 | |
| CS | 109 | Introduction to Probability for Computer Scientists (see note 3) | | | | 5 | |
| *Plus two electives (see note 4)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (26 units minimum)* | | |
| *Science 11 units minimum)* | | | | | | | |
| PHYS | 41 | Mechanics (or PHYS 21 or 61) | | | | 4 | |
| PHYS | 43 | Electricity and Magnetism (or PHYS 23 or 63) | | | | 4 | |
| | | Elective (see note 5) | | | | 3 to 5 | |
| | | | | | *Science Unit Total (11 units minimum)* | | |
| | | | | | *(37 units min. Math/Sci combined)* | | |
| **Technology in Society Requirement** *(1 course required; see UGHB Figure 3-3 for approved list; see note 15)* | | | | | | | |
| | | | | | | | |
| **Engineering Fundamentals** (13 units minimum) | | | | | | | |
| CS | 106 | Programming Abstractions (B or X) | | | | 5 | |
| ENGR | 40 | Introductory Electronics | | | | 5 | |
| | | Elective (see note 6) | | | | 3 to 5 | |
| | | | | | *Engineering Fundamentals Total (13 units minimum)* | | |

**NOTES**

- * This printed form must be signed by the departmental representative. Changes must be petitioned (see UGHB pg 27-29) and initialed in ink
- * All courses listed on this form must be taken for a letter grade (if offered) and can be included under only one catagory.
- * Minimum Grade Point Average (GPA) for all courses in Engineering Funds and CS Core, Depth, and Senior Project (combined) is 2.0..
- * Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's Office. Transfer credits in Computer Science Core, Depth and Senior Project must be approved by the Computer Science undergraduate program office.

( 1 ) Math 19, 20 and 21 may be taken instead of Math 41 and 42 as long as at least 26 math units are taken.

( 2 ) Students who have taken either CS 103X or CS 103A, B are considered to have satisfied the CS 103 requirement. Students who took CS 103X are required to complete one additional unit in their depth courses (I.e., 26 units minimum for track and elective courses).

( 3 ) Students who complete STATS 116, MS&E 120, or CME 106 in *Winter 2008-09 or earlier* may count that course as satisfying the CS 109 requirement. These same courses taken in *Spring 2008-09 or later* cannot be used to satisfy the CS 109 requirement.

( 4 ) The Mathematics electives list consists of: Math 51, 103, 104, 108, 109, 110, 113; CS 156, 157, 205A; Phil 151; CME 100, 102, 104. Completion of Math 52 & 53 will (together) count as one Math elective. Restrictions: Math 51 + Math 103, or Math 103 + Math 113, or CS 157 + Phil 151, may not be used in combination to satisfy the Math electives requirement. Students who have taken both Math 51 and 52 may not count CME 100 as an elective.

( 5 ) Any course of 3 or more units from the SoE Science List (Fig. 3-2 in the UGHB), PSYCH 310 or 55, or AP Chemistry may be used.

( 6 ) One course required; may not be CS 106A, B or X. See Engineering Fundamentals Chap 3, Fig. 3-4 in the UGHB for approved list.

*program sheet continues on page 2*

# CS HCI Track Program Sheet (continued)

**Human-Computer Interaction Track Core, Depth and Senior Project** *(43 units minimum) Be advised, no course may be listed twice on the sheet. No double-counting.*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Core (15 units minimum)** | | | | | | | |
| CS | 107 | Computer Organization and Systems (see note 7) | | | | 5 | |
| CS | 110 | Principlets of Computer Systems (see note 8) | | | | 5 | |
| CS | 161 | Design and Analysis of Algorithms (see note 9) | | | | 5 | |
| **Depth; Track and Electives (25 units and seven courses minimum)** | | | | | | | |
| CS | 147 | Introduction to HCI Design (Track Requirement A) | | | | 4 | |
| CS | 247 | HCI Design Studio (Track Requirement A) | | | | 4 | |
| CS | | Track Requirement B (see note 10) | | | | 3 to 5 | |
| CS | | Track Requirement C (see note 11) | | | | 3 or 4 | |
| | | Track Requirement D (see note 12) | | | | 3 to 6 | |
| | | Elective (see note 13) | | | | 3 to 5 | |
| | | Elective (see note 13) | | | | 3 to 5 | |
| | | Optional Elective | | | | | |
| **Senior Project (1 course required)** | | | | | | | |
| CS | | At least 3 units of 191, 191W, 194, 210B, 294 or 294W *(see note 15)* | | | | 3 | |
| | | *Computer Science Core, Depth and Senior Project Total (43 units minimum)* | | | | | |

## Program Approvals

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 7 ) The name of CS 107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this requirement.

( 8 ) Students who complete CS108 and either CS 140 or CS 143 by Winter Quarter 2008-09 or earlier may choose to count CS 108 as satisfying the CS 110 requirement. In such a case CS 108 may not also be counted as an elective and the student will be required to complete one additional unit in their depth courses (i.e., 27 units minimum for track and elective courses).

( 9 ) Students who took CS161 for 4 units are required to complete one add'l unit in depth courses (I.e., 26 units min for track and elective courses).

( 10 ) Track Requirement B: Any one of CS 148, 248, 376, 377, 378

(11) Track Requirement C: Any one of CS 108, 124, 140, 142, 221, 229, 249A

(12) Track Requirement D: Any one of PSYCH 55, 252; MS&E 184; ME 101

(13) Track Electives: At least two additional courses selected from the Track Requirement B list, C list, D list, the General CS Electives list (see note 14), or the following - ARTSTUD 60; COMM 269; CME 340; CS 447 (with permission of undergraduate advisor), 448B (with permission of undergraduate advisor); ME 115, 216A; PSYCH 205, 221

(14) General CS Electives: CS 108, 121 or 221*, 124, 140, 142, 143, 144, 145, 148, 149, 154, 155, 156, 157 or (PHIL 151), 164, 205A, 205B, 210A,, 222, 223A, 223B, 224M, 224N, 224S, 224U, 225A, 225B, 226, 227, 228, 228T, 229, 240, 241, 242, 243, 244, 244B, 245, 248, 249A, 249B, 255, 256, 257, 258, 261, 262, 270, 271, 272, 273A, 274, 276, 277, 295; CME 108; EE 108B, 282 *(Students may not count both CS 121 and 221 toward their major requirements.)

( 15 ) The WIM requirement for Freshmen and Transfer students entering Fall 96 or later may be met by taking CS 181 as a Technology in Society course or through the Senior Project course (191W, 194, 210B or 294W only).

**Stanford University ♦ School of Engineering**

# Computer Science

## Information Track

## 2009-2010 Program Sheet

*Final version of program sheet due to the department no later than one month prior to the last quarter of senior year.*

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirement** *(Delete courses and units not taken)*

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Mathematics (26 units minimum)* | | | | | | | |
| MATH | 41 | Calculus (see note 1) | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS | 103 | Mathematical Foundations of Computing (see note 2) | | | | 5 | |
| CS | 109 | Introduction to Probability for Computer Scientists (see note 3) | | | | 5 | |
| *Plus two electives (see note 4)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (26 units minimum)* | | |
| *Science 11 units minimum)* | | | | | | | |
| PHYS | 41 | Mechanics (or PHYS 21 or 61) | | | | 4 | |
| PHYS | 43 | Electricity and Magnetism (or PHYS 23 or 63) | | | | 4 | |
| | | Elective (see note 5) | | | | 3 to 5 | |
| | | | | | *Science Unit Total (11 units minimum)* | | |
| | | | | | *(37 units min. Math/Sci combined)* | | |
| **Technology in Society Requirement** *(1 course required; see UGHB Figure 3-3 for approved list; see note 13 )* | | | | | | | |
| | | | | | | | |
| **Engineering Fundamentals** (13 units minimum) | | | | | | | |
| CS | 106 | Programming Abstractions (B or X) | | | | 5 | |
| ENGR | 40 | Introductory Electronics | | | | 5 | |
| | | Elective (see note 6) | | | | 3 to 5 | |
| | | | | | *Engineering Fundamentals Total (13 units minimum)* | | |

**NOTES**

- * The printed form must be signed by the departmental representative. Changes must be petitioned (see UGHB pg 27-29) and initialed in ink.
- * All courses listed on this form must be taken for a letter grade (if offered).
- * Minimum Grade Point Average (GPA) for all courses in ENGR Fundamentals and CS Core, Depth, and Senior Project (combined) is 2.0.
- * Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's Office. Transfer credits in Computer Science Core, Depth and Senior Project must be approved by the Computer Science undergraduate program office.
- * All courses listed on this form may only be included under one category. Delete courses not taken.

( 1 ) Math 19, 20 and 21 may be taken instead of Math 41 and 42 as long as at least 26 math units are taken.

( 2 ) Students who have taken either CS 103X or CS 103A, B are considered to have satisfied the CS 103 requirement. Students who took CS 103X are required to complete one additional unit in their depth courses (I.e., 26 units minimum for track and elective courses).

( 3 ) Students who complete STATS 116, MS&E 120, or CME 106 in *Winter 2008-09 or earlier* may count that course as satisfying the CS 109 requirement. These same courses taken in *Spring 2008-09 or later* cannot be used to satisfy the CS 109 requirement.

( 4 ) Math electives: Math 51, 103, 104, 108, 109, 110, 113; CS 156, 157, 205A; PHIL 151; CME 100, 102, 104. Completion of Math 52 & 53 will (together) count as one Math elective. Restrictions: Math 51+ Math 103, Math 103 + Math 113, or CS 157+ Phil 151 may not be used in combination to satisfy the Math electives req't. Students who have taken both Math 51 & 52 may not count CME 100 as an elective.

( 5 ) Any course of 3 or more units from the SoE Science List (Fig. 3-2 in the UGHB), PSYCH 30 or 55, or AP Chemistry may be used.

( 6 ) One course required; may not be CS 106A, B or X. See Engineering Fundamentals Chap 3, Fig. 3-4 in the UGHB for approved list.

*program sheet continues on page 2*

# CS Information Track Program Sheet (continued)

**Information Track Core, Depth and Senior Project** *(43 units minimum) Be advised, no course may be listed twice on the sheet. No double-counting.*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Core (15 units minimum)** | | | | | | | |
| CS | 107 | Computer Organization and Systems (see note 7) | | | | 5 | |
| CS | 110 | Principlets of Computer Systems (see note 8) | | | | 5 | |
| CS | 161 | Design and Analysis of Algorithms (see note 9) | | | | 5 | |
| **Depth; Track and Electives (25 units and seven courses minimum)** | | | | | | | |
| CS | 124 | From Languages to Information (Track Requirement A) | | | | 4 | |
| CS | 145 | Introduction to Databases (Track Requirement A) | | | | 4 | |
| CS | | Track Requirement B (see note 10) | | | | 3 to 5 | |
| CS | | Track Requirement B (see note 10) | | | | 3 to 5 | |
| | | Elective (see note 11) | | | | 3 to 5 | |
| | | Elective (see note 11) | | | | 3 to 5 | |
| | | Elective (see note 11) | | | | 3 to 5 | |
| | | Optional Elective | | | | | |
| **Senior Project (1 course required)** | | | | | | | |
| CS | | At least 3 units of 191, 191W, 194, 294 or 294W *(see note 13)* | | | | 3 | |
| | | *Computer Science Core, Depth and Senior Project Total (43 units minimum)* | | | | | |

## Program Approvals

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 7 ) The name of CS 107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this requirement.

( 8 ) Students who complete CS108 and either CS 140 or CS 143 by Winter Quarter 2008-09 or earlier may choose to count CS 108 as satisfying the CS 110 requirement. In such a case CS 108 may not also be counted as an elective and the student will be required to complete one additional unit in their depth courses (i.e., 26 units minimum for track and elective courses).

( 9 ) Students who took CS161 for 4 units are required to complete one additional unit in their depth courses (I.e., 26 units minimum for track and elective courses.)

( 10 ) Track Requirement B: Two courses, each from a different area: Area I) Information-based AI applications [CS 224N, 224S, 229]; AreaII) Database and Information Systems [CS 140, 240D, 245, 345, 346, 347]; AreaIII) Information Systems in Biology [CS 262, 270, 274]; Area IV) Information Systems on the Web [CS 276, 364B]

(11) Track Electives: At least three additional courses selected from the Track Requirement B list, or the General CS Electives list (see note 12).

(12) General CS Electives: CS 108, 121 or 221*, 140, 142, 143, 144, 147, 148, 149, 154, 155, 156, 157 (or PHIL 151), 164, 205A, 205B, 210A, 22, 223A, 223B, 224M, 224N, 224S, 224U, 225A, 225B, 226, 227, 228, 228T, 229, 240, 241, 242, 243, 244, 244B, 245, 247, 248, 249B, 255, 256, 257, 258, 261, 262, 270, 271, 272, 273A, 274, 276, 277, 295; CME 108; EE 108B, 282 *(Students may not count both CS 121 and 221 toward their major requirements.)

( 13 ) The WIM requirement for Freshmen and Transfer students entering Fall 96 or later may be met by taking CS 181 as a Technology in Society course or through the Senior Project course (191W, 194, 210B, or 294W only).

**Stanford University ♦ School of Engineering**

# Computer Science

## Systems Track

## 2009-2010 Program Sheet

*Final version of program sheet due to the department no later than one month prior to the last quarter of senior year.*

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirement** *(Delete courses and units not taken)*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (26 units minimum)* | | | | | | | |
| MATH | 41 | Calculus (see note 1) | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS | 103 | Mathematical Foundations of Computing (see note 2) | | | | 5 | |
| CS | 109 | Introduction to Probability for Computer Scientists (see note 3) | | | | 5 | |
| *Plus two electives (see note 4)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (26 units minimum)* | | |
| *Science 11 units minimum)* | | | | | | | |
| PHYS | 41 | Mechanics (or PHYS 21 or 61) | | | | 4 | |
| PHYS | 43 | Electricity and Magnetism (or PHYS 23 or 63) | | | | 4 | |
| | | Elective (see note 5) | | | | 3 to 5 | |
| | | | | | *Science Unit Total (11 units minimum)* | | |
| | | | | | *(37 units min. Math/Sci combined)* | | |
| **Technology in Society Requirement** *(1 course required; see UGHB Figure 3-3 for approved list; see note 13)* | | | | | | | |
| | | | | | | | |
| **Engineering Fundamentals** (13 units minimum) | | | | | | | |
| CS | 106 | Programming Abstractions (B or X) | | | | 5 | |
| ENGR | 40 | Introductory Electronics | | | | 5 | |
| | | Elective (see note 6) | | | | 3 to 5 | |
| | | | | | *Engineering Fundamentals Total (13 units minimum)* | | |

**NOTES**

- * This printed form must be signed by the departmental representative. Changes must be petitioned (see UGHB pg 27-29) and initialed in ink.
- * All courses listed on this form must be taken for a letter grade (if offered) and can be included under only one category.
- * Minimum Grade Point Average (GPA) for all courses in ENGR Fundamentals and CS Core, Depth, and Senior Project (combined) is 2.0.
- * Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's Office. Transfer credits in Computer Science Core, Depth and Senior Project must be approved by the Computer Science undergraduate program office.

( 1 ) Math 19, 20 and 21 may be taken instead of Math 41 and 42 as long as at least 26 math units are taken.

( 2 ) Students who have taken either CS 103X or CS 103A, B are considered to have satisfied the CS 103 requirement. Students who took CS 103X are required to complete one additional unit in their depth courses (I.e., 26 units minimum for track and elective courses).

( 3 ) Students who complete STATS 116, MS&E 120, or CME 106 in *Winter 2008-09 or earlier* may count that course as satisfying the CS 109 requirement. These same courses taken in *Spring 2008-09 or later* cannot be used to satisfy the CS 109 requirement.

( 4 ) Math electives: Math 51, 103, 104, 108, 109, 110, 113; CS 156, 157, 205A; PHIL 151; CME 100, 102, 104. Completion of Math 52 & 53 will (together) count as one Math elective. Restrictions: Math 51+ Math 103, Math 103 + Math 113, or CS 157+ Phil 151 may not be used in combination to satisfy the Math electives requirement. Students who have taken both Math 51 and 52 may not count CME 100 as an elective.

( 5 ) Any course of 3 or more units from the SoE Science List (Fig. 3-2 in the UGHB), PSYCH 30 or 55, or AP Chemistry may be used.

( 6 ) One course required; may not be CS 106A, B or X. See Engineering Fundamentals Chap 3, Fig. 3-4 in the UGHB for approved list.

*program sheet continues on page 2*

# CS Systems Program Sheet (continued)

**Systems Track Core, Depth and Senior Project** *(43 units minimum) Be advised, no course may be listed twice on the sheet. No double-counting.*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Core (15 units minimum)** | | | | | | | |
| CS | 107 | Computer Organization and Systems (see note 7) | | | | 5 | |
| CS | 110 | Principlets of Computer Systems (see note 8) | | | | 5 | |
| CS | 161 | Design and Analysis of Algorithms (see note 9) | | | | 5 | |
| **Depth; Track and Electives (25 units and seven courses minimum)** | | | | | | | |
| CS | 140 | Operating Sys and Systems Program (Track Requirement A) | | | | 4 | |
| | | One of: CS 143, EE 108B (Track Requirement B) | | | | 3 or 4 | |
| CS | | Track Requirement C (see note 10) | | | | 3 or 4 | |
| CS | | Track Requirement C (see note 10) | | | | 3 or 4 | |
| | | Elective (see note 11) | | | | 3 to 5 | |
| | | Elective (see note 11) | | | | 3 to 5 | |
| | | Elective (see note 11) | | | | 3 to 5 | |
| | | Optional Elective | | | | | |
| **Senior Project (1 course required)** | | | | | | | |
| CS | | At least 3 units of 191, 191W, 194, 210B, 294 or 294W *(see note 13 )* | | | | 3 | |
| | | *Computer Science Core, Depth and Senior Project Total (43 units minimum)* | | | | | |

## Program Approvals

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 7 ) The name of CS 107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this requirement.

( 8 ) Students who complete CS108 and either CS 140 or CS 143 by Winter Quarter 2008-09 or earlier may choose to count CS 108 as satisfying the CS 110 requirement. In such a case CS 108 may not also be counted as an elective and the student will be required to complete one additional unit in their depth courses (i.e., 26 units minimum for track and elective courses).

( 9 ) Students who took CS 161 for 4 units are required to complete one additional unit in their depth courses (I.e., 26 units minimum for track and elective courses.)

( 10 ) Track Requirement C: Two courses selected from the Track Requirement B list or the following - CS 144, 145, 155, 240, 240C, 240D, 242, 243, 244, 245; EE 271, 282

(11) Track Electives: At least three additional courses selected from the Track Requirement C list, the General CS Electives list (see note 12), or the following - CS 240E, 240X, 244C, 244E, 315A, 315B, 343, 344, 344E, 345, 346, 347, 349 (with permission of undergraduate advisor), 448; EE 382A, 382C, 384A, 384B, 384C, 384S, 384X, 384Y

(12) General CS Electives: CS 108, 121 or 221*, 124, 142, 143, 144, 145, 147, 148, 149, 154, 155, 156, 157 or Phil 151, 164, 205A, 205B, 210A, 222, 223A, 223B, 224M, 224N, 224S, 224U, 225A, 225B, 226, 227, 228, 228T, 229, 240, 241, 242, 243, 244, 244B, 245, 247, 248, 249A, 249B, 255, 256, 257, 258, 261, 262, 270, 271, 272, 273A, 274, 276, 277, 295; CME 108; EE 108B, 282

*(Students may not count both CS 121 and 221 toward their major requirements.)

( 13 ) The WIM requirement for Freshmen and Transfer students entering Fall 96 or later may be met by taking CS 181 as a Technology in Society course or through the Senior Project course (191W, 194, 210B, or 294W only).

**Stanford University ♦ School of Engineering**

# Computer Science

## Theory Track

## 2009-2010 Program Sheet

*Final version of program sheet due to the department no later than one month prior to the last quarter of senior year.*

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirement** *(Delete courses and units not taken)*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (26 units minimum)* | | | | | | | |
| MATH | 41 | Calculus (see note 1) | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS | 103 | Mathematical Foundations of Computing (see note 2) | | | | 5 | |
| CS | 109 | Introduction to Probability for Computer Scientists (see note 3) | | | | 5 | |
| *Plus two electives (see note 4)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (26 units minimum)* | | |
| *Science 11 units minimum)* | | | | | | | |
| PHYS | 41 | Mechanics (or PHYS 21 or Phys 61) | | | | 4 | |
| PHYS | 43 | Electricity and Magnetism (or PHYS 23 or Phys 63) | | | | 4 | |
| | | Elective (see note 5) | | | | 3 to 5 | |
| | | | | | *Science Unit Total (11 units minimum)* | | |
| | | | | | *(37 units min. Math/Sci combined)* | | |
| **Technology in Society Requirement** *(1 course required; see UGHB Figure 3-3 for approved list; see note 14 )* | | | | | | | |
| | | | | | | | |
| **Engineering Fundamentals** (13 units minimum) | | | | | | | |
| CS | 106 | Programming Abstractions (B or X) | | | | 5 | |
| ENGR | 40 | Introductory Electronics | | | | 5 | |
| | | Elective (see note 6) | | | | 3 to 5 | |
| | | | | | *Engineering Fundamentals Total (13 units minimum)* | | |

**NOTES**

* This printed form must be signed by the departmental representative. Changes must be petitioned (see UGHB pg 27-29) and initialed in ink.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Grade Point Average (GPA) for all courses in ENGR Fundamentals and CS Core, Depth, and Senior Project (combined) is 2.0.

* Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's Office. Transfer credits in Computer Science Core, Depth and Senior Project must be approved by the Computer Science undergraduate program office.

* All courses listed on this form may only be included under one category. Delete courses not taken.

( 1 ) Math 19, 20 and 21 may be taken instead of Math 41 and 42 as long as at least 26 math units are taken.

( 2 ) Students who have taken either CS 103X or CS 103A, B are considered to have satisfied the CS 103 requirement. Students who took CS 103X are required to complete one additional unit in their depth courses (I.e., 26 units minimum for track and elective courses).

( 3 ) Students who complete STATS 116, MS&E 120, or CME 106 in *Winter 2008-09 or earlier* may count that course as satisfying the CS 109 requirement. These same courses taken in *Spring 2008-09 or later* cannot be used to satisfy the CS 109 requirement.

( 4 ) Math electives: Math 51, 103, 104, 108, 109, 110, 113; CS 156, 157, 205A; PHIL 151; CME 100, 102, 104. Completion of Math 52 & 53 will (together) count as one Math elective. Restrictions: Math 51+ Math 103, Math 103 + Math 113, or CS 157+ Phil 151may not be used in combination to satisfy the Math electives requirement. Students who have taken both Math 51 and 52 may not count CME 100 as an elective.

( 5 ) Any course of 3 or more units from the SoE Science List (Fig. 3-2 in the UGHB), PSYCH 30 or 55, or AP Chemistry may be used.

( 6 ) One course required; may not be CS 106A, B or X. See Engineering Fundamentals Fig. 3-4 in the UGHB for approved list.

*program sheet continues on page 2*

# CS Theory Track Program Sheet (continued)

**Theory Track Core, Depth and Senior Project** *(43 units minimum) Be advised, no course may be listed twice on the sheet. No double-counting.*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Core (15 units minimum)** | | | | | | | |
| CS | 107 | Computer Organization and Systems (see note 7) | | | | 5 | |
| CS | 110 | Principlets of Computer Systems (see note 8) | | | | 5 | |
| CS | 161 | Design and Analysis of Algorithms (see note 9) | | | | 5 | |
| **Depth; Track and Electives (25 units and seven courses minimum)** | | | | | | | |
| CS | 154 | Intro Automata and Complexity Theory (Track Requirement A) | | | | 4 | |
| CS | | Track Requirement B (see note 10) | | | | 3 | |
| | | Track Requirement C (see note 11) | | | | 3 or 4 | |
| | | Track Requirement C (see note 11) | | | | 3 or 4 | |
| | | Elective (see note 12) | | | | 3 to 5 | |
| | | Elective (see note 12) | | | | 3 to 5 | |
| | | Elective (see note 12) | | | | 3 to 5 | |
| | | Optional Elective | | | | | |
| **Senior Project (1 course required)** | | | | | | | |
| CS | | At least 3 units of 191, 191W, 194, 210B, 294 or 294W *(see note 14 )* | | | | 3 | |
| | | *Computer Science Core, Depth and Senior Project Total (43 units minimum)* | | | | | |

## Program Approvals

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 7 ) The name of CS 107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this requirement.

( 8 ) Students who complete CS108 and either CS 140 or CS 143 by Winter Quarter 2008-09 or earlier may choose to count CS 108 as satisfying the CS 110 requirement. In such a case CS 108 may not also be counted as an elective and the student will be required to complete one additional unit in their depth courses (i.e., 27 units minimum for track and elective courses).

( 9 ) Students who took CS161 for 4 units are required to complete one additional unit in their depth courses (I.e., 26 units minimum for track and elective courses).

( 10 ) Track Requirement B: Any one of CS 164, 255, 258, 261, 268, 361A, 361B, 365

( 11 ) Track Requirement C: Two courses selected from the Track Requirement B list or the following - CS 143, 155, 156, 157 (or PHIL 151), 205A, 228, 242, 256, 259, 262, 354, 355, 357, 358, 359 (with permission of undergraduate advisor), 364A, 364B, 369 (with permission of under graduate advisor), 374; MS&E 310

( 12 ) Track Electives: At least three additional courses selected from the Track Requirement B list, the Track Requirement C list, the General CS Electives list (see note 13), or the following - CME 302, 305: Phil 152

( 13) General CS Electives: CS 108, 121 or 221*, 124, 140, 142, 143, 144, 145, 147, 148, 149, 155, 156, 157 or Phil 151, 164, 205A, 205B, 210A, 222, 223A, 223B, 224M, 224N, 224S, 224U, 225A, 225B, 226, 227, 228, 228T, 229, 240,241, 242, 243, 244, 244B, 245, 247, 248, 249A, 249B, 255, 256, 257, 258, 261, 262, 270, 271, 272, 273A, 274, 276, 277, 295; CME 108; EE 108B, 282

*(Students may not count both CS 121 and 221toward their major requirements.)

( 14 ) The WIM requirement for Freshmen and Transfer students entering Fall 96 or later may be met by taking CS 181 as a Technology in Society course or through the Senior Project course (191W, 194, 210B, or 294W only).

**Stanford University ♦ School of Engineering**

# Computer Science

## Unspecialized Track

## 2009-2010 Program Sheet

*Final version of program sheet due to the department no later than one month prior to the last quarter of senior year.*

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirement** *(Delete courses and units not taken)*

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Mathematics (26 units minimum)* | | | | | | | |
| MATH | 41 | Calculus (see note 1) | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS | 103 | Mathematical Foundations of Computing (see note 2) | | | | 5 | |
| CS | 109 | Introduction to Probability for Computer Scientists (see note 3) | | | | 5 | |
| *Plus two electives (see note 4)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (26 units minimum)* | | |
| *Science 11 units minimum)* | | | | | | | |
| PHYS | 41 | Mechanics (or PHYS 21 or PHYS 61) | | | | 4 | |
| PHYS | 43 | Electricity and Magnetism (or PHYS 23 or PHYS 63) | | | | 4 | |
| | | Elective (see note 5) | | | | 3 to 5 | |
| | | | | | *Science Unit Total (11 units minimum)* | | |
| | | | | | *(37 units min. Math/Sci combined)* | | |
| **Technology in Society Requirement** *(1 course required; see UGHB Figure 3-3 for approved list; see note 14 )* | | | | | | | |
| | | | | | | | |
| **Engineering Fundamentals** (13 units minimum) | | | | | | | |
| CS | 106 | Programming Abstractions (B or X) | | | | 5 | |
| ENGR | 40 | Introductory Electronics | | | | 5 | |
| | | Elective (see note 6) | | | | 3 to 5 | |
| | | | | | *Engineering Fundamentals Total (13 units minimum)* | | |

**NOTES**

* This printed form must be signed by the departmental representative. Changes must be petitioned (see UGHB pg 27-29) and initialed in ink.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Grade Point Average (GPA) for all courses in ENGR Fundamentals and CS Core, Depth, and Senior Project (combined) is 2.0.

* Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's Office. Transfer credits in Computer Science Core, Depth and Senior Project must be approved by the Computer Science undergraduate program office.

* All courses listed on this form may only be included under one category. Delete courses not taken.

( 1 ) Math 19, 20 and 21 may be taken instead of Math 41 and 42 as long as at least 26 math units are taken.

( 2 ) Students who have taken either CS 103X or CS 103A, B are considered to have satisfied the CS 103 requirement. Students who took CS 103X are required to complete one additional unit in their depth courses (I.e., 26 units minimum for track and elective courses).

( 3 ) Students who complete STATS 116, MS&E 120, or CME 106 in *Winter 2008-09 or earlier* may count that course as satisfying the CS 109 requirement. These same courses taken in *Spring 2008-09 or later* cannot be used to satisfy the CS 109 requirement.

( 4 ) Math electives: Math 51, 103, 104, 108, 109, 110, 113; CS 156, 157, 205A; PHIL 151; CME 100, 102, 104. Completion of Math 52 & 53 will (together) count as one Math elective. Restrictions: Math 51+ Math 103,-Math 103 + Math 113, or CS 157+ Phil 151 may not be used in combination to satisfy the Math electives requirement. Students who have taken both Math 51 and 52 may not count CME 100 as an elective.

( 5 ) Any course of 3 or more units from the SoE Science List (Fig. 3-2 in the UGHB), PSYCH 30 or 55, or AP Chemistry may be used.

( 6 ) One course required; may not be CS 106A, B or X. See Engineering Fundamentals Fig. 3-4 in the UGHB for approved list.

*program sheet continues on page 2*

# CS Unspecialized Track Program Sheet (continued)

**Unspecialized Track Core, Depth and Senior Project** *(43 units minimum) Be advised, no course may be listed twice on the sheet. No double-counting.*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Core (15 units minimum)** | | | | | | | |
| CS | 107 | Computer Organization and Systems (see note 7) | | | | 5 | |
| CS | 110 | Principlets of Computer Systems (see note 8) | | | | 5 | |
| CS | 161 | Design and Analysis of Algorithms (see note 9) | | | | 5 | |
| **Depth; Track and Electives (25 units and seven courses minimum)** | | | | | | | |
| CS | 154 | Intro Automata and Complexity Theory (Track Requirement A) | | | | 4 | |
| CS | | One of CS 140, 143 (Track Requirement B) | | | | 4 | |
| | | Track Requirement C (see note 10) | | | | 3 or 4 | |
| CS | | Track Requirement D (see note 11) | | | | 3 or 4 | |
| CS | | Track Requirement E (see note 12) | | | | 3 to 5 | |
| | | Elective (see note 13) | | | | 3 to 5 | |
| | | Elective (see note 13) | | | | 3 to 5 | |
| | | Optional Elective | | | | | |
| **Senior Project (1 course required)** | | | | | | | |
| CS | | At least 3 units of 191, 191W, 194, 210B, 294 or 294W *(see note 14)* | | | | 3 | |
| | | *Computer Science Core, Depth and Senior Project Total (43 units minimum)* | | | | | |

## Program Approvals

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 7 ) The name of CS 107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this requirement.

( 8 ) Students who complete CS108 and either CS 140 or CS 143 by Winter Quarter 2008-09 or earlier may choose to count CS 108 as satisfying the CS 110 requirement. In such a case CS 108 may not also be counted as an elective and the student will be required to complete one additional unit in their depth courses (i.e., 27 units minimum for track and elective courses).

( 9 ) Students who took CS161 for 4 units are required to complete one add'l unit in their depth courses (I.e., 26 units min for track and elective courses).

( 10 ) Track Requirement C: One additional course from the Track Requirement B list or the following: CS 144, 155, 240D, 242, 244; EE 108B

( 11 ) Track Requirement D: Any one of CS 121, 221, 223A, 223B, 228, 229

( 12 ) Track Requirement E: Any one of CS 145, 147, 148, 248, 262

( 13 ) At least two courses from the General CS Electives list: CS 108, 121 or 221*, 124, 140, 142, 143, 144, 145, 147, 148, 149, 155, 156, 157 (or PHIL 151), 164, 205A, 205B, 210A, 222, 223A, 223B, 224M, 224N, 224S, 224U, 225A, 225B, 226, 227, 228, 228T, 229, 240, 241, 242, 243, 244, 244B, 245, 247, 248, 249A, 249B, 255, 256, 257, 258, 261, 262, 270, 271, 272, 273A, 274, 276, 277, 295; CME 108; EE 108B, 282

*(Students may not count both CS 121 and 221 toward their major requirements.)

( 14 ) The WIM requirement for Freshmen and Transfer students entering Fall 96 or later may be met by taking CS 181 as a Technology in Society course or through the Senior Project course (191W, 194, 210B, or 294W only).

**Stanford University ♦ School of Engineering**

# Computer Science

## Individually Designed Track

## 2009-2010 Program Sheet

*Final version of program sheet due to the department no later than one month prior to the last quarter of senior year.*

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirement** *(Delete courses and units not taken)*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (26 units minimum)* | | | | | | | |
| MATH | 41 | Calculus (see note 1) | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| CS | 103 | Mathematical Foundations of Computing (see note 2) | | | | 5 | |
| CS | 109 | Introduction to Probability for Computer Scientists (see note 3) | | | | 5 | |
| *Plus two electives (see note 4)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (26 units minimum)* | | |
| *Science 11 units minimum)* | | | | | | | |
| PHYS | 41 | Mechanics (or PHYS 21 or 61) | | | | 4 | |
| PHYS | 43 | Electricity and Magnetism (or PHYS 23 or 63) | | | | 4 | |
| | | Elective (see note 5) | | | | 3 to 5 | |
| | | | | | *Science Unit Total (11 units minimum)* | | |
| | | | | | *(37 units min. Math/Sci combined)* | | |
| **Technology in Society Requirement** *(1 course required; see UGHB Figure 3-3 for approved list; see note 11 )* | | | | | | | |
| | | | | | | | |
| **Engineering Fundamentals** (13 units minimum) | | | | | | | |
| CS | 106 | Programming Abstractions (B or X) | | | | 5 | |
| ENGR | 40 | Introductory Electronics | | | | 5 | |
| | | Elective (see note 6) | | | | 3 to 5 | |
| | | | | | *Engineering Fundamentals Total (13 units minimum)* | | |

**NOTES**

* This printed form must be signed by the departmental representative. Changes must be petitioned (see UGHB pg 27-29) and initialed in ink.

* All courses listed on this form must be taken for a letter grade (if offered).

* Minimum Grade Point Average (GPA) for all courses in ENGR Fundamentals and CS Core, Depth, and Senior Project (combined) is 2.0.

* Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's Office. Transfer credits in Computer Science Core, Depth and Senior Project must be approved by the Computer Science undergraduate program office.

* All courses listed on this form may only be included under one category. Delete courses not taken.

( 1 ) Math 19, 20 and 21 may be taken instead of Math 41 and 42 as long as at least 26 math units are taken.

( 2 ) Students who have taken either CS 103X or CS 103A, B are considered to have satisfied the CS 103 requirement. Students who took CS 103X are required to complete one additional unit in their depth courses (I.e., 26 units minimum for track and elective courses).

( 3 ) Students who complete STATS 116, MS&E 120, or CME 106 in *Winter 2008-09 or earlier* may count that course as satisfying the CS 109 requirement. These same courses taken in *Spring 2008-09 or later* cannot be used to satisfy the CS 109 requirement.

( 4 ) Math electives: Math 51, 103, 104, 108, 109, 110, 113; CS 156, 157, 205A; PHIL 151; CME 100, 102, 104. Completion of Math 52 & 53 will (together) count as one Math elective. Restrictions: Math 51+ Math 103, Math 103 + Math 113, or CS 157+ Phil 151 may not be used in combination to satisfy the Math electives requirement. Students who have taken both Math 51 and 52 may not count CME 100 as an elective.

( 5 ) Any course of 3 or more units from the SoE Science List (Fig. 3-2 in the UGHB), PSYCH 30 or 55, or AP Chemistry may be used.

( 6 ) One course required; may not be CS 106A, B or X. See Engineering Fundamentals Fig. 3-4 in the UGHB for approved list.

*program sheet continues on page 2*

# CS Individually Designed Track Program Sheet (continued)

**Individually Designed Track Core, Depth and Senior Project** *(43 units minimum) Be advised, no course may be listed twice on the sheet. No double-counting.*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| **Core (15 units minimum)** | | | | | | | |
| CS | 107 | Computer Organization and Systems (see note 7) | | | | 5 | |
| CS | 110 | Principlets of Computer Systems (see note 8) | | | | 5 | |
| CS | 161 | Design and Analysis of Algorithms (see note 9) | | | | 5 | |
| **Depth; Track and Electives (25 units and seven courses minimum)** *see note 10* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| **Senior Project (1 course required)** | | | | | | | |
| CS | | At least 3 units of 191, 191W, 194, 210B, 294 or 294W *(see note 11 )* | | | | 3 | |
| | | *Computer Science Core, Depth and Senior Project Total (43 units minimum)* | | | | | |

## Program Approvals

***Undergraduate Advisor***

Printed Name: _____ Date: _____

Signature: _____

***Department***

Printed Name: _____

Signature: _____ Date: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 7 ) The name of CS 107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this requirement.

( 8 ) Students who complete CS108 and either CS 140 or CS 143 by Winter Quarter 2008-09 or earlier may choose to count CS 108 as satisfying the CS 110 requirement. In such a case CS 108 may not also be counted as an elective and the student will be required to complete one additional unit in their depth courses (i.e., 26 units minimum for track and elective courses).

( 9 ) Students who took CS161 for 4 units are req'd to complete one add'l unit in their depth courses (I.e., 26 units min for track& elective courses)

( 10 ) Students may propose an Individually Designed Track. Proposals should include a minimum of seven courses, at least four of which must be CS courses numbered 100 or above. Proposals must be submitted and approved at least two quarters before graduation. To create a individually designed program, students should complete an *Individually Designed Track* program sheet and seek approval from their undergraduate advisor and from the Associate Chair for Education, Prof. Mehran Sahami. Proposals will be evaluated for coherence and rigo Approved program sheets should be given to the staff in the CS undergraduate program office. Any subsequent changes must go through th same proposal and approval process.

( 11 ) The WIM requirement for Freshmen and Transfer students entering Fall 96 or later may be met by taking CS 181 as a Technology in Society course or through the Senior Project course (191W, 194, 210B, or 294W only).

# COMPUTER SYSTEMS ENGINEERING

Computer Systems Engineering is an interdisciplinary program between the Computer Science Department and the Electrical Engineering Department. It is a School of Engineering major that leads to a Bachelor of Science in Engineering degree. The program is targeted for undergraduates with an interest in implementation and application of computers and computer-based systems. Through course work and laboratory experiences, students obtain a strong foundation in the basics of both Computer Science and Electrical Engineering. From there, students specialize in either Digital Systems, Networking, or Robotics and Mechatronics. A senior project caps the program and provides a special hands-on experience.

## UNDERGRADUATE RESEARCH OPPORTUNITIES

### CURIS (Undergraduate Research in Computer Science)

Each summer undergraduates work with CS faculty through the summer research college. Interested students apply for positions during the winter quarter; CURIS decisions are made and offers sent out before spring quarter begins. These positions are fully-funded and provide invaluable experience in cutting-edge research. All CS and CSE students are notified via email of CURIS opportunities and the application process.

### Research Opportunities for Computer Science/Computer Systems Engineering Undergraduates

At the beginning of each academic year CS faculty are asked to provide a list of ongoing research projects that are appropriate for undergraduate involvement. Descriptions of the projects are listed at `http://curis.stanford.edu/research.html` (don't let the 'curis' fool you; this is not the web site for the summer CURIS program).

### Research Tour/Lunch Series

Each year the CS department offers research lab tours and luncheons specifically geared toward undergraduates. These tours allow students to experience first-hand what goes on in a lab, and the luncheons provide an opportunity for students to discuss interests with research faculty. Past tours included the AI Robotics Lab, the IRoom and the Graphics Lab.

## Research Seminars and Talks

At various times throughout the year, the CS department hosts talks and presentations on various research and technology topics. In addition to these one-time events, there are regularly scheduled seminars which are open to undergraduates. Many of these seminars are available as 1 unit, 500-level courses, but enrollment is not required for attendance.

## Pursuing a Research-Oriented Undergraduate Program:

### *Freshman and Sophomore Year*

Students interested in pursuing research should plan to finish the CS core (CS 103, 106, 107, 109, 110 and 161) by the end of the sophomore year. If you already have an idea of the area in CS you'd like to pursue, you may find these course suggestions useful:

| **If you're considering…** | **…make sure to take these freshman/sophomore year** |
|---|---|
| Possible AI courses | CS 109 |
| Possible graphics courses | Math 51 and/or Math 104 |
| Possible theory courses | CS 109, CS 154 or 161 |

Students are encouraged to apply for CURIS summer research positions but should be aware they may not yet have the necessary background to explore a research area in depth.

### *Junior Year*

During the junior year students considering research can take one of the following sequences:

| **Field of Interest** | **Fall** | **Winter** | **Spring** |
|---|---|---|---|
| Artificial Intelligence | 221 | Any 22x | Coursework suggested by CURIS advisor |
| Databases | 145 | 245 | |
| Graphics | 148* | 448 | |
| Human-Computer Interaction | 147 | 247 | |
| Systems | 144 | 140 | |
| Theory | 157 and 161 | 256 or 259 | |

* Students should take CS 148 and Math 51 before taking CS 248.

Students doing summer research through CURIS should expect to take a course or two spring quarter to prepare them for their research project.

***Senior Year***

Students may choose to take CS 294 if they do not have a specific project in mind but wish to contribute to active research.

*Note:* The above are meant to be taken only as suggestions. If you have questions, contact the CS course advisor at **advisor@cs.stanford.edu**.

# REQUIREMENTS

| Course | Title | Units | Quarter | Year |
|---|---|---|---|---|
| **Mathematics (25 units minimum)** | | | | |
| MATH 41 | Calculus | 5 | A | Fr |
| MATH 42 | Calculus | 5 | A,W | Fr |
| MATH 51 | Linear Alg and Differential Calculus of Several Variables | 5 | A,W,S | Fr |
| MATH 52 or 53 | Integral Calc of Several Variables/ Linear Algebra | 5 | A,W,S | So |
| CS 109 | Introduction to Probability for Computer Scientists[1] | 5 | W,S | So |
| **Science (12 units minimum)** | | | | |
| PHYSICS 41 | Mechanics | 4 | W | Fr |
| PHYSICS 43 | Electricity and Magnetism | 4 | S | Fr |
| PHYSICS 45 | Light and Heat | 4 | A | Fr/So |
| **Engineering Fundamentals (13 units minimum)** | | | | |
| ENGR 40 | Introductory Electronics | 5 | A,S | So |
| CS 106B *or*<br>CS 106X | Programming Abstractions<br>Programming Abstractions (Accelerated) | 5 | A,W,S<br>A | Fr/So<br>Fr/So |
| Fund. Elective | See list of approved courses earlier in Handbook; may not be 106A, B or X | | | |
| **Technology in Society (One course, 3-5 units)** | | | | |
| *See Figure 3-3 for list of SoE approved courses.* | | | | |
| **Writing in the Major (One course)** | | | | |
| *CS 181, CS191W, CS194, CS210B and CS294W fulfill the "Writing in the Major" requirement.* | | | | |
| **Core (32 units minimum)** | | | | |
| CS 103 | Mathematical Foundations of Computing[2] | 5 | A,S | Fr/So |
| CS 107 | Computer Organization and Systems[3] | 5 | A,S | So |
| CS 108 *or*<br>CS 110 | Object-Oriented Systems Design<br>Principles of Computer Systems | 4<br>5 | A,W<br>W, S | So<br>So |
| EE 108A | Digital Systems I | 4 | A,W | So/Jr |
| EE 108B | Digital Systems II | 3-4 | A,W | So/Jr |
| Senior Project | CS 191, 191W, 194, 210B, 294 or 294W (see note 4) | 3 | | Sr |

| Plus two of the following (see note5): | | | | |
|---|---|---|---|---|
| EE 101A | Circuits I | 4 | W | So/Jr |
| EE 101B | Circuits II | 4 | A,S | So/Jr |
| EE 102A | Signals and Systems I | 4 | W | So/Jr |
| EE 102B | Signals and Systems II | 4 | S | So/Jr |

## CHOOSE ONE OF THE FOLLOWING THREE SPECIALIZATIONS:

| **Digital Systems Specialization (20 units minimum)** | | | | |
|---|---|---|---|---|
| CS 140 *or*<br>CS 143 | Operating Systems<br>Compilers | 4 | W, S<br>A | Jr/Sr<br>Jr/Sr |
| EE 109 | Digital Systems Design Lab | 4 | S | So/Jr |
| EE 271 | VLSI Systems | 3 | A | Jr/Sr |
| Plus three to four of the following (see note 6) | | | | |
| CS 140 *or* 143 | (if not counted above) | 4 | W, S/A | Jr/Sr |
| CS 144 | Introduction to Computer Networking | 4 | A | Jr/Sr |
| CS 240E | Low Power Wireless System Software | 3 | Not given 2009-10 | Jr/Sr |
| CS 244 | Advanced Topics in Networking | 4 | W | Jr/Sr |
| CS 244E | Low-Power Wireless Networking | 3 | S | Jr/Sr |
| EE 273 | Digital Systems Engineering | 3 | W | Jr/Sr |
| EE 282 | Computer Architecture | 3 | A | Jr/Sr |

| **Networking Specialization (20 units minimum)** | | | | |
|---|---|---|---|---|
| CS 140 | Operating Systems | 4 | W, S | Jr/Sr |
| CS 144 | Introduction to Computer Networking | 4 | A | Jr/Sr |
| Plus four to five of the following (see note 6) | | | | |
| CS 240 | Advanced Topics in Operating Systems | 3 | S | Jr/Sr |
| CS 240E | Low Power Wireless System Software | 3 | Not given 2009-10 | Jr/Sr |
| CS 240X | Advanced Operating Systems II | 3 | Not given 2009-10 | Jr/Sr |
| CS 244 | Advanced Topics in Networking | 4 | W | Jr/Sr |
| CS 244B | Distributed Systems | 3 | S | Jr/Sr |
| CS 244E | Low-Power Wireless Networking | 3 | S | Jr/Sr |
| CS 249A | OOP from a Modeling and Simulation Perspective | 3 | A | Jr/Sr |
| CS 249B | Advanced Object-Oriented Programming | 3 | W | Jr/Sr |
| EE 179 | Introduction to Communication | 3 | S | Jr/Sr |
| EE 276 | Introduction to Wireless Personal Communications | 3 | S | Jr/Sr |

| **Robotics and Mechatronics Specialization (19 units minimum)** | | | | |
|---|---|---|---|---|
| CS 205A | Mathematical Methods for Robotics, Vision and Graphics | 3 | A | So/Jr |
| CS 223A | Introduction to Robotics | 3 | W | Jr/Sr |
| ME 210 or EE 118 | Introduction to Mechatronics | 4 | W | So/Jr |
| ENGR 105 | Feedback Control Design | 3 | W | So/Jr |
| Plus two to three of the following (see note 6) | | | | |
| AA 278 | Optimal Control and Hybrid Systems | 3 | Not given 2009-10 | Jr/Sr |
| CS 223B | Introduction to Computer Vision | 3 | W | Jr/Sr |
| CS 225A | Experimental Robotics | 3 | s | Jr/Sr |
| CS 225B | Robot Programming Laboratory | 4 | A | Jr/Sr |
| CS 277 | Experimental Haptics | 3 | W | Jr/Sr |
| ENGR 205 | Introduction to Control Design Techniques | 3 | A | Jr/Sr |
| ENGR 206 | Control System Design | 4 | Not given 2009-10 | Jr/Sr |
| ENGR 207A | Linear Control Systems I | 3 | W | Jr/Sr |
| ENGR 207B | Linear Control Systems II | 3 | S | Jr/Sr |

**Notes:**

1. Students who complete STATS 116, MS&E 120, or CME 106 in *Winter 2008-09 or earlier* may count that course as satisfying the CS109 requirement. These same courses taken in *Spring 2008-09 or later* cannot be used to satisfy the CS109 requirement.
2. Students who have taken either CS 103X or CS 103A, B are considered to have satisfied the CS103 requirement. Students taking CS103A, B may complete the lower number of elective courses in a given specialization (see note 6).
3. The name of CS 107 has changed. The previous CS107 course titled *Programming Paradigms* also fulfills this requirement.
4. CS191 and 191W independent study projects require faculty sponsorship and must be approved, in advance, by the advisor, faculty sponsor, and the CSE senior project advisor (Robert Plummer or Patrick Young). A form bearing these signatures, along with a brief description of the project, should be filed with the department representative in Gates 182 the quarter before work on the project is begun.
5. Students pursuing the **Robotics and Mechatronics** or **Networking** specializations must take EE 102A and 102B.
6. Students who take CS 103A,B may complete the lower number of elective courses in a given specialization (i.e., one less elective than students taking CS 103X or CS 103).

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download an online CSE program sheet from **`ughb.stanford.edu`** to ensure you are using an accurate major plan.

# INSTRUCTIONS FOR DECLARING MAJOR IN ENGINEERING: COMPUTER SYSTEMS ENGINEERING

## 1. Find an Advisor

For details see **http://csmajor /ChoosingAdvisor.shtml**

Find a CS professor or lecturer who verbally agrees to be your advisor. See **http://csmajor/FacultyList.php** for a list of faculty members. You should meet with him or her in person, either in office hours or by appointment. Write your advisor's name here.

I have spoken to [ ] and he/she has agreed to be my advisor.

## 2. Go to Axess

Print out a copy of your unofficial transcript from Axess (Academics → View Unofficial Transcript). *Please don't staple it.*

❑ **I have an unofficial transcript from this quarter.**

While you're on Axess, be sure to declare there. (Academics → Declare a Major/Minor). CSE majors select "Engineering", as your major and CSE as your field of study (subplan).

❑ **I have declared on Axess.**

## 3. Basic Information

| | | | | | |
|---|---|---|---|---|---|
| Full Name | First | Middle | | Last | |
| Name you go by: | | Birth date: | Month: | Day: | Year: |
| SUID # | | E-mail | | @stanford.edu | |
| Major | ❍ CS<br>❍ CSE | Expected graduation | ❍ 2012 ❍ 2011<br>❍ 2010 ❍ 2009 ❍ Other: | | |
| Date you came to see the Course Advisor: | | | | | |

## 4. See the Course Advisor in Gates 160

Bring this form to the Course Advisor's office hours in **Gates 160**. The current quarter's office hours are posted at **http://csmajor /WhoToSee.shtml**.

*NOTE: There are no office hours during finals week, break, or summer quarter. It may take up to a week for a declaration to go through, so please plan accordingly! Juniors should do this before winter quarter.*

**Stanford University ♦ School of Engineering**

# Computer Systems Engineering – Digital Systems Specialization

# 2009–2010 Program Sheet

***Final version of completed and signed program sheet due to the department no later than one month prior to the final quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (25 units minimum)* | | | | | | | |
| MATH | 41 | Calculus | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| MATH | 51 | Calculus | | | | 5 | |
| MATH | 52 *or* 53 | Calculus | | | | 5 | |
| CS | 109 | Introduction to Probability for Computer Scientists[1] | | | | 5 | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (25 units minimum)* | | |
| *Science (12 units minimum)* | | | | | | | |
| PHYSICS | 41 | Mechanics | | | | 4 | |
| PHYSICS | 43 | Electricity and Magnetism | | | | 4 | |
| PHYSICS | 45 | Light and Heat | | | | 4 | |
| | | | | | | | |
| | | | | | *Science Unit Total (12 units minimum)* | | |
| | | | | | *Mathematics and Science Unit Total (37 units minimum)* | | |

## Technology in Society Requirement *(1 course required; see UGHB Fig. 3-3 for approved list)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

## Engineering Fundamentals *(13 units minimum)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CS | 106 | Programming Abstractions (B or X) | | | | 5 | |
| ENGR | 40 | Introductory Electronics | | | | 5 | |
| | | Elective *(see UGHB Fig.3-4; 1 course required; may not be CS 106A, B or X)* | | | | | |
| | | | | | *Engineering Fundamentals Total (13 units minimum)* | | |

**NOTES**

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the departmental

* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to Eng majors.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Grade Point Average (GPA) for all courses in Engineering Fundamentals and Computer Systems Engineering Core and Depth (combined) is 2.0.

* Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's office. Transfer credits in CSE Core and Depth must be approved by the Computer Science undergraduate program representative. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.

* All courses listed on this form must only be included under one category. Delete courses not taken.

( 1 ) Students who complete STATS 116, MS&E 120, or CME 106 in Winter 2008-09 or earlier may count that course as satisfying the CS 109 requirement. These same courses taken in Spring 2008-09 or later cannot be used to satisfy the CS 109 requirement.

**Computer Systems Engineering** *(55 units minimum)*

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Transfer/AP Approval Initials | Transfer/AP Approval Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Core (32 units minimum)* | | | | | | | |
| CS | 103 | Mathematical Foundations of Computing[2] | | | | 5 | |
| CS | 107 | Computer Organization and Systems[3] | | | | 5 | |
| CS | 108 or 110 | Object-Oriented Systems Design, *or* Principles of Comp Sys | | | | 4 or 5 | |
| EE | 108A | Digital Systems I | | | | 4 | |
| EE | 108B | Digital Systems II | | | | 3 or 4 | |
| Senior Project | | CS191, 191W, 194, 210B, 294 or 294W (see notes 4,5) | | | | 3 | |
| *Plus two of the following (delete courses not taken)* | | | | | | | |
| EE | 101A | Circuits I | | | | 4 | |
| EE | 101B | Circuits II | | | | 4 | |
| EE | 102A | Signals and Systems I | | | | 4 | |
| EE | 102B | Signals and Systems II | | | | 4 | |
| | | *Computer Systems Engineering Core Total (32 units minimum)* | | | | | |

*Depth (20 units minimum)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CS | 140 or 143 | Operating Systems or Compilers | | | | 4 | |
| EE | 109 | Digital Systems Design Lab | | | | 4 | |
| EE | 271 | VLSI Systems | | | | 3 | |
| *Plus three to four of the following (see note 6; delete courses not taken)* | | | | | | | |
| CS | 140 or 143 | *if not counted above* | | | | 4 | |
| CS | 144 | Introduction to Computer Networking | | | | 4 | |
| CS | 149 | Parallel Programming | | | | 4 | |
| CS | 240E | Low Power Wireless System Software | | | | 3 | |
| CS | 244 | Advanced Topics in Networking | | | | 4 | |
| CS | 244E | Low-Power Wireless Networking | | | | 3 | |
| EE | 273 | Digital Systems Engineering | | | | 3 | |
| EE | 282 | Computer Architecture | | | | 3 | |
| | | *Computer Systems Engineering Depth Total (20 units minimum)* | | | | | |

*Computer Systems Engineering Core + Depth Total (53 units minimum)*

**Program Approvals**

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 2 ) Students who have taken either CS 103X or CS 103A, B are considered to have satisfied the CS 103 req't. Students taking CS103A/B may complete the lower number of elective courses in a given specialization (see footnote 6).

( 3 ) The name of CS107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this req't.

( 4 ) The WIM req't may be met by taking CS 181 for TIS or through the Senior Project class (191W, 194, 210B, or 294W only).

( 5) Independent study projects (CS 191 or 191W) require faculty sponsorship and must be approved, in advance, by the advisor, faculty sponsor, and the CSE senior project advisor (Robert Plummer or Patrick Young). A signed approval form, along with a brief description of the proposed project, should be filed with the department representative in Gates 182 the quarter before work on the project is begun.

( 6) Students who take CS 103A, B may complete the lower number of elective courses in a given specialization (I.e., one less elective than students taking CS 103X or CS 103).

**Stanford University ♦ School of Engineering**

# Computer Systems Engineering – Networking Specialization
# 2009–2010 Program Sheet

***Final version of completed and signed program sheet due to the department no later than one month prior to the***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Mathematics (25 units minimum)* | | | | | | | |
| MATH | 41 | Calculus | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| MATH | 51 | Calculus | | | | 5 | |
| MATH | 52 *or* 53 | Calculus | | | | 5 | |
| CS | 109 | Introduction to Probability for Computer Scientists[1] | | | | 5 | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (25 units minimum)* | | |

*Science (12 units minimum)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PHYSICS | 41 | Mechanics | | | | 4 | |
| PHYSICS | 43 | Electricity and Magnetism | | | | 4 | |
| PHYSICS | 45 | Light and Heat | | | | 4 | |
| | | | | | | | |
| | | | | | *Science Unit Total (12 units minimum)* | | |
| | | | | | *Mathematics and Science Unit Total (37 units minimum)* | | |

## Technology in Society Requirement *(1 course required; see UGHB Fig. 3-3 for approved list)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

## Engineering Fundamentals *(13 units minimum)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CS | 106 | Programming Abstractions (B or X) | | | | 5 | |
| ENGR | 40 | Introductory Electronics | | | | 5 | |
| | | Elective *(see UGHB Fig.3-4; 1 course required; may not be CS 106A, B or X)* | | | | | |
| | | | | | *Engineering Fundamentals Total (13 units minimum)* | | |

**NOTES**

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the departmental

* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to Eng majors.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Grade Point Average (GPA) for all courses in Engineering Fundamentals and Computer Systems Engineering Core

* Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's office. Transfer credits in Computer Systems Engineering Core and Depth must be approved by the Computer Science undergraduate program representative. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.

* All courses listed on this form must only be included under one category. Delete courses not taken.

( 1 ) Students who complete STATS 116, MS&E 120, or CME 106 in Winter 2008-09 or earlier may count that course as satisfying the CS 109 requirement. These same courses taken in Spring 2008-09 or later cannot be used to satisfy the CS 109 requirement.

**Computer Systems Engineering** *(54 units minimum)*

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Core (32 units minimum)* | | | | | | | |
| CS | 103 | Mathematical Foundations of Computing[2] | | | | 5 | |
| CS | 107 | Computer Organization and Systems[3] | | | | 5 | |
| CS | 108 or 110 | Object-Oriented Systems Design, *or* Principles of Comp Sys | | | | 4 or 5 | |
| EE | 102A | Signals and Systems I | | | | 4 | |
| EE | 102B | Signals and Systems II | | | | 4 | |
| EE | 108A | Digital Systems I | | | | 4 | |
| EE | 108B | Digital Systems II | | | | 3 or 4 | |
| Senior Project | | CS191, 191W, 194, 210B, 294 or 294W (see notes 4, 5) | | | | 3 | |
| | | *Computer Systems Engineering Core Total (32 units minimum)* | | | | | |
| *Depth (20 units minimum)* | | | | | | | |
| CS | 140 | Operating Systems | | | | 4 | |
| CS | 144 | Introduction to Computer Networking | | | | 4 | |
| *Plus four to five of the following (see note 6; delete courses not taken)* | | | | | | | |
| CS | 240 | Advanced Topics in Operating Systems | | | | 3 | |
| CS | 240E | Low Power Wireless System Software | | | | 3 | |
| CS | 240X | Advanced Operating Systems II | | | | 3 | |
| CS | 244 | Advanced Topics in Networking | | | | 4 | |
| CS | 244B | Distributed Systems | | | | 3 | |
| CS | 244E | Low-Power Wireless Networking | | | | 3 | |
| CS | 249A | OOP from a Modeling and Simulation Perspective | | | | 3 | |
| CS | 249B | Advanced Object-Oriented Programming | | | | 3 | |
| EE | 179 | Introduction to Communication | | | | 3 | |
| EE | 276 | Introduction to Wireless Personal Communications | | | | 3 | |
| | | *Computer Systems Engineering Depth Total (20 units minimum)* | | | | | |

*Computer Systems Engineering Core + Depth Total (53 units minimum)* _____

**Program Approvals**

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 2 ) Students who have taken either CS 103X or CS 103A, B are considered to have satisfied the CS 103 requirement. Students taking CS103A, B may complete the lower number of elective courses in a given specialization (see footnote 6).

( 3 ) The name of CS107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this requirement.

( 4 ) The WIM requirement may be met by taking CS 201 as a Technology in Society course or through the Senior Project course (191W, 194, 210B, or 294W only).

(5 ) Independent study projects (CS 191 or 191W) require faculty sponsorship and must be approved, in advance, by the advisor, faculty sponsor, and the CSE senior project advisor (Robert Plummer or Patrick Young). A signed approval form, along with a brief description of the proposed project, should be filed with the department representative in Gates 182 the quarter before work on the project is begun.

(6) Students who take CS 103A, B may complete the lower number of elective courses in a given specialization (il.e., one fewer elective than students taking CS 103X or CS 103).

**Stanford University ♦ School of Engineering**

# Computer Systems Engineering

## Robotics and Mechatronics Specialization

## 2009–2010 Program Sheet

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

### Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Mathematics (25 units minimum)* | | | | | | | |
| MATH | 41 | Calculus | | | | 5 | |
| MATH | 42 | Calculus | | | | 5 | |
| MATH | 51 | Calculus | | | | 5 | |
| MATH | 52 *or* 53 | Calculus | | | | 5 | |
| CS | 109 | Introduction to Probability for Computer Scientists[1] | | | | 5 | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (25 units minimum)* | | |

*Science (12 units minimum)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PHYSICS | 41 | Mechanics | | | | 4 | |
| PHYSICS | 43 | Electricity and Magnetism | | | | 4 | |
| PHYSICS | 45 | Light and Heat | | | | 4 | |
| | | | | | | | |
| | | | | | *Science Unit Total (12 units minimum)* | | |
| | | | | | *Mathematics and Science Unit Total (37 units minimum)* | | |

### Technology in Society Requirement *(1 course required; see UGHB Fig. 3-3 for approved list)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

### Engineering Fundamentals *(13 units minimum)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CS | 106 | Programming Abstractions (B or X) | | | | 5 | |
| ENGR | 40 | Introductory Electronics | | | | 5 | |
| | | Elective *(see UGHB Fig.3-4; 1 course required; may not be CS 106A, B or X)* | | | | | |
| | | | | | *Engineering Fundamentals Total (13 units minimum)* | | |

**NOTES**

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the departmental

* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to Eng majors.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Grade Point Average (GPA) for all courses in Engineering Fundamentals and Computer Systems Engineering Core

* Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's office. Transfer credits in Computer Systems Engineering Core and Depth must be approved by the Computer Science undergraduate program representative. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.

* All courses listed on this form must only be included under one category. Delete courses not taken.

( 1 ) Students who complete STATS 116, MS&E 120, or CME 106 in Winter 2008-09 or earlier may count that course as satisfying the CS 109 requirement. These same courses taken in Spring 2008-09 or later cannot be used to satisfy the CS 109 requirement.

**Computer Systems Engineering** *(53 units minimum)*

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Core (32 units minimum)* | | | | | | | |
| CS | 103 | Mathematical Foundations of Computing[2] | | | | 5 | |
| CS | 107 | Computer Organization and Systems[3] | | | | 5 | |
| CS | 108 or 110 | Object-Oriented Systems Design, *or* Principles of Comp Sys | | | | 4 or 5 | |
| EE | 102A | Signals and Systems I | | | | 4 | |
| EE | 102B | Signals and Systems II | | | | 4 | |
| EE | 108A | Digital Systems I | | | | 4 | |
| EE | 108B | Digital Systems II | | | | 3 or 4 | |
| Senior Project | | CS191, 191W, 194, 210B, 294 or 294W (see notes 4, 5) | | | | 3 | |
| | | *Computer Systems Engineering Core Total (32 units minimum)* | | | | | |
| *Depth (19 units minimum)* | | | | | | | |
| CS | 205A | Mathematical Methods for Robotics, Vision and Graphics | | | | 3 | |
| CS | 223A | Introduction to Robotics | | | | 3 | |
| ME | 210 | Introduction to Mechatronics (or EE 118) | | | | 4 | |
| ENGR | 105 | Feedback Control Design | | | | 3 | |
| *Plus two to three of the following (see note 6; delete courses not taken from form)* | | | | | | | |
| AA | 278 | Optimal Control and Hybrid Systems | | | | 3 | |
| CS | 223B | Introduction to Computer Vision | | | | 3 | |
| CS | 225A | Experimental Robotics | | | | 3 | |
| CS | 225B | Robot Programming Laboratory | | | | 4 | |
| CS | 277 | Experimental Haptics | | | | 3 | |
| ENGR | 205 | Introduction to Control Design Techniques | | | | 3 | |
| ENGR | 206 | Control System Design | | | | 4 | |
| ENGR | 207A | Linear Control Systems I | | | | 3 | |
| ENGR | 207B | Linear Control Systems II | | | | 3 | |
| | | *Computer Systems Engineering Depth Total (19 units minimum)* | | | | | |
| | | *Computer Systems Engineering Core + Depth Total (52 units minimum)* | | | | | |

**Program Approvals**

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 2 ) Students who have taken either CS 103X or CS 103A, B are considered to have satisfied the CS 103 requirement. Students taking CS103A, B may complete the lower number of elective courses in a given specialization (see footnote 6).

( 3 ) The name of CS107 has changed. The previous CS 107 course titled *Programming Paradigms* also fulfills this requirement.

( 4 ) The WIM requirement may be met by taking CS 181 as a Technology in Society course or through the Senior Project course (191W, 194, 210B, or 294W only).

(5 ) Independent study projects (CS 191 or 191W) require faculty sponsorship and must be approved, in advance, by the advisor, faculty sponsor, and the CSE senior project advisor (Robert Plummer or Patrick Young). A signed approval form, along with a brief description of the proposed project, should be filed with the department representative in Gates 182 the quarter before work on the project is begun.

( 6 ) Students who take CS 103A, B may complete the lower number of elective courses in a given specialization (I.e., one less elective than students taking CS 103X or CS 103).

# ELECTRICAL ENGINEERING

## — ABET ACCREDITATION CRITERIA APPLY —

The mission of the Department of Electrical Engineering is to offer an EE undergraduate program that augments the liberal education expected of all Stanford undergraduates and imparts a basic understanding of electrical engineering built on a foundation of physical science, mathematics, computing, and technology.

Graduates of the undergraduate program should possess knowledge of electrical engineering fundamentals and at least one specialty area. They are expected to have the basic experimental, design, and communication skills to be prepared for continued study at the graduate level or entry level positions that require basic knowledge of electrical engineering, science, and technology.

The educational objectives and student outcomes for the Department of Electrical Engineering are shown in the table on the following page.

The Departmental Requirements for a BS degree in Electrical Engineering include a core set of courses required of every major and a set of specialty areas from which one sequence must be chosen. Each program of study is also expected to include physics as part of science, and calculus, linear algebra, and ordinary differential equations as part of mathematics. The math requirement also includes a course in basic probability and statistics. Specific math and science requirements for EEs are listed below. Other program requirements detailed below include Technology in Society (one course) and one and one half years of Engineering Topics (68 minimum required; also called Engineering Science and Design units), which include Engineering Fundamentals and Depth, which in turn includes a selection of electrical engineering core courses, a specialty sequence, electrical engineering electives, and a design course from an approved list. To be considered electrical engineering courses, courses must either be listed in the Stanford Bulletin as EE courses or as EE "cognate courses" (courses considered by the Department of EE to be programmatically equivalent to EE courses).The design course is intended to culminate the substantial design experience distributed throughout the curriculum. Students are required to pass a writing-intensive course (WIM) within their major (those who double-major will have to take two WIM courses). The WIM course for the Electrical Engineering Major is EE 108A combined with ENGR 102E.

Students are required to have a program planning sheet approved by their advisor and the department prior to the end of the quarter following the quarter they declare their major and at least one year prior to graduation. Programs may be changed at anytime except during the final quarter before graduation by submitting and having approved a new program sheet. Program sheets for the general EE requirements and for each of the EE specialty sequences may be found at **`http://ughb.stanford.edu`**.

### OBJECTIVES AND OUTCOMES FOR ELECTRICAL ENGINEERING

**Objectives:**

1. *Technical Knowledge:* Provide a basic knowledge of electrical engineering principles along with the required supporting knowledge of mathematics, science, computing, and engineering fundamentals. The program must include depth in at least one specialty area, currently including Computer Hardware, Computer Software, Controls, Circuits and Devices, Fields and Waves, Communication and Signal Processing, and Solid State and Photonic Devices.
2. *Laboratory and Design Skills:* Develop the basic skills needed to perform and design experimental projects. Develop the ability to formulate problems and projects and to plan a process for solutions taking advantage of diverse technical knowledge and skills.
3. *Communications Skills:* Develop the ability to organize and present information, and to write and speak effective English.
4. *Preparation for Further Study:* Provide sufficient breadth and depth for successful subsequent graduate study, post-graduate study, or lifelong learning programs.
5. *Preparation for the Profession:* Provide an appreciation for the broad spectrum of issues arising in professional practice, including teamwork, leadership, safety, ethics, service, economics, and professional organizations.

**Outcomes:**

(a) An ability to apply knowledge of mathematics, science, and engineering
(b) An ability to design and conduct experiments, as well as to analyze and interpret data
(c) An ability to design a system, component, or process to meet desired needs
(d) An ability to function on multi-disciplinary teams
(e) An ability to identify, formulate, and solve engineering problems
(f) An understanding of professional and ethical responsibility
(g) An ability to communicate effectively
(h) The broad education necessary to understand he impact of engineering solutions in a global and societal context
(i) A recognition of the need for, and an ability to engage in, life-long learning
(j) A knowledge of contemporary issues
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
(l) Background for admission to engineering or other professional graduate programs

To place the requirements in context, sample programs of study are given which satisfy all requirements for the BS degree in EE. Students with advanced placement will have greater freedom in course selection than is shown in the program examples. Those considering studying at one of the foreign centers should consult the Overseas Study Office as soon as possible, for this

will add constraints in program planning. All students are expected to consult their faculty advisor, are encouraged to consult the Electrical Engineering Undergraduate Advising Center in Packard 110; phone: (650) 725-1736, and may find it useful to consult other students when designing their program.
For updated information, visit the EE website at: **http://ee.stanford.edu/**

# RESEARCH EXPERIENCE FOR UNDERGRADUATES

The Electrical Engineering Department at Stanford University invites undergraduates majoring in EE to participate in its REU Summer Program from June to August. The program is designed to give undergraduates an opportunity to work with members of the EE Faculty and their research groups on advanced research topics.

### Program Structure

The program is designed to give both an in-depth research experience on a particular topic, as well as a broad hands-on exposure to various areas within EE.

Bi-weekly seminars are offered to cover a wide range of topics. The seminar series lecturers are comprised of EE faculty and guests. Discussions will include topics such as graduate education, internships and career opportunities.

### Presentations

The last week of the summer program will be devoted to writing a final report and creating a poster on the research project. The students will present their projects at a poster fair, to which the EE community will be invited.

### Funding/Housing

Each student receives a summer stipend. Students are required to reside in undergraduate housing with the Summer Research College. A meal plan is also provided.

### Application Procedure

1. Go to **http://eeclass.stanford.edu/reu/**
2. Click on STUDENTS
3. Register
4. Login

5. The application has two steps. You can re-submit both steps at any point up to the deadline. The deadline for students to apply is Feb 19, 2010.
6. If you have any questions about the application, email **gradta@stanford.edu**
   If you have any questions about the logistics of the REU program, email **studentservices@ee.stanford.edu**

**REU Requirements**

Students must declare EE as their undergraduate major. With the exception of co-terms, in order to be eligible students may not be seniors when they apply. In the event the number of applicants exceeds the number of spaces available, preference is given to first time participants. If you have any questions regarding this information, please email studentservices**@ee.stanford.edu**..

# STANFORD UNIVERSITY/ÉCOLE CENTRALE PARIS JUNIOR YEAR ABROAD PROGRAM

Although not formally part of the Overseas Studies Program, Stanford Electrical Engineering undergraduates can receive credit for study abroad at École Centrale Paris. École Centrale Paris is one of the best known science and engineering schools in France and Europe. Stanford students are enrolled in engineering program classes with French and international students. Instruction is mostly in French. For more information, see the "Overseas Studies" section of this handbook and the website **http://www.ecp.fr/study-program/stanford**, or contact Prof. Robert M. Gray, Packard 261.

# REQUIREMENTS

**Math and Science Requirements:**

A minimum of 45 units of mathematics and science combined are required, including the following required courses:
**Math:** MATH 41, 42, OR (51 AND 52) OR (CME 100 AND CME 104), (53 OR CME 102), (EE178 [PREFERRED] OR STATS 116 OR MATH 151 OR CME 106)

**Science:** PHYSICS (41, 43) OR (61, 63)
A minimum of 12 science units is required. Phys 45 or 65 is strongly recommended for those pursuing the *Fields and Waves* or the *Solid State and Photonic Devices* specialties. Substitutions require approval of the advisor, department, and Dean's Office.

### Technology in Society:

See the "Approved Courses" section of this handbook (Figure 3-3) for courses that fulfill the TIS requirement.

### Engineering Topics:

A minimum of 68 units (approximately 1.5 years) of Engineering Topics(Engineering Science and Design units) and a minimum of 8 units of Experimentation is required by ABET and by the Department. Engineering Topics include both Engineering Fundamentals and Engineering Depth. In general, the number of Science and Design units assigned to a course equals the course unit total (see table below). Engineering Fundamentals consist of three courses chosen from the School list of approved courses (Figure 3-4), one of which must be E70B or X (same as CS 106B or X) and one of which must be outside of EE and CS. Note that CS 106A does not count as an Engineering Fundamental course. Electrical Engineering Depth comprises Core courses, a Specialty Sequence, and EE Electives. In addition to courses taught within the EE department, extra-departmental courses designated as EE "cognate courses" are considered to be equivalent to EE courses with respect to all of the degree requirements. A list of approved EE cognate courses for undergraduates is given in a table on the following page. Information regarding graduate courses can be found in the EE Graduate Handbook at **`http://ee.stanford.edu/gradhandbook/`**. Any extra-departmental course included in the EE core or a specialty sequence may be assumed to be an EE cognate course.

**ENGINEERING FUNDAMENTALS:**

| | |
|---|---|
| Programming Abstractions (or Accelerated version) | ENGR 70B or X (CS 106B or X) |
| 2 from approved list (ENGR 40 recommended) | |

**CORE COURSES REQUIRED OF ALL MAJORS:**

| | |
|---|---|
| Circuits | EE 101A,B |
| Signal Processing and Linear Systems | EE 102A,B |
| Digital Systems | EE 108A,B |
| Technical Writing | ENGR 102E (taken concurrnently with EE 108A) |
| Physics in Electrical Engineering | EE 41 or EE 141 |
| The Electrical Engineering Profession | EE 100 |

**THREE COURSES FROM ONE OF THE SPECIALTY AREAS LISTED BELOW:**

| | |
|---|---|
| Computer Hardware | EE 109, CS 107, EE 271, EE 273, EE 282 |
| Computer Software | CS 107, CS 108, CS 140, CS 143, CS 145, CS 148, CS 194, (EE 284 or CS 144) |
| Controls | ENGR 105, ENGR 205 ENGR 206, ENGR 207A, B, ENGR 209A, B, EE 263 |
| Circuits and Devices | EE 114, EE 116, EE 122, EE 133, EE 212, EE 214, EE 216, EE 271 |
| Fields and Waves | EE 134, EE 141, EE 242, EE 246, EE 247, EE 252, EE 256 |
| Signal Processing and Communications | EE 124, EE 133, EE 168, EE 179, EE 261, EE 263, (EE 264 or EE 265), EE 276, EE 278, EE 279 |

| | |
|---|---|
| Solid State and Photonic Devices | EE 116, EE 134, EE 136, EE 141, EE 216, EE 222, EE 223, EE 228, EE 235, EE268 |

Note: EE 141 can be included in a specialty sequence only if it is not used to fulfill the Physics in EE core requirement.

**DESIGN COURSE:**

At least one of the following design projects must be included in each program:
EE 109, EE 133, EE 134, EE 168, CS 194, ENGR 206, EE 256, EE 262, EE 265.

**ELECTIVES:**

A total of 68 Engineering Topics Units consisting of Engineering Science and Engineering Design units from any graded EE or EE cognate courses, any CS 193 courses, or a maximum of two additional Engineering Fundamentals are required. Freshman and Sophomore seminars, EE 100, ENGR 102E, and CS 106A do not count toward the 68 units. Up to 10 units of EE 191 (Special Studies with Reports) can count toward the 68 Engineering Topics units (check with the instructor to determine the number of Topics units that can be applied. Freshman seminars do not in general count towards the 68 units.

**ELECTRICAL ENGINEERING COGNATE COURSES :**

| Course | Course Title | EE Level |
|---|---|---|
| AA 272C | Global Positioning Systems | 200-299 |
| AA 278 | Optimal Control and Hybrid Systems | 200-299 |
| APPPHYS 207 | Laboratory Electronics | 100-199 |
| APPPHYS 208 | Laboratory Electronics | 100-199 |
| APPPHYS 226 | Physics of Quantum Information | 200-299 |
| APPPHYS 227 | Applications of Quantum Information | 200-299 |
| APPPHYS 272 | Solid State Physics I | 200-299 |
| APPPHYS 273 | Solid State Physics II | 200-299 |
| CS 107 | Computer Organization and Systems | 100-199 |
| CS 108 | Object-Oriented Systems Design | 100-199 |
| CS 140 | Operating Systems and Systems Programming | 200-299 |
| CS 143 | Compilers | 200-299 |
| CS 144 | Introduction to Computer Networks | 200-299 |
| CS 145 | Introduction to Databases | 200-299 |
| CS 148 | Introductory Computer Graphics | 100-199 |
| CS 194 | Software Project | 100-199 |
| CS 205 | Mathematical Methods for Robotics, Vision, and Graphics | 200-299 |
| CS 221 | Artificial Intelligence: Principles and Techniques | 200-299 |
| CS 223B | Introduction to Computer Vision | 200-299 |
| CS 228 | Probabilistic Models in Artificial Intelligence | 200-299 |
| CS 229 | Machine Learning | 200-299 |
| CS 240 | Advanced Topics in Operating Systems | 200-299 |
| CS 242 | Programming Languages | 200-299 |
| CS 248 | Introduction to Computer Graphics | 200-299 |

| | | |
|---|---|---|
| CS 255 | Introduction to Cryptography | 200-299 |
| ENGR 105 | Feedback Control Design | 100-199 |
| ENGR 205 | Introduction to Control Design Techniques | 200-299 |
| ENGR 206 | Control System Design | 200-299 |
| ENGR 207A | Modern Control Design I | 300-299 |
| ENGR 207B | Modern Control Design II | 300-299 |
| ENGR 209A | Analysis and Control of Nonlinear Systems | 300-299 |
| ENGR 209B | Advanced Nonlinear Control | 300-299 |
| ENGR 210B | Advanced Topics in Computation for Control | 300-299 |
| ENGR 240 | Introduction to Micro- and Nanofabrication technologies | 200-299 |
| GEOPHYS 140 | Introduction to Remote Sensing | 100-199 |
| MATSCI 199/209 | Electronic and Optical Properties of Solids | 200-299 |
| MATSCI 323 | Thin Film and Interface Microanalysis | 200-299 |
| MATSCI 347 | Introduction to Magnetism and Magnetic Nanostructures | 200-299 |
| ME 358 | Heat Transfer in Microdevices | 200-299 |
| MS&E 237 | Progress in Worldwide Telecommunications | 200-299 |
| MS&E 251 | Stochastic Decision Models | 200-299 |
| MS&E 246 | Game Theory with Engineering Applications | 200-299 |
| STATS 315A | Modern Applied Statistics: Learning | 200-299 |
| STATS 315B | Modern Applied Statistics: Data Mining | 200-299 |

**Total Engineering Topics Units: 68 units** (Fundamental + Core + EE Specialty + Electives)

It is a School of Engineering requirement that all courses counting toward the major must be taken for a letter grade (A,B,C,D,F) if the instructor offers that option. Students with multiple majors should be aware that a depth course cannot be counted toward multiple majors, but any course can be double counted in a secondary major. This may necessitate taking additional courses in the case of double majors, but will have no effect if one is a secondary major.

Sample 4-year plans and flowcharts illustrating ways to fulfill the EE undergraduate major requirements are provided for each of the specialties. These examples are given to assist in planning a complete program. They are only guidelines. In general, however, scheduling is easier if engineering classes are taken as early as possible. Variations that appear in the first two years of the different sample schedules simply illustrate different options available to students before they specialize (except that MATH 113 may be needed for the Controls specialty).

Sample EE undergraduate Program Sheets follow the sample 4-year plans for Electrical Engineering specialties. For updated information and Excel templates, visit the web site at **http://ughb.stanford.edu.**

The following two tables provide the total units, the division of engineering science and engineering design units, and the experimentation units for courses used toward the EE degree. The experimentation units are counted separately and are used only for the ABET Laboratory units requirement.

# ENGINEERING SCIENCE, ENGINEERING DESIGN, AND EXPERIMENTATION UNITS

| Course | Title | Engr. Sci.* | Engr. Dsgn.* | Expr. | Total |
|---|---|---|---|---|---|
| **Fundamentals** | | | | | |
| ENGR 70B or<br>ENGR 70X<br>(CS 106B or X) | Programming Abstractions<br>Or Programming Abstractions, Accelerated | 3<br>3 | 2<br>2 | -<br>- | 5<br>5 |
| ENGR 40 | Introductory Electronics (recommended) | 3 | 2 | 2 | 5 |
| ENGR 14<br>ENGR 15* | Applied Mechanics: Statics and Deformables *or*<br>Mechanics | 2<br>2 | 1<br>1 | -<br>- | 3<br>3 |
| ENGR 20 | Introduction to Chemical Engineering | 2 | 1 | - | 3 |
| ENGR 30 | Engineering Thermodynamics | 3 | - | - | 3 |
| ENGR 50 | Introductory Science of Materials | 4 | - | - | 4 |
| ENGR 60<br>ENGR 62* | Engineering Economy *OR*<br>Introduction to Optimization | 3<br>4 | -<br>- | -<br>- | 3<br>4 |
| **Core Courses** | | - | - | - | - |
| EE 41<br>EE 141** | Physics of Electrical Engineering *or*<br>Engineering Electromagnetics | 3<br>3 | 2<br>- | 2<br>- | 5<br>3 |
| EE 100 | The Electrical Engineering Profession | - | - | - | 1 |
| EE 101A | Circuits I | 4 | - | 1 | 4 |
| EE 101B | Circuits II | 3 | 1 | 1 | 4 |
| EE 102A | Signal Processing and Linear Systems I | 4 | - | 1 | 4 |
| EE 102B | Signal Processing and Linear Systems II | 4 | - | 1 | 4 |
| EE 108A | Digital Systems I | 3 | 1 | 1 | 4 |
| EE 108B | Digital Systems II | 3 | 1 | 1 | 4 |
| ENGR102E | Technical/Professional Writing for Electrical Engineers | - | - | - | - |
| **Specialty Courses** | | | | | |
| *Computer Hardware* | | | | | |
| CS 107 | Computer Organization and Systems | 2 | 3 | - | 5 |
| EE 109 | Digital Systems Design Laboratory | 1 | 3 | 4 | 4 |
| EE 271 | Introduction to VLSI systems | 1.5 | 1.5 | - | 3 |
| EE 273 | Digital Systems Engineering | 2 | 1 | - | 3 |
| EE 282 | Computer Architecture and Organization | 2 | 1 | - | 3 |
| *Computer Software* | | | | | |
| CS 107 | Computer Organization and Systems | 2 | 3 | - | 5 |
| CS 108 | Object-oriented Systems Design | 2 | 2 | - | 4 |
| CS 140 | Operating Systems and Systems Programming | 4 | - | - | 4 |
| CS 143 | Compilers | 3 | 1 | - | 4 |
| CS 144 | Introduction to Computer Networks | 4 | - | - | 4 |
| CS 145 | Introduction to Databases | 2 | 2 | - | 4 |
| CS 148 | Introductory Computer Graphics | 2 | 1 | - | 3 |
| EE 284 | Introduction to Computer Networks | 3 | - | - | 3 |

* Freshman and sophomore seminars, EE 100, ENGR 102E, and CS 106A do not count toward the 68 units..
** "Or" means that only one of the two courses may be used to fulfill an Engineering Fundamental requirement.

| Course | Title | Engr. Sci. | Engr. Dsgn. | Expr. | Total |
|---|---|---|---|---|---|
| CS 194 | Software Project | - | 3 | - | 3 |
| *Controls* | | | | | |
| ENGR 207A | Modern Control Design I | 3 | - | - | 3 |
| ENGR 207B | Modern Control Design II | 3 | - | - | 3 |
| ENGR 209A | Analysis & Control of Nonlinear Systems | - | 3 | | 3 |
| ENGR 209B | Advanced Nonlinear Control | 3 | - | - | 3 |
| EE 263 | Introduction to Linear Dynamical Systems | 2.5 | 0.5 | - | 3 |

| *Circuits and Devices* | | | | | |
|---|---|---|---|---|---|
| EE 114 | Fundamentals of Analog Integrated Circuits Design | - | 3 | - | 3 |
| EE 116 | Semiconductor Device Physics | 3 | - | - | 3 |
| EE 122 | Analog Lab | 1 | 2 | 3 | 3 |
| EE 133 | Analog Communications Design Lab | - | 4 | 2 | 4 |
| EE 212 | Integrated Circuit Fabrication Processes | 2 | 1 | - | 3 |
| EE 214 | Advanced Analog Integrated Circuit Design | - | 3 | - | 3 |
| EE 216 | Principles and Models of Semiconductor Devices | 3 | - | - | 3 |
| EE 271 | Introduction to VLSI Systems | 1.5 | 1.5 | - | 3 |
| *Fields and Waves* | | | | | |
| EE 134 | Introduction to Photonics | 2 | 2 | 2 | 4 |
| EE 141 | Engineering Electromagnetics | 4 | - | - | 4 |
| EE 144 | Wireless Electromagnetic Design Lab | 1.5 | 1.5 | 1.5 | 3 |
| EE 242 | Electromagnetic Waves | 2.5 | 0.5 | - | 3 |
| EE 246 | Microwave Engineering | 1.5 | 1.5 | - | 3 |
| EE 247 | Introduction to Optical Fiber Communications | 2 | 1 | - | 3 |
| EE 252 | Antennas for Telecommunication and Remote Sensing | 2 | 1 | - | 3 |
| EE 256 | Electromagnetics | 1 | 2 | - | 3 |
| *Signal Processing* | | | | | |
| EE 124 | Introduction to Neuroelectrical Engineering | 2 | 1 | 0 | 3 |
| EE 133 | Analog Communications Design Lab | - | 4 | 2 | 4 |
| EE 168 | Introduction to Digital Image Processing | 3 | - | - | 3 |
| EE 179 | Signal Processing and Communication | 3 | - | - | 3 |
| EE 261 | Fourier Transform and its Applications | 3 | - | - | 3 |
| EE 263 | Introduction to Linear Dynamical Systems | 2.5 | 0.5 | - | 3 |
| EE 264 | Digital Filtering | 1.5 | 1.5 | - | 3 |
| EE 265 | Signal Processing Laboratory | 2 | 2 | 3 | 4 |
| EE 276 | Introduction to Wireless Personal Communications | 2 | 1 | 0 | 3 |
| EE 278 | Introduction to Statistical Signal Processing | 3 | - | - | 3 |
| EE 279 | Introduction to Communication Systems | 3 | - | - | 3 |
| *Solid State and Photonic Devices* | | | | | |
| EE 116 | Semiconductor Device Physics | 3 | - | - | 3 |
| EE 134 | Introduction to Photonics | 2 | 2 | 2 | 4 |
| EE 136 | Introduction to Nanophotonics and Nanostructures | 3 | - | - | 3 |
| EE 141 | Engineering Electromagnetics | 3 | - | - | 3 |
| EE 216 | Principles and Models of Semiconductor Devices | 3 | - | - | 3 |
| EE 222 | Applied Quantum Mechanics I | 3 | - | - | 3 |
| EE 223 | Applied Quantum Mechanics II | 3 | - | - | 3 |
| EE 228 | Basic Physics for Solid State Electronics | 3 | - | - | 3 |
| EE 235 | Guided Wave Optical Devices | 3 | - | - | 3 |
| EE 268 | Introduction to Modern Optics | 3 | - | - | 3 |
| **Other Courses** | | | | | |
| CS 193D | C++ and Object Oriented Programming | 1.5 | 1.5 | - | 3 |

# Electrical Engineering

*Typical Sequence of Courses*

| *Freshman* | *Sophomore* | | *Junior* |
|---|---|---|---|
| MATH 41 (A) | MATH 52 (A,W,S) or CME 104 (S) | EE 102A (W) | EE 101A (W) |
| MATH 42 (A,W) | MATH 53 (A,W,S) or CME 102 (W) | EE 102B (S) | EE 101B (S) |
| MATH 51 (A,W,S) or CME 100 (A) | ENGR 40 (A) | EE 108A (A,W) | Design Course |
| PHYS 41 (W) | EE 100 (A) | EE 178 (W) or STAT 116 (A,W,S)or CME 106/MATH 151 (W) | EE 108B (W,S) |
| PHYS 43 (S) | CS 106B (AWS) or 106X (A) | | EE 41 (W) or EE 141 (A) |
| PHYS 45 (A) (Optional) | Engineering Fundamental | Science | Technology in Society *(or senior yr)* |

***Junior/Senior Year: Choose one track below***

*Typical courses: see track descriptions for course options*

| Computer Hardware | Computer Software | Controls | Circuits & Devices |
|---|---|---|---|
| CS 107 | CS 107 | ENGR 105 | EE 114 |
| EE 109 | CS 108 | ENGR 205 | EE 116 |
| EE 271 | CS 140 | ENGR 206 | EE 122 |
| EE 273 | CS 143 | ENGR 207A | EE 133 |
| EE 282 | CS 145 | ENGR 209A | EE 212 |
| EE Elective | CS 148 | EE 263 | EE 214 |
| EE Elective | CS 194 | EE Elective | EE 216 |
| | CS 144 or EE 284 | EE Elective | EE 271 |
| | EE Elective | | |
| | EE Elective | | |

| Fields and Waves | Signal Processing & Communications | Solid State and Photonic Devices |
|---|---|---|
| EE 134 | EE 124 | EE 116 |
| EE 141 | EE 133 | EE 134 |
| EE 242 | EE 168 | EE 136 |
| EE 246 | EE 179 | EE 141 |
| EE 247 | EE 261 | EE 216 |
| EE 252 | EE 263 | EE 222 |
| EE 256 | EE 264 or 265 | EE 223 |
| | EE 276 | EE 228 |
| | EE278 | EE 235 |
| | EE 279 | EE 268 |

* Arrows represent direct prerequisites; dashed arrows represent recommendations
* Dashed-line boxes indicate alternate courses that may be taken at a given time.

# Electrical Engineering

*Computer Hardware*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | CS 106A | | - | 5 |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | PHYS 45 | 4 | - | - | Writing | - | - | 4 | ENGR 40 | - | 5 | - |
| | | | | | PHYS 41 | 4 | - | - | PHYS 43 | 4 | - | - |
| | *Subtotals* | *9* | *0* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *4* | *5* | *9* |
| | Total | | | 13 | Total | | | 17 | Total | | | 18 |
| *Sophomore* | EE 100 | - | - | 1 | EE 108B | - | 4 | - | CS 107 | - | 5 | - |
| | CME 100 | 5 | - | - | CME 102 | 5 | - | - | CME 104 | 5 | - | - |
| | GER | - | - | 5 | CS 106B | - | 5 | - | EE 109 | - | 4 | - |
| | EE 108A | - | 4 | - | Writing | - | - | 4 | | | | |
| | ENGR 102E | - | - | 1 | | | | | | | | |
| | *Subtotals* | *5* | *4* | *7* | *Subtotals* | *5* | *9* | *4* | *Subtotals* | *5* | *9* | *0* |
| | Total | | | 16 | Total | | | 18 | Total | | | 14 |
| *Junior* | EE 122A | - | 3 | - | EE 101A | - | 4 | - | EE 101B | - | 4 | - |
| | EE 281 | - | 3 | - | EE 102A | - | 4 | - | EE 102B | - | 4 | - |
| | CHEM 31A | 4 | - | - | EE 41 | - | 5 | - | GER | - | - | 5 |
| | | | | | | | | | STATS 116 | 5 | - | - |
| | *Subtotals* | *4* | *6* | *0* | *Subtotals* | *0* | *13* | *0* | *Subtotals* | *5* | *8* | *5* |
| | Total | | | 10 | Total | | | 13 | Total | | | 18 |
| *Senior* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | EE 271 | - | 3 | - | EE 273 | - | 3 | - | ENGR 50 | - | 4 | - |
| | EE 282 | - | 3 | - | EE 313 | - | 3 | - | COMM 120 | - | - | 5 |
| | GER | - | - | 5 | GER | - | - | 5 | | | | |
| | *Subtotals* | *0* | *6* | *10* | *Subtotals* | *0* | *6* | *10* | *Subtotals* | *0* | *4* | *10* |
| | Total | | | 16 | Total | | | 16 | Total | | | 14 |

| | |
|---|---|
| Total Math & Science Units: | 46 |
| Total Engineering Units: | 70 |
| Total Other Units: | 67 |
| Total Units: | 183 |

# Electrical Engineering

*Computer Software*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | CS 106X | - | 5 | - | PHYSICS 41 | 4 | - | - | INTRO SEM | - | - | 3 |
| | PHYSICS 45 | 4 | - | - | Writing | - | - | 4 | PHYSICS 43 | 4 | - | - |
| | *Subtotals* | *9* | *5* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *7* |
| | Total | | | 18 | Total | | | 17 | Total | | | 16 |
| *Sophomore* | MATH 52 | 5 | - | - | EE 108A | - | 4 | - | EE 108B | - | 4 | - |
| | CS 107 | - | 5 | - | ENGR 102E | - | - | 1 | MATH 53 | 5 | - | - |
| | ENGR 40 | - | 5 | - | Writing | - | - | 4 | GER | - | - | 5 |
| | EE 100 | - | - | 1 | CS 108 | - | 4 | - | | | | |
| | *Subtotals* | *5* | *10* | *1* | *Subtotals* | *0* | *8* | *5* | *Subtotals* | *5* | *4* | *5* |
| | Total | | | 16 | Total | | | 13 | Total | | | 14 |
| *Junior* | ENGR 60 | - | 3 | - | EE 101A | - | 4 | - | EE 101B | - | 4 | - |
| | STAT 116 | 5 | - | - | EE 102A | - | 4 | - | EE 102B | - | 4 | - |
| | MATH 113 | 3 | - | - | CS 255 | - | 3 | - | GER | - | - | 5 |
| | GER | | | 5 | STS 110 | - | - | 5 | | | | |
| | *Subtotals* | *8* | *3* | *5* | *Subtotals* | *0* | *11* | *5* | *Subtotals* | *0* | *8* | *5* |
| | Total | | | 16 | Total | | | 16 | Total | | | 13 |
| *Senior* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CS 140 | - | 4 | - | CS 244A | - | 4 | - | CS 194 | - | 3 | - |
| | EE 282 | - | 3 | - | EE 41 | - | 5 | - | GER | - | - | 5 |
| | | | | | EE 261 | - | 3 | - | | | | |
| | *Subtotals* | *0* | *7* | *5* | *Subtotals* | *0* | *12* | *5* | *Subtotals* | *0* | *3* | *10* |
| | Total | | | 12 | Total | | | 17 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 45 |
| Total Engineering Units: | 71 |
| Total Other Units: | 65 |
| **Total Units:** | 181 |

# Electrical Engineering

*Controls*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | PHYSICS 45 | 4 | - | - | Writing | - | - | 4 | ENGR 40 | - | 5 | - |
| | | | | | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | *Subtotals* | *9* | *0* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *5* | *4* |
| | Total | | | 13 | Total | | | 17 | Total | | | 18 |
| *Sophomore* | MATH 52 | 5 | - | - | EE 101A | - | 4 | - | EE 101B | - | 4 | - |
| | CS 106A | - | - | 5 | EE 102A | - | 4 | - | EE 102B | - | 4 | - |
| | GER | - | - | 5 | CS 106B | - | 5 | - | MATH 53 | 5 | - | - |
| | EE 100 | - | - | 1 | Writing | - | - | 4 | ENGR 62 | - | 4 | - |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *0* | *13* | *4* | *Subtotals* | *5* | *12* | *0* |
| | Total | | | 16 | Total | | | 17 | Total | | | 17 |
| *Junior* | Math 113 | 3 | - | - | EE 178 | 3 | - | - | MATH 114 | 3 | - | - |
| | EE 108A | - | 4 | - | EE 108B | - | 4 | - | EE 122A | - | 3 | - |
| | ENGR 105 | - | 3 | - | ENGR 102E | - | - | 1 | STS 180 | - | - | 4 |
| | GER | - | - | 5 | ENGR 206 | - | 4 | - | | | | |
| | *Subtotals* | *3* | *7* | *5* | *Subtotals* | *3* | *8* | *1* | *Subtotals* | *3* | *3* | *4* |
| | Total | | | 15 | Total | | | 12 | Total | | | 10 |
| *Senior* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | EE 263 | - | 3 | - | EE 209A | - | 3 | - | EE 278 | - | 3 | - |
| | ENGR 205 | - | 3 | - | EE 265 | - | 4 | - | GER | - | - | 5 |
| | GER | - | - | 5 | EE 41 | - | 5 | - | | | | |
| | *Subtotals* | *0* | *6* | *10* | *Subtotals* | *0* | *12* | *5* | *Subtotals* | *0* | *3* | *10* |
| | Total | | | 16 | Total | | | 17 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 46 |
| Total Engineering Units: | 69 |
| Total Other Units: | 66 |
| **Total Units:** | 181 |

# Electrical Engineering

*Circuits and Devices*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | PHYSICS 45 | 4 | - | - | PHYSICS 41 | 4 | - | - | ENGR 40 | - | 5 | - |
| | PHYSICS 46 | 1 | - | - | Writing | | | 4 | PHYSICS 43 | 4 | - | - |
| | *Subtotals* | *10* | *0* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *5* | *4* |
| | Total | | | 14 | Total | | | 17 | Total | | | 18 |
| *Sophomore* | MATH 52 | 5 | - | - | CS 106B | - | 5 | - | Math 53 | 5 | - | - |
| | EE 100 | - | - | 1 | EE 101A | - | 4 | - | EE 101B | - | 4 | - |
| | CS 106A | - | - | 5 | EE 108B | - | 4 | - | EE 122A | - | 3 | - |
| | EE 108A | - | 4 | - | ENGR 102E | - | - | 1 | | | | |
| | | | | | Writing | | | 4 | | | | |
| | *Subtotals* | *5* | *4* | *6* | *Subtotals* | *0* | *13* | *1* | *Subtotals* | *5* | *7* | *0* |
| | Total | | | 15 | Total | | | 14 | Total | | | 12 |
| *Junior* | EE 271 | - | 3 | - | EE 41 | - | 5 | - | EE 102B | - | 4 | - |
| | EE 212 | - | 3 | - | EE 102A | - | 4 | - | GER | - | - | 5 |
| | EE 114 | - | 3 | - | EE 178 | 3 | - | - | GER | - | - | 5 |
| | EARTHSYS 10 | 4 | - | - | Elective | - | - | 3 | EE 116 | - | 3 | - |
| | *Subtotals* | *0* | *9* | *0* | *Subtotals* | *3* | *9* | *3* | *Subtotals* | *0* | *7* | *10* |
| | Total | 4 | | 13 | Total | | | 15 | Total | | | 17 |
| *Senior* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | EE 214 | - | 3 | - | EE 133 | - | 4 | - | GER | - | - | 5 |
| | EE 216 | - | 3 | - | EE 223 | - | 3 | - | ENGR 50 | - | 4 | - |
| | EE 222 | - | 3 | - | STS 110 | - | - | 5 | GER | - | - | 4 |
| | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *0* | *7* | *10* | *Subtotals* | *0* | *4* | *14* |
| | Total | | | 14 | Total | | | 17 | Total | | | 18 |

| | |
|---|---|
| Total Math & Science Units: | 41 |
| Total Engineering Units: | 74 |
| Total Other Units: | 65 |
| Total Units: | 180 |

# Electrical Engineering

*Fields and Waves*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Writing | - | - | 4 | PHYSICS 41 | 4 | - | - | ENGR 40 | - | 5 | - |
| | PHYSICS 45 | 4 | - | - | | | | | PHYSICS 43 | 4 | - | - |
| | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *4* | *Subtotals* | *9* | *5* | *4* |
| | Total | | | 17 | Total | | | 13 | Total | | | 18 |
| *Sophomore* | EE 100 | - | - | 1 | CS 106B | - | 5 | - | EE 178 | 3 | - | - |
| | MATH 52 | 5 | - | - | MATH 53 | 5 | - | - | EE 102B | - | 4 | - |
| | EE 141 | - | 3 | - | EE 242 | - | 3 | - | GER | - | - | 5 |
| | CS 106A | - | - | 5 | EE 102A | - | 4 | - | | | | |
| | Writing | - | - | 4 | | | | | | | | |
| | *Subtotals* | *5* | *3* | *10* | *Subtotals* | *5* | *12* | *0* | *Subtotals* | *3* | *4* | *5* |
| | Total | | | 18 | Total | | | 17 | Total | | | 12 |
| *Junior* | EE 108A | - | 4 | - | EE 101A | - | 4 | - | EE 101B | - | 4 | - |
| | EE 122A | - | 3 | - | EE 108B | - | 4 | - | EE 252 | - | 3 | - |
| | ENGR 102E | - | - | 1 | EE 179 | - | 3 | - | ENGR 14 | - | 3 | - |
| | MATH 113 | 3 | - | - | EE 134 | - | 4 | - | GER | - | - | 5 |
| | *Subtotals* | *3* | *7* | *1* | *Subtotals* | *0* | *15* | *0* | *Subtotals* | *0* | *10* | *5* |
| | Total | | | 11 | Total | | | 15 | Total | | | 15 |
| *Senior* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | EE 247 | - | 3 | - | EE 279 | - | 3 | - | GER | - | - | 5 |
| | EE 261 | - | 3 | - | MATH 131 | 3 | - | - | EE 278 | - | 3 | - |
| | GER | - | - | 5 | STS 110 | - | - | 5 | | | | |
| | *Subtotals* | *0* | *6* | *10* | *Subtotals* | *3* | *3* | *10* | *Subtotals* | *0* | *3* | *10* |
| | Total | | | 16 | Total | | | 16 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 46 |
| Total Engineering Units: | 68 |
| Total Other Units: | 67 |
| **Total Units:** | 181 |

# Electrical Engineering

*Signal Processing and Communications*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | PHYSICS 45 | 4 | - | - | Writing | - | - | 4 | ENGR 40 | - | 5 | - |
| | | | | | PHYSICS 41 | 4 | - | - | PHYSICS 43 | 4 | - | - |
| | *Subtotals* | *9* | *0* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *5* | *4* |
| | Total | | | 13 | Total | | | 17 | Total | | | 18 |
| *Sophomore* | EE 100 | - | - | 1 | EE 102A | - | 4 | - | EE 102B | - | 4 | - |
| | MATH 52 | 5 | - | - | EE 178 | 3 | - | - | EE 122A | - | 3 | - |
| | CS 106A | - | - | 5 | CS 106B | - | 5 | - | GER | - | - | 5 |
| | MATH 113 | 3 | - | - | Writing | - | - | 4 | MATH 53 | 5 | - | - |
| | *Subtotals* | *8* | *0* | *6* | *Subtotals* | *3* | *9* | *4* | *Subtotals* | *5* | *7* | *5* |
| | Total | | | 14 | Total | | | 16 | Total | | | 17 |
| *Junior* | EE 108A | - | 4 | - | EE 101A | - | 4 | - | EE 101B | - | 4 | - |
| | EE 141 | - | 3 | - | EE 108B | - | 4 | - | EE 278 | - | 3 | - |
| | ENGR 102E | - | - | 1 | EE 179 | - | 3 | - | GER | - | - | 5 |
| | EE 261 | - | 3 | - | GER | - | - | 5 | | | | |
| | GER | - | - | 5 | | | | | | | | |
| | *Subtotals* | *0* | *10* | *6* | *Subtotals* | *0* | *11* | *5* | *Subtotals* | *0* | *7* | *5* |
| | Total | | | 16 | Total | | | 16 | Total | | | 12 |
| *Senior* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | EE 265 | - | 3 | - | EE 133 | - | 3 | - | EE 276 | - | 3 | - |
| | EE 263 | - | 3 | - | EE 279 | - | 3 | - | ENGR 62 | - | 4 | - |
| | STS 110Q | - | - | 4 | ESYS 10 | 3 | - | - | | | | |
| | *Subtotals* | *0* | *6* | *9* | *Subtotals* | *3* | *6* | *5* | *Subtotals* | *0* | *7* | *5* |
| | Total | | | 15 | Total | | | 14 | Total | | | 12 |

| | |
|---|---|
| Total Math & Science Units: | 46 |
| Total Engineering Units: | 68 |
| Total Other Units: | 66 |
| **Total Units:** | 180 |

# Electrical Engineering

*Solid State and Photonic Devices*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Writing | - | - | 4 | PHYSICS 41 | 4 | - | - | ENGR 40 | - | 5 | - |
| | PHYSICS 45 | 4 | - | - | | | | | PHYSICS 43 | 4 | - | - |
| | PHYSICS 46 | 1 | - | - | | | | | | | | |
| | *Subtotals* | *10* | *0* | *8* | *Subtotals* | *9* | *0* | *4* | *Subtotals* | *9* | *5* | *4* |
| | Total | | | 18 | Total | | | 13 | Total | | | 18 |
| *Sophomore* | EE 100 | - | - | 1 | CS 106B | - | 5 | - | MATH 53 | 5 | - | - |
| | MATH 52 | 5 | - | - | STS 110 | - | - | 5 | EE 134 | - | 4 | - |
| | EE 141 | - | 3 | - | EE 136 | - | 3 | - | EE 101B | - | 4 | - |
| | CS 106A | - | - | 5 | EE 101A | - | 4 | - | | | | |
| | Writing | - | - | 4 | | | | | | | | |
| | *Subtotals* | *5* | *3* | *10* | *Subtotals* | *0* | *12* | *5* | *Subtotals* | *5* | *8* | *0* |
| | Total | | | 18 | Total | | | 17 | Total | | | 13 |
| *Junior* | GER | - | - | 5 | EE 102A | - | 4 | - | EE 102B | - | 4 | - |
| | EE 122A | - | 3 | - | MATH 113 | 3 | - | - | EE 116 | - | 3 | - |
| | EE 108A | - | 4 | - | EE 108B | - | 4 | - | STATS 116 | 5 | - | - |
| | MATH 131 | 3 | - | - | GER | - | - | 5 | GER | - | - | 5 |
| | | | | | ENGR 102E | - | - | 1 | | | | |
| | *Subtotals* | *3* | *7* | *5* | *Subtotals* | *3* | *8* | *6* | *Subtotals* | *5* | *7* | *5* |
| | Total | | | 15 | Total | | | 17 | Total | | | 17 |
| *Senior* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | EE 222 | - | 3 | - | EE 223 | - | 3 | - | EE 235 | - | 3 | - |
| | EE 228 | - | 3 | - | EE 216 | - | 3 | - | GER | - | - | 5 |
| | EE 268 | - | 3 | - | | | | | ENGR 50 | - | 4 | - |
| | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *0* | *6* | *5* | *Subtotals* | *0* | *7* | *10* |
| | Total | | | 14 | Total | | | 11 | Total | | | 17 |

| | |
|---|---|
| Total Math & Science Units: | 49 |
| Total Engineering Units: | 72 |
| Total Other Units: | 67 |
| **Total Units:** | 188 |

# INSTRUCTIONS FOR DECLARING MAJOR IN ELECTRICAL ENGINEERING

Declaring an EE major consists of the following steps:

1. Declare a major in EE on Axess. Note that you cannot declare Honors on Axess until an application has been filled out with signatures from your thesis adviser and a second reader, one of whom must be a member of the EE faculty, and the application has been submitted to the department along with the thesis proposal.
2. Fill out a copy of the Undergraduate Sign-Up Sheet, which can be found in the Packard lobby area. The "Specialty" is particularly important to assist in the choice of a faculty advisor. It can always be changed.
3. Meet with the Vice Chair in Packard 176. You can check on office hours by sending email to **vicechair@eemail.stanford.edu**. In the Vice Chair's absence, see the Director of Student and Academic Services in Packard 170. Make sure to bring your Undergraduate Sign-up Sheet, unofficial transcript, and academic file (which you should get from your previous advisor) to the meeting. The purpose of the meeting is to go over the basics in getting a BS in EE, and to assign an EE faculty adviser.
4. After the meeting, leave your academic file and Undergraduate Sign-up Sheet with the EE Student Services – Degree Progress Officer in Packard 177, who will certify your Axess declaration within a working day. This completes the formal declaration.
5. It is a good idea to subscribe to both the EE undergrad mailing list and the general EE student mailing list. To do this, go to the **http://mailman.stanford.edu** Website and follow the instructions for subscribing to the lists ee-students and ee-undergrad. These lists are used for announcements about seminars, research opportunities, and other events.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download an online EE program sheet from **ughb.stanford.edu** to ensure you are using an accurate major plan.

**Stanford University ♦ School of Engineering**

# Electrical Engineering - Required Courses
# 2009–2010 Program Sheet

**— ABET Acceditation Criteria Apply —**

***Completed and signed program sheet must be submitted to the department before the end of the quarter following the quarter in which the EE major is declared.***

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Mathematics* | | | | | | | | | | |
| MATH | 41 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 42 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 51 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 52 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 53 | Ordinary Differential Eq (req'd; see note 1) | | | | 5 | | | | |
| EE | 178 | Intro Probabilistic Sys Analysis (req'd; see note 1) | | | | 3 | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Mathematics Unit Total* | | | | | |
| *Science* | | | | | | | | | | |
| PHYS | 41 | Mechanics (req'd) | | | | 4 | | | | 0 |
| PHYS | 43 | Electricity and Magnetism (req'd) | | | | 4 | | | | 0 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Science Unit Total (12 units minimum)* | | | | | |
| | | | | | *Mathematics and Science Unit Total (45 units minimum)* | | | | | |

**Technology in Society Requirement** (1 course required; see UGHB Fig. 3-3 for SoE approved list)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |

**NOTES**

* Engineering Science, Engineering Design, and Experimentation units do not apply to shaded areas.

* This form is available as an Excel file at http://ughb.stanford.edu. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink. Delete courses not taken.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Combined GPA for all courses in Engineering Topics (Engr Science and Engr Design courses) is 2.0.

* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.

* All courses on this form must listed under only one category; no double-counting.

1 The CME math sequence (CME 100, 102, and 104 or 106) may be substitued for the MATH 51/52/53 sequence; CME 106, STAT 116 or MATH 151 may be substituted for EE178. Other substitutions require approval.

*program sheet continues on page 2*

# Electrical Engineering/General Program Sheet (continued)

**Engineering Topics** (Engr Science + Engr Design combined must equal 68 units. See note 2)

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Engineering Fundamentals (3 courses required)* | | | | | | | | | | |
| ENGR | 40 | Introductory Electronics (recomm'd) | | | | 5 | | 3 | 2 | 2 |
| ENGR | 70X | Prog Meth and Abst (CS106X) (req'd) | | | | 5 | | 4 | 1 | 0 |
| ENGR | | *Fundamentals Elective* | | | | | | | | |
| | | | | | *Engineering Fundamentals Unit Total* | | | | | |
| *Engineering Depth (Delete courses and units not taken)* | | | | | | | | | | |
| EE | 100 | Electrical Engineering Profession (req'd) | | | | 1 | | 0 | 0 | 0 |
| EE | 41 | Physics of Electrical Eng (req'd) (see note 3) | | | | 5 | | 3 | 2 | 2 |
| EE | 101A | Circuits I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 101B | Circuits II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 102A | Signal Processing and Linear Systems I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 102B | Signal Processing and Linear Systems II (req'd) | | | | 4 | | 4 | 0 | 1 |
| ENGR | 102E | Tech/Prof Writing (req'd) WIM (see note 4) | | | | 1 | | 0 | 0 | 0 |
| EE | 108A | Digital Systems I (req'd) WIM (see note 4) | | | | 4 | | 3 | 1 | 1 |
| EE | 108B | Digital Systems II (req'd) | | | | 4 | | 3 | 1 | 1 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Depth Unit Totals/Engr Science/Engr Design/Experiment* | | | | | |

**Program Totals (ABET Requirements)**

| | |
|---|---|
| *Mathematics and Science* *(45 units minimum)* | |
| *Engineering Topics (Engr Science + Engr Design)* *(68 units minimum)* | |
| *Experimentation* *(8 units minimum)* | |

## Program Approvals

*Advisor*

Printed Name: _____ Date: _____

Signature: _____

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

2 In order to satisfy ABET requirements for graduation, the EE major must take enough courses so that the combined Engineering Science and Design units from Fundamentals and Depth courses add up to a minimum of 68 units. Neither freshman/sophomore seminars, EE 100, ENGR 102E, nor CS 106A count toward the 68 units.

3 May take either EE 41 or EE 141.

4 Fulfills the "Writing in the Major" requirement. ENGR102E and EE108A must be taken concurrently.

**Stanford University ♦ School of Engineering**

# Electrical Engineering - Computer Hardware
# 2009–2010 Program Sheet

**— ABET Acceditation Criteria Apply —**

***Completed and signed program sheet must be submitted to the department before the end of the quarter following the quarter in which the EE major is declared.***

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Mathematics* | | | | | | | | | | |
| MATH | 41 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 42 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 51 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 52 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 53 | Ordinary Differential Eq (req'd; see note 1) | | | | 5 | | | | |
| STAT | 116 | Theory of Probability (req'd; see note 1) | | | | 5 | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Mathematics Unit Total* | | | | | |
| *Science* | | | | | | | | | | |
| PHYS | 41 | Mechanics (req'd) | | | | 4 | | | | 0 |
| PHYS | 43 | Electricity and Magnetism (req'd) | | | | 4 | | | | 0 |
| PHYS | 45 | Light and Heat (req'd) | | | | 4 | | | | 0 |
| CHEM | 31 | Chemical Principles | | | | 4 | | | | 0 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Science Unit Total (12 units minimum)* | | | | | |
| | | | | | *Mathematics and Science Unit Total (45 units minimum)* | | | | | |

**Technology in Society Requirement** (1 course required; see UGHB Fig. 3-3 for SoE approved list)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| COMM | 120 | Digital Media in Society | | | | 5 | | | | |

**NOTES**

- * Engineering Science, Engineering Design, and Experimentation units do not apply to shaded areas.
- * This form is available as an Excel file at http://ughb.stanford.edu. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink. Delete courses not taken.
- * All courses listed on this form must be taken for a letter grade if offered by the instructor.
- * Minimum Combined GPA for all courses in Engineering Topics (Engr Science and Engr Design courses) is 2.0.
- * Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.
- * All courses on this form must listed under only one category; no double-counting.

( 1 ) The CME math sequence (CME 100, 102, and 104 or 106) may be substitued for the MATH 51/52/53 sequence; CME 106, STAT 116 or MATH 151 may be substituted for EE178. Other substitutions require approval.

*program sheet continues on page 2*

# Electrical Engineering/Computer Hardware Program Sheet (continued)

**Engineering Topics** (Engr Science + Engr Design combined must equal 68 units. See note 2)

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Engineering Fundamentals (3 courses required)* | | | | | | | | | | |
| ENGR | 40 | Introductory Electronics (recomm'd) | | | | 5 | | 3 | 2 | 2 |
| ENGR | 70B/X | Prog Abst (CS106B or 106X) (req'd) | | | | 5 | | 4 | 1 | 0 |
| ENGR | 50 | Introductory Science of Materials | | | | 4 | | 4 | 0 | 0 |
| | | *Engineering Fundamentals Unit Total* | | | | | | | | |
| *Engineering Depth (Delete courses and units not taken)* | | | | | | | | | | |
| EE | 100 | Electrical Engineering Profession (req'd) | | | | 1 | | 0 | 0 | 0 |
| EE | 41 | Physics of Electrical Eng (req'd) (see note 3) | | | | 5 | | 3 | 2 | 2 |
| EE | 101A | Circuits I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 101B | Circuits II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 102A | Signal Processing and Linear Systems I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 102B | Signal Processing and Linear Systems II (req'd) | | | | 4 | | 4 | 0 | 1 |
| ENGR | 102E | Tech/Prof Writing (req'd) WIM (see note 4) | | | | 1 | | 0 | 0 | 0 |
| EE | 108A | Digital Systems I (req'd) WIM (see note 4) | | | | 4 | | 3 | 1 | 1 |
| EE | 108B | Digital Systems II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 122 | Analog Laboratory | | | | 3 | | 1 | 2 | 3 |
| CS | 107 | Computer Organization and Systems | | | | 5 | | 2 | 3 | 0 |
| EE | 109 | Digital Design Laboratory | | | | 4 | | 1 | 3 | 4 |
| EE | 212 | Integrated Circuit Fabrication Processes | | | | 3 | | 1 | 2 | 0 |
| EE | 271 | Introduction to VLSI | | | | 3 | | 1.5 | 1.5 | 0 |
| EE | 273 | Digital Systems Engineering | | | | 3 | | 2 | 1 | 0 |
| EE | 282 | Computer Architecture and Organization | | | | 3 | | 3 | 0 | 0 |
| EE | 313 | Digital MOS Integrated Circuits | | | | 3 | | 3 | 0 | 0 |
| | | | | | | | | | | |
| | | *Depth Unit Totals/Engr Science/Engr Design/Experiment* | | | | | | | | |

**Program Totals (ABET Requirements)**

| | |
|---|---|
| *Mathematics and Science* *(45 units minimum)* | |
| *Engineering Topics (Engr Science + Engr Design)* *(68 units minimum)* | |
| *Experimentation* *(8 units minimum)* | |

**Program Approvals**

*Advisor*
Printed Name: _____ Date: _____
Signature: _____

*Departmental*
Printed Name: _____ Date: _____
Signature: _____

*School of Engineering (signature not required prior to graduation)*
Printed Name: _____ Date: _____
Signature: _____

**NOTES (continued from page 1)**

( 2 ) In order to satisfy ABET requirements for graduation, the EE major must take enough courses so that the combined Engineering Science and Design units from Fundamentals and Depth courses add up to a minimum of 68 units. Neither freshman/sophomore seminars, EE 100, ENGR 102E, nor CS 106A count toward the 68 units.

( 3 ) May take either EE 41 or EE 141.

( 4 ) Fulfills the "Writing in the Major" requirement. ENGR102E and EE108A must be taken concurrently.

**Stanford University ♦ School of Engineering**

# Electrical Engineering - Computer Software

# 2009–2010 Program Sheet

**— ABET Acceditation Criteria Apply —**

***Completed and signed program sheet must be submitted to the department before the end of the quarter following the quarter in which the EE major is declared.***

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Mathematics* | | | | | | | | | | |
| MATH | 41 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 42 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 51 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 52 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 53 | Ordinary Differential Eqs (req'd; see note 1) | | | | 5 | | | | |
| STAT | 116 | Theory of Probability (req'd; see note 1) | | | | 5 | | | | |
| MATH | 113 | Linear Algebra and Matrix Theory | | | | 3 | | | | |
| | | | | | | | | | | |
| | | | | | *Mathematics Unit Total* | | | | | |
| *Science* | | | | | | | | | | |
| PHYS | 41 | Mechanics (req'd) | | | | 4 | | | | 0 |
| PHYS | 43 | Electricity and Magnetism (req'd) | | | | 4 | | | | 0 |
| PHYS | 45 | Light and Heat | | | | 4 | | | | 0 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Science Unit Total (12 units minimum)* | | | | | |
| | | | | | *Mathematics and Science Unit Total (45 units minimum)* | | | | | |

**Technology in Society Requirement** (1 course required; see UGHB Fig. 3-3 for SoE approved list)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STS | 110 | Ethics and Public Policy | | | | 5 | | | | |

**NOTES**

* Engineering Science, Engineering Design, and Experimentation units do not apply to shaded areas.
* This form is available as an Excel file at http://ughb.stanford.edu. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink. Delete courses not taken.
* All courses listed on this form must be taken for a letter grade if offered by the instructor.
* Minimum Combined GPA for all courses in Engineering Topics (Engr Science and Engr Design courses) is 2.0.
* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.
* All courses on this form must listed under only one category; no double-counting.

( 1 ) The CME math sequence (CME 100, 102, and 104 or 106) may be substitued for the MATH 51/52/53 sequence; CME 106, STAT 116 or MATH 151 may be substituted for EE178. Other substitutions require approval.

*program sheet continues on page 2*

## Electrical Engineering/Computer Software Program Sheet (continued)

**Engineering Topics** (Engr Science + Engr Design combined must equal 68 units. See note 2)

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Engineering Fundamentals (3 courses required)* | | | | | | | | | | |
| ENGR | 40 | Introductory Electronics (recomm'd) | | | | 5 | | 3 | 2 | 2 |
| ENGR | 70B/X | Prog Abst (CS106B or 106X) (req'd) | | | | 5 | | 4 | 1 | 0 |
| ENGR | 60 | Engineering Economy | | | | 3 | | 3 | 0 | 0 |
| | | *Engineering Fundamentals Unit Total* | | | | | | | | |
| *Engineering Depth (Delete courses and units not taken)* | | | | | | | | | | |
| EE | 12N | How Cyberspace Works | | | | 3 | | 3 | 0 | 0 |
| EE | 100 | Electrical Engineering Profession (req'd) | | | | 1 | | 0 | 0 | 0 |
| EE | 41 | Physics of Electrical Eng (req'd) (see note 3) | | | | 4 | | 4 | 0 | 0 |
| EE | 101A | Circuits I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 101B | Circuits II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 102A | Signal Processing and Linear Systems I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 102B | Signal Processing and Linear Systems II (req'd) | | | | 4 | | 4 | 0 | 1 |
| ENGR | 102E | Tech/Prof Writing (req'd) WIM (see note 4) | | | | 0 | | 0 | 0 | 0 |
| EE | 108A | Digital Systems I (req'd) WIM (see note 4) | | | | 4 | | 3 | 1 | 1 |
| EE | 108B | Digital Systems II (req'd) | | | | 4 | | 3 | 1 | 1 |
| CS | 107 | Computer Organization and Systems | | | | 5 | | 2 | 3 | 0 |
| CS | 108 | Object-Oriented Sys Design | | | | 4 | | 2 | 2 | 0 |
| CS | 140 | Operating Systems and Systems Progr | | | | 4 | | 4 | 0 | 0 |
| CS | 143 | Compilers | | | | 4 | | 3 | 1 | 0 |
| CS | 144 | Introduction to Computer Networks | | | | 4 | | 4 | 0 | 0 |
| CS | 145 | Introduction to Databases | | | | 4 | | 3 | 1 | 0 |
| CS | 148 | Introductory Computer Graphics | | | | 3 | | 2 | 1 | 0 |
| CS | 194 | Software Project Laboratory | | | | 3 | | 0 | 3 | 0 |
| EE | 261 | Fourier Transform and its Applications | | | | 3 | | 3 | 0 | 0 |
| CS | 255 | Introduction to Cryptography | | | | 3 | | 3 | 0 | 0 |
| EE | 282 | Computer Architecture and Organization | | | | 3 | | 3 | 0 | 0 |
| | | *Depth Unit Totals/Engr Science/Engr Design/Experiment* | | | | | | | | |

**Program Totals (ABET Requirements)**

| | |
|---|---|
| *Mathematics and Science* *(45 units minimum)* | |
| *Engineering Topics (Engr Science + Engr Design)* *(68 units minimum)* | |
| *Experimentation* *(8 units minimum)* | |

**Program Approvals**

*Advisor*

Printed Name: _____ Date: _____

Signature: _____

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 2 ) In order to satisfy ABET requirements for graduation, the EE major must take enough courses so that the combined Engineering Science and Design units from Fundamentals and Depth courses add up to a minimum of 68 units. Neither freshman/sophomore seminars, EE 100, ENGR 102E, nor CS 106A count toward the 68 units.

( 3 ) May take either EE 41 or EE 141.

( 4 ) Fulfills the "Writing in the Major" requirement. ENGR102E and EE108A must be taken concurrently.

**Stanford University ♦ School of Engineering**

# Electrical Engineering - Controls
# 2009–2010 Program Sheet

**— ABET Acceditation Criteria Apply —**

***Completed and signed program sheet must be submitted to the department before the end of the quarter following the quarter in which the EE major is declared.***

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Mathematics* | | | | | | | | | | |
| MATH | 41 | Calculus (req'd) | | | | 5 | | | | |
| MTH | 42 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 51 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 52 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 53 | Ordinary Differential Eqs (req'd; see note 1) | | | | 5 | | | | |
| EE | 178 | Intro Prob Sys Anal (req'd; see note 1) | | | | 3 | | | | |
| MATH | 113 | Linear Algebra and Matrix Theory | | | | 3 | | | | |
| MATH | 114 | Linear Algebra and Matrix Theory II | | | | 3 | | | | |
| | | | | | *Mathematics Unit Total* | | | | | |
| *Science* | | | | | | | | | | |
| PHYS | 41 | Mechanics (req'd) | | | | 4 | | | | 0 |
| PHYS | 43 | Electricity and Magnetism (req'd) | | | | 4 | | | | 0 |
| PHYS | 45 | Light and Heat | | | | 4 | | | | 0 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Science Unit Total (12 units minimum)* | | | | | |
| | | | | | *Mathematics and Science Unit Total (45 units minimum)* | | | | | |

**Technology in Society Requirement** (1 course required; see UGHB Fig. 3-3 for SoE approved list)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STS | 113 | Sci, Ethics, & Society: Debates & Controversies | | | | 5 | | | | |

**NOTES**

* Engineering Science, Engineering Design, and Experimentation units do not apply to shaded areas.
* This form is available as an Excel file at http://ughb.stanford.edu. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink. Delete courses not taken.
* All courses listed on this form must be taken for a letter grade if offered by the instructor.
* Minimum Combined Grade Point Average for all courses in Engineering Topics (Engineering Science and Engineering Design courses) is 2.0.
* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.
* All courses on this form must listed under only one category; no double-counting.

( 1 ) The CME math sequence (CME 100, 102, and 104 or 106) may be substitued for the MATH 51/52/53 sequence; CME 106, STAT 116 or MATH 151 may be substituted for EE178. Other substitutions require approval.

*program sheet continues on page 2*

## Electrical Engineering/Controls Program Sheet (continued)

**Engineering Topics** (Engr Science + Engr Design combined must equal 68 units. See note 2)

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Engineering Fundamentals (3 courses required)* | | | | | | | | | | |
| ENGR | 40 | Introductory Electronics (recomm'd) | | | | 5 | | 3 | 2 | 2 |
| ENGR | 70B/X | Prog Abst (CS106B or 106X) (reqd) | | | | 5 | | 4 | 1 | 0 |
| ENGR | 62 | Introduction to Optimization | | | | 4 | | 4 | 0 | 0 |
| | | *Engineering Fundamentals Unit Total* | | | | | | | | |
| *Engineering Depth (Delete courses and units not taken)* | | | | | | | | | | |
| EE | 100 | Electrical Engineering Profession (req'd) | | | | 1 | | 0 | 0 | 0 |
| EE | 41 | Physics of Electrical Eng (req'd) (see note 3) | | | | 5 | | 5 | 0 | 0 |
| EE | 101A | Circuits I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 101B | Circuits II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 102A | Singal Processing and Linear Systems I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 102B | Singal Processing and Linear Systems II (req'd) | | | | 4 | | 4 | 0 | 1 |
| ENGR | 102E | Tech/Prof Writing (req'd) WIM (see note 4) | | | | 1 | | 0 | 0 | 0 |
| EE | 108A | Digital Systems I (req'd) WIM (see note 4) | | | | 4 | | 3 | 1 | 1 |
| EE | 108B | Digital Systems II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 122 | Analog Laboratory | | | | 3 | | 1 | 2 | 3 |
| ENGR | 105 | Feedback Control Design | | | | 3 | | 1 | 2 | 0 |
| ENGR | 205 | Intro to Control Design Techniques | | | | 3 | | 3 | 0 | 0 |
| ENGR | 206 | Control System Design & Simul | | | | 4 | | 0 | 4 | 3 |
| ENGR | 209A | Nonlinear Control | | | | 3 | | 0 | 3 | 0 |
| EE | 263 | Intro to Linear Dynamical Systems | | | | 3 | | 3 | 0 | 0 |
| EE | 265 | Signal Processing Laboratory | | | | 3 | | 2.5 | 1.5 | 1 |
| EE | 278 | Intro to Statistical Signal Processing | | | | 3 | | 3 | 0 | 0 |
| | | *Depth Unit Totals/Engr Science/Engr Design/Experiment* | | | | | | | | |

**Program Totals (ABET Requirements)**

| | | |
|---|---|---|
| *Mathematics and Science* | *(45 units minimum)* | |
| *Engineering Topics (Engr Science + Engr Design)* | *(68 units minimum)* | |
| *Experimentation* | *(8 units minimum)* | |

### Program Approvals

*Advisor*
Printed Name: _____ Date: _____
Signature: _____

*Departmental*
Printed Name: _____ Date: _____
Signature: _____

*School of Engineering (signature not required prior to graduation)*
Printed Name: _____ Date: _____
Signature: _____

**NOTES (continued from page 1)**

( 2 ) In order to satisfy ABET requirements for graduation, the EE major must take enough courses so that the combined Engineering Science and Design units from Fundamentals and Depth courses add up to a minimum of 68 units. Neither freshman/sophomore seminars, EE 100, ENGR 102E, nor CS 106A count toward the 68 units.

( 3 ) May take either EE 41 or EE 141.

( 4 ) Fulfills the "Writing in the Major" requirement. ENGR102E and EE108A must be taken concurrently.

**Stanford University ♦ School of Engineering**

# Electrical Engineering - Circuits and Devices
# 2009–2010 Program Sheet

**— ABET Acceditation Criteria Apply —**

***Completed and signed program sheet must be submitted to the department before the end of the quarter following the quarter in which the EE major is declared.***

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Mathematics* | | | | | | | | | | |
| MATH | 41 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 42 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 51 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 52 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 53 | Ordinary Differential Eqs (req'd; see note 1) | | | | 5 | | | | |
| EE | 178 | Intro Probabilistic Sys Analysis (req'd; see note 1) | | | | 3 | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Mathematics Unit Total* | | | | | |
| *Science* | | | | | | | | | | |
| PHYS | 41 | Mechanics (req'd) | | | | 4 | | | | 0 |
| PHYS | 43 | Electricity and Magnetism (req'd) | | | | 4 | | | | 0 |
| PHYS | 45 | Light and Heat | | | | 4 | | | | 0 |
| PHYS | 46 | Light and Heat Lab | | | | 1 | | | | 1 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Science Unit Total (12 units minimum)* | | | | | |
| | | | | | *Mathematics and Science Unit Total (45 units minimum)* | | | | | |

**Technology in Society Requirement** (1 course required; see UGHB Fig. 3-3 for SoE approved list)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STS | 110 | Ethics and Public Policy | | | | 5 | | | | |

**NOTES**

* Engineering Science, Engineering Design, and Experimentation units do not apply to shaded areas.
* This form is available as an Excel file at http://ughb.stanford.edu. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink. Delete courses not taken.
* All courses listed on this form must be taken for a letter grade if offered by the instructor.
* Minimum Combined GPA for all courses in Engineering Topics (Engr Science and Engr Design courses) is 2.0.
* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.
* All courses on this form must listed under only one category; no double-counting.

( 1 ) The CME math sequence (CME 100, 102, and 104 or 106) may be substitued for the MATH 51/52/53 sequence; CME 106, STAT 116 or MATH 151 may be substituted for EE178. Other substitutions require approval.

*program sheet continues on page 2*

## Electrical Engineering/Circuits Program Sheet (continued)

**Engineering Topics** (Engr Science + Engr Design combined must equal 68 units. See note 2)

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Engineering Fundamentals (3 courses required)* | | | | | | | | | | |
| ENGR | 40 | Introductory Electronics (recomm'd) | | | | 5 | | 3 | 2 | 2 |
| ENGR | 70B/X | Prog Abst (CS106B or 106X) (req'd) | | | | 5 | | 4 | 1 | 0 |
| ENGR | 50 | Introductory Science of Materials | | | | 4 | | 4 | 0 | 0 |
| | | *Engineering Fundamentals Unit Total* | | | | | | | | |
| *Engineering Depth (Delete courses and units not taken)* | | | | | | | | | | |
| EE | 100 | Electrical Engineering Profession (req'd) | | | | 1 | | 0 | 0 | 0 |
| EE | 41 | Physics of Electrical Eng (req'd) (see note 3) | | | | 5 | | 3 | 2 | 2 |
| EE | 101A | Circuits I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 101B | Circuits II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 102A | Signal Processing and Linear Systems I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 102B | Signal Processing and Linear Systems II (req'd) | | | | 4 | | 4 | 0 | 1 |
| ENGR | 102E | Tech/Prof Writing (req'd) WIM (see note 4) | | | | 1 | | 0 | 0 | 0 |
| EE | 108A | Digital Systems I (req'd) WIM (see note 4) | | | | 4 | | 3 | 1 | 1 |
| EE | 108B | Digital Systems II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 114 | Fundamentals Analog Integrated Circuits Design | | | | 3 | | 0 | 3 | 0 |
| EE | 122 | Analog Laboratory | | | | 3 | | 1 | 2 | 3 |
| EE | 116 | Semiconductor Device Physics | | | | 3 | | 3 | 0 | 0 |
| EE | 133 | Analog Communication Design Lab | | | | 3 | | 0 | 3 | 2 |
| EE | 212 | Integrated Circuit Fabrication Processes | | | | 3 | | 2 | 1 | 0 |
| EE | 214 | Advanced Analog Integrated Circuits Design | | | | 3 | | 0 | 3 | 0 |
| EE | 216 | Princples and Models of Semic. Devices | | | | 3 | | 3 | 0 | 0 |
| EE | 222 | Applied Quantum Mechanics I | | | | 3 | | 3 | 0 | 0 |
| EE | 223 | Applied Quantum Mechanics II | | | | 3 | | 3 | 0 | 0 |
| EE | 271 | Intro to VLSI Systems | | | | 3 | | 1.5 | 1.5 | 0 |
| | | *Depth Unit Totals/Engr Science/Engr Design/Experiment* | | | | | | | | |

**Program Totals (ABET Requirements)**

*Mathematics and Science* *(45 units minimum)*

*Engineering Topics (Engr Science + Engr Design)* *(68 units minimum)*

*Experimentation* *(8 units minimum)*

### Program Approvals

*Advisor*

Printed Name: _____ Date: _____

Signature: _____

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 2 ) In order to satisfy ABET requirements for graduation, the EE major must take enough courses so that the combined Engineering Science and Design units from Fundamentals and Depth courses add up to a minimum of 68 units. Neither freshman/sophomore seminars, EE 100, ENGR 102E, nor CS 106A count toward the 68 units.

( 3 ) May take either EE 41 or EE 141.

( 4 ) Fulfills the "Writing in the Major" requirement. ENGR102E and EE108A must be taken concurrently.

**Stanford University ♦ School of Engineering**

# Electrical Engineering - Fields and Waves
# 2009–2010 Program Sheet

**— ABET Acceditation Criteria Apply —**

***Completed and signed program sheet must be submitted to the department before the end of the quarter following the quarter in which the EE major is declared.***

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Mathematics* | | | | | | | | | | |
| MATH | 41 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 42 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 51 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 52 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 53 | Ordinary Differential Eqs (req'd; see note 1) | | | | 5 | | | | |
| EE | 178 | Intro Prob Sys Anal (req'd; see note 1) | | | | 3 | | | | |
| MATH | 113 | Linear Algebra and Matrix Theory | | | | 3 | | | | |
| MATH | 131 | Partial Differential Equations I | | | | 3 | | | | |
| | | | | | *Mathematics Unit Total* | | | | | |
| *Science* | | | | | | | | | | |
| PHYS | 41 | Mechanics (req'd) | | | | 4 | | | | 0 |
| PHYS | 43 | Electricity and Magnetism (req'd) | | | | 4 | | | | 0 |
| PHYS | 45 | Light and Heat | | | | 4 | | | | 0 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Science Unit Total (12 units minimum)* | | | | | |
| | | | | | *Mathematics and Science Unit Total (45 units minimum)* | | | | | |

**Technology in Society Requirement** (1 course required; see UGHB Fig. 3-3 for SoE approved list)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STS | 110 | Ethics and Public Policy | | | | 5 | | | | |

**NOTES**

- * Engineering Science, Engineering Design, and Experimentation units do not apply to shaded areas.
- * This form is available as an Excel file at http://ughb.stanford.edu. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink. Delete courses not taken.
- * All courses listed on this form must be taken for a letter grade if offered by the instructor.
- * Minimum Combined GPA for all courses in Engineering Topics (Engr Science and Engr Design courses) is 2.0.
- * Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.
- * All courses on this form must listed under only one category; no double-counting.
- ( 1 ) The CME math sequence (CME 100, 102, and 104 or 106) may be substitued for the MATH 51/52/53 sequence; CME 106, STAT 116 or MATH 151 may be substituted for EE178. Other substitutions require approval.

*program sheet continues on page 2*

## Electrical Engineering/Fields and Waves Program Sheet (continued)

**Engineering Topics** (Engr Science + Engr Designcombined must equal 68 units. See note 2)

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Engineering Fundamentals (3 courses required)* | | | | | | | | | | |
| ENGR | 40 | Introductory Electronics (recomm'd) | | | | 5 | | 3 | 2 | 2 |
| ENGR | 70B/X | Prog Abst (CS106B or 106X) (req'd) | | | | 5 | | 4 | 1 | 0 |
| ENGR | 14 | Applied Mechanics | | | | 3 | | 2 | 1 | 0 |
| | | *Engineering Fundamentals Unit Total* | | | | | | | | |
| *Engineering Depth (Delete courses and units not taken)* | | | | | | | | | | |
| EE | 100 | Electrical Engineering Profession (req'd) | | | | 1 | | 0 | 0 | 0 |
| EE | 141 | Eng Electromagnetics (req'd) (see note 3) | | | | 3 | | 3 | 0 | 0 |
| EE | 101A | Circuits I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 101B | Circuits II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 102A | Signal Processing and Linear Systems I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 102B | Signal Processing and Linear Systems II (req'd) | | | | 4 | | 4 | 0 | 1 |
| ENGR | 102E | Tech/Prof Writing (req'd) WIM (see note 4) | | | | 1 | | 0 | 0 | 0 |
| EE | 108A | Digital Systems I (req'd) WIM (see note 4) | | | | 4 | | 3 | 1 | 1 |
| EE | 108B | Digital Systems II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 122 | Analog Laboratory | | | | 3 | | 1 | 2 | 3 |
| EE | 134 | Into. to Photonics | | | | 4 | | 2 | 2 | 2 |
| EE | 179 | Introduction to Communication | | | | 3 | | 3 | 0 | 0 |
| EE | 242 | Electromagnetic Waves | | | | 3 | | 2.5 | 0.5 | 0 |
| EE | 247 | Intro to Optical Fiber Comm | | | | 3 | | 2 | 1 | 0 |
| EE | 252 | Antennas for Telecom. and Remote Sensing | | | | 3 | | 2 | 1 | 0 |
| EE | 261 | Fourier Transform and Applications | | | | 3 | | 3 | 0 | 0 |
| EE | 278 | Intro to Statistical Signal Processing | | | | 3 | | 3 | 0 | 0 |
| EE | 279 | Intro to Communication Systems | | | | 3 | | 3 | 0 | 0 |
| | | *Depth Unit Totals/Engr Science/Engr Design/Experiment* | | | | | | | | |

**Program Totals (ABET Requirements)**

| | |
|---|---|
| *Mathematics and Science* *(45 units minimum)* | |
| *Engineering Topics (Engr Science + Engr Design)* *(68 units minimum)* | |
| *Experimentation* *(8 units minimum)* | |

### Program Approvals

*Advisor*

Printed Name: _____ Date: _____

Signature: _____

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 2 ) In order to satisfy ABET requirements for graduation, the EE major must take enough courses so that the combined Engineering Science and Design units from Fundamentals and Depth courses add up to a minimum of 68 units. Neither freshman/sophomore seminars, EE 100, ENGR 102E, nor CS 106A count toward the 68 units.

( 3 ) May take either EE 41 or EE 141.

( 4 ) Fulfills the "Writing in the Major" requirement. ENGR102E and EE108A must be taken concurrently.

**Stanford University ♦ School of Engineering**

# Electrical Engineering - Signal Processing
# 2009–2010 Program Sheet

**— ABET Acceditation Criteria Apply —**

***Completed and signed program sheet must be submitted to the department before the end of the quarter following the quarter in which the EE major is declared.***
***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____
Email: _____ Local Phone: _____
Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Mathematics* | | | | | | | | | | |
| MATH | 41 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 42 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 51 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 52 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 53 | Ordinary Differential Eqs (req'd; see note 1) | | | | 5 | | | | |
| EE | 178 | Intro Probabilistic Sys Analysis (req'd; see note 1) | | | | 3 | | | | |
| MATH | 113 | Linear Algebra and Matrix Theory | | | | 3 | | | | |
| | | | | | | | | | | |
| | | | | | *Mathematics Unit Total* | | | | | |
| *Science* | | | | | | | | | | |
| PHYS | 41 | Mechanics (req'd) | | | | 4 | | | | 0 |
| PHYS | 43 | Electricity and Magnetism (req'd) | | | | 4 | | | | 0 |
| PHYS | 45 | Light and Heat | | | | 4 | | | | 0 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Science Unit Total (12 units minimum)* | | | | | |
| | | | | | *Mathematics and Science Unit Total* | | *(45 units minimum)* | | | |

**Technology in Society Requirement** (1 course required; see UGHB Fig. 3-3 for SoE approved list)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STS | 101 | Sci., Tech., and Contemporary Society | | | | 4 | | | | |

**NOTES**

* Engineering Science, Engineering Design, and Experimentation units do not apply to shaded areas.
* This form is available as an Excel file at http://ughb.stanford.edu. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink. Delete courses not taken.
* All courses listed on this form must be taken for a letter grade if offered by the instructor.
* Minimum Combined GPA for all courses in Engineering Topics (Engr Science and Engr Design courses) is 2.0.
* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.
* All courses on this form must listed under only one category; no double-counting.

( 1 ) The CME math sequence (CME 100, 102, and 104 or 106) may be substitued for the MATH 51/52/53 sequence; CME 106, STAT 116 or MATH 151 may be substituted for EE178. Other substitutions require approval.

*program sheet continues on page 2*

## Electrical Engineering/Signal Processing Program Sheet (continued)

**Engineering Topics** (Engr Science + Engr Design combined must equal 68 units. See note 2)

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Engineering Fundamentals (3 courses required)* | | | | | | | | | | |
| ENGR | 40 | Introductory Electronics (recomm'd) | | | | 5 | | 3 | 2 | 2 |
| ENGR | 70B/X | Prog Abst (CS106B or 106X) (req'd) | | | | 5 | | 4 | 1 | 0 |
| ENGR | 62 | Introduction to Optimization | | | | 4 | | 4 | 0 | 0 |
| | | *Engineering Fundamentals Unit Total* | | | | | | | | |
| *Engineering Depth (Delete courses and units not taken)* | | | | | | | | | | |
| EE | 100 | Electrical Engineering Profession (req'd) | | | | 1 | | 0 | 0 | 0 |
| EE | 141 | Eng Electromagnetics (req'd) (see note 3) | | | | 3 | | 3 | 0 | 0 |
| EE | 101A | Circuits I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 101B | Circuits II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 102A | Signal Processing and Linear Systems I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 102B | Signal Processing and Linear Systems II (req'd) | | | | 4 | | 4 | 0 | 1 |
| ENGR | 102E | Tech/Prof Writing (req'd) WIM (see note 4) | | | | 1 | | 0 | 0 | 0 |
| EE | 108A | Digital Systems I (req'd) WIM (see note 4) | | | | 4 | | 3 | 1 | 1 |
| EE | 108B | Digital Systems II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 122A | Analog Circuit Laboratory | | | | 3 | | 1 | 2 | 3 |
| EE | 124 | Intro to Neuroelectrical Engineering | | | | 3 | | 2 | 1 | 0 |
| EE | 133 | Analog Communications Laboratory | | | | 4 | | 0 | 4 | 2 |
| EE | 179 | Introduction to Communication | | | | 3 | | 3 | 0 | 0 |
| EE | 261 | Fourier Transforms | | | | 3 | | 3 | 0 | 0 |
| EE | 263 | Intro. To Linear Dynamical Systems | | | | 3 | | 3 | 0 | 0 |
| EE | 265 | Signal Processing Laboratory | | | | 3 | | 2 | 1 | 3 |
| EE | 276 | Intro to Wireless Personal Comm | | | | 3 | | 3 | 0 | 0 |
| EE | 278 | Intro to Statistical Signal Processing | | | | 3 | | 3 | 0 | 0 |
| EE | 279 | Intro to Communication Systems | | | | 3 | | 3 | 0 | 0 |
| | | *Depth Unit Totals/Engr Science/Engr Design/Experiment* | | | | | | | | |

**Program Totals (ABET Requirements)**

| | |
|---|---|
| *Mathematics and Science* *(45 units minimum)* | |
| *Engineering Topics (Engr Science + Engr Design)* *(68 units minimum)* | |
| *Experimentation* *(8 units minimum)* | |

### Program Approvals

*Advisor*
Printed Name: _____ Date: _____
Signature: _____

*Departmental*
Printed Name: _____ Date: _____
Signature: _____

*School of Engineering (signature not required prior to graduation)*
Printed Name: _____ Date: _____
Signature: _____

**NOTES (continued from page 1)**

( 2 ) In order to satisfy ABET requirements for graduation, the EE major must take enough courses so that the combined Engineering Science and Design units from Fundamentals and Depth courses add up to a minimum of 68 units. Neither freshman/sophomore seminars, EE 100, ENGR 102E, nor CS 106A count toward the 68 units.

( 3 ) May take either EE 41 or EE 141.

( 4 ) Fulfills the "Writing in the Major" requirement. ENGR102E and EE108A must be taken concurrently.

**Stanford University ♦ School of Engineering**

# Electrical Engineering – Solid State and Photonic Devices
# 2009–2010 Program Sheet

**— ABET Acceditation Criteria Apply —**

***Completed and signed program sheet must be submitted to the department before the end of the quarter following the quarter in which the EE major is declared.***

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit Total | Grade | ABET Units Engr Sci | Engr Des | Experiment |
|---|---|---|---|---|---|---|---|---|---|---|
| *Mathematics* | | | | | | | | | | |
| MATH | 41 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 42 | Calculus (req'd) | | | | 5 | | | | |
| MATH | 51 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 52 | Calculus (req'd; see note 1) | | | | 5 | | | | |
| MATH | 53 | Ordinary Differential Eqs (req'd; see note 1) | | | | 5 | | | | |
| EE | 178 | Intro Prob Sys Anal (req'd; see note 1) | | | | 3 | | | | |
| MATH | 113 | Linear Algebra and Matrix Theory | | | | 3 | | | | |
| MATH | 131 | Partial Differential Equations I | | | | 3 | | | | |
| | | *Mathematics Unit Total* | | | | | | | | |
| *Science* | | | | | | | | | | |
| PHYS | 41 | Mechanics (req'd) | | | | 4 | | | | 0 |
| PHYS | 43 | Electricity and Magnetism (req'd) | | | | 4 | | | | 0 |
| PHYS | 45 | Light and Heat | | | | 4 | | | | 0 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | *Science Unit Total (12 units minimum)* | | | | | | | | |
| | | *Mathematics and Science Unit Total (45 units minimum)* | | | | | | | | |

**Technology in Society Requirement** (1 course required; see UGHB Fig. 3-3 for SoE approved list)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| STS | 110 | Ethics and Public Policy | | | | 5 | | | | |

**NOTES**

- * Engineering Science, Engineering Design, and Experimentation units do not apply to shaded areas.
- * This form is available as an Excel file at http://ughb.stanford.edu. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink. Delete courses not taken.
- * All courses listed on this form must be taken for a letter grade if offered by the instructor.
- * Minimum Combined GPA for all courses in Engineering Topics (Engr Science and Engr Design courses) is 2.0.
- * Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu.
- * All courses on this form must listed under only one category; no double-counting.

( 1 ) The CME math sequence (CME 100, 102, and 104 or 106) may be substitued for the MATH 51/52/53 sequence; CME 106, STAT 116 or MATH 151 may be substituted for EE178. Other substitutions require approval.

*program sheet continues on page 2*

## Electrical Engineering/Solid State and Photonic Devices Program Sheet (continued)

**Engineering Topics** (Engr Science + Engr Design combined must equal 68 units. See note 2)

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Engineering Fundamentals (3 courses required)* | | | | | | | | | | |
| ENGR | 40 | Introductory Electronics (recomm'd) | | | | 5 | | 3 | 2 | 2 |
| ENGR | 70B/X | Prog Abst (CS106B or 106X) (req'd) | | | | 5 | | 4 | 1 | 0 |
| ENGR | 14 | Applied Mechanics | | | | 3 | | 2 | 1 | 0 |
| | | *Engineering Fundamentals Unit Total* | | | | | | | | |
| *Engineering Depth (Delete courses and units not taken)* | | | | | | | | | | |
| EE | 41 | Physics of Electrical Engr (req'd) (see note 3) | | | | 4 | | 4 | 0 | 0 |
| EE | 100 | Electrical Engineering Profession (req'd) | | | | 1 | | 0 | 0 | 0 |
| EE | 101A | Circuits I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 101B | Circuits II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 102A | Signal Processing and Linear Sys I (req'd) | | | | 4 | | 4 | 0 | 1 |
| EE | 102B | Signal Processing and Linear Sys II (req'd) | | | | 4 | | 4 | 0 | 1 |
| ENGR | 102E | Tech/Prof Writing (req'd) WIM (see note 4) | | | | 1 | | 0 | 0 | 0 |
| EE | 108A | Digital Systems I (req'd) WIM (see note 4) | | | | 4 | | 3 | 1 | 1 |
| EE | 108B | Digital Systems II (req'd) | | | | 4 | | 3 | 1 | 1 |
| EE | 122 | Analog Laboratory | | | | 3 | | 1 | 2 | 3 |
| EE | 235 | Guide Wave Optical Devices | | | | 3 | | 3 | 0 | 0 |
| EE | 134 | Intro. to Photonics | | | | 4 | | 2 | 2 | 4 |
| EE | 141 | Engineering Electromagnetics | | | | 3 | | 3 | 0 | 0 |
| EE | 242 | Electromagnetic Waves | | | | 3 | | 2.5 | 0.5 | 0 |
| EE | 116 | Semiconductor Device Physics | | | | 3 | | 3 | 0 | 0 |
| EE | 216 | Princ and Models of Semiconductor Physics | | | | 3 | | 3 | 0 | 0 |
| EE | 222 | Applied Quantum Mechanics | | | | 3 | | 3 | 0 | 0 |
| EE | 223 | Applied Quantum Mechanics | | | | 3 | | 3 | 0 | 0 |
| EE | 228 | Basic Physics for Solid State Devices | | | | 3 | | 3 | 0 | 0 |
| | | *Depth Unit Totals/Engr Science/Engr Design/Experiment* | | | | | | | | |

**Program Totals (ABET Requirements)**

| | | |
|---|---|---|
| *Mathematics and Science* | *(45 units minimum)* | |
| *Engineering Topics (Engr Science + Engr Design)* | *(68 units minimum)* | |
| *Experimentation* | *(8 units minimum)* | |

**Program Approvals**

*Advisor*

Printed Name: _____ Date: _____

Signature: _____

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 2 ) In order to satisfy ABET requirements for graduation, the EE major must take enough courses so that the combined Engineering Science and Design units from Fundamentals and Depth courses add up to a minimum of 68 units. Neither freshman/sophomore seminars, EE 100, ENGR 102E, nor CS 106A count toward the 68 units.

( 3 ) May take either EE 41 or EE 141.

( 4 ) Fulfills the "Writing in the Major" requirement. ENGR102E and EE108A must be taken concurrently.

# ENGINEERING PHYSICS

The Engineering Physics program is designed for students who have an interest in and an aptitude for both engineering and physics. The program provides students with a firm foundation in physics and mathematics, together with engineering design and problem-solving skills. This background prepares students to tackle complex problems in multidisciplinary areas that are at the forefront of 21st-century technology, such as solid state devices, quantum optics and photonics, materials science, nanotechnology, electromechanical systems, energy systems, and any engineering field that requires a very solid background in physics. Because the program emphasizes science, mathematics and engineering, students are well prepared to pursue graduate work in either engineering or physics.

Engineering Physics majors may participate in on-campus summer research programs in engineering, physics, or applied physics. To conduct research with a faculty member in the School of Engineering, students apply to the summer research program for the department of the faculty mentor. To conduct research with a faculty member in the Physics or Applied Physics Departments, students apply through the Physics, Applied Physics and SLAC program at
**http://www.stanford.edu/dept/physics/academics/summer/SummerResearch.htm**

## REQUIREMENTS

**Math and Science Requirements:** Includes the following required courses:

**Math:** MATH 51 and 52 or CME 100 and 104, MATH 53 or CME 102, MATH 131.
Plus one advanced math elective such as EE 261, PHYSICS 112, or CME 106. Also qualified are EE 263, any Math or Statistics course numbered 100 or above, and any CME course numbered 200 or above, except CME 206.

**Science:** PHYSICS (41, 43, 44, 45, 46, 70) or (61, 63, 64, 65, 67)

**Technology in Society**: One 3-5 unit approved course required; see Figure 3-3 for SoE approved course list.

**Engineering Fundamentals and Depth:**

At least 50 of the units in Engineering Fundamentals, Required Depth Classes and Required Depth Electives must be engineering units.

**Engineering Fundamentals:**

Three courses from approved list; see Figure 3-4.
A course in computer science, such as CS106B or X, is recommended.

**Engineering Physics Depth - Core Courses Required in All Specialty Areas:**

| | |
|---|---|
| Intermediate Mechanics | ENGR 15 or PHYSICS 110 |
| Intermediate Electricity and Magnetism | EE (141 and 242) or PHYSICS (120 and 121) |
| Numerical Methods | AP 215 or CME 108 or CME 206/ME 300C or PHYSICS 113 |
| Electronics Laboratory | ENGR 40 or EE 101B or EE 122A or PHYSICS 105 or APPPHYS 207 |
| Writing Laboratory (WIM) | EE108A and ENGR 102E or ME 203 and ENGR 102M or MATSCI 161 or MATSCI 164 or PHYSICS 107 |
| Quantum Mechanics | EE 222 and 223 or PHYSICS 130 and 131 |
| Thermodynamics, Kinetics, & Statistical Mech | PHYSICS 170 and 171, or ME 346A. |

**Design Course:**

At least one of the following design-project courses must be included in each program:
CS 108, EE 133, ME 203, ME 210 or EE 118, PHYSICS 108.
If ME 203 is used to satisfy both the Writing Laboratory and the Design Course requirements, then the combination of ME 203, ME 103D and ENGR 102M should be taken.

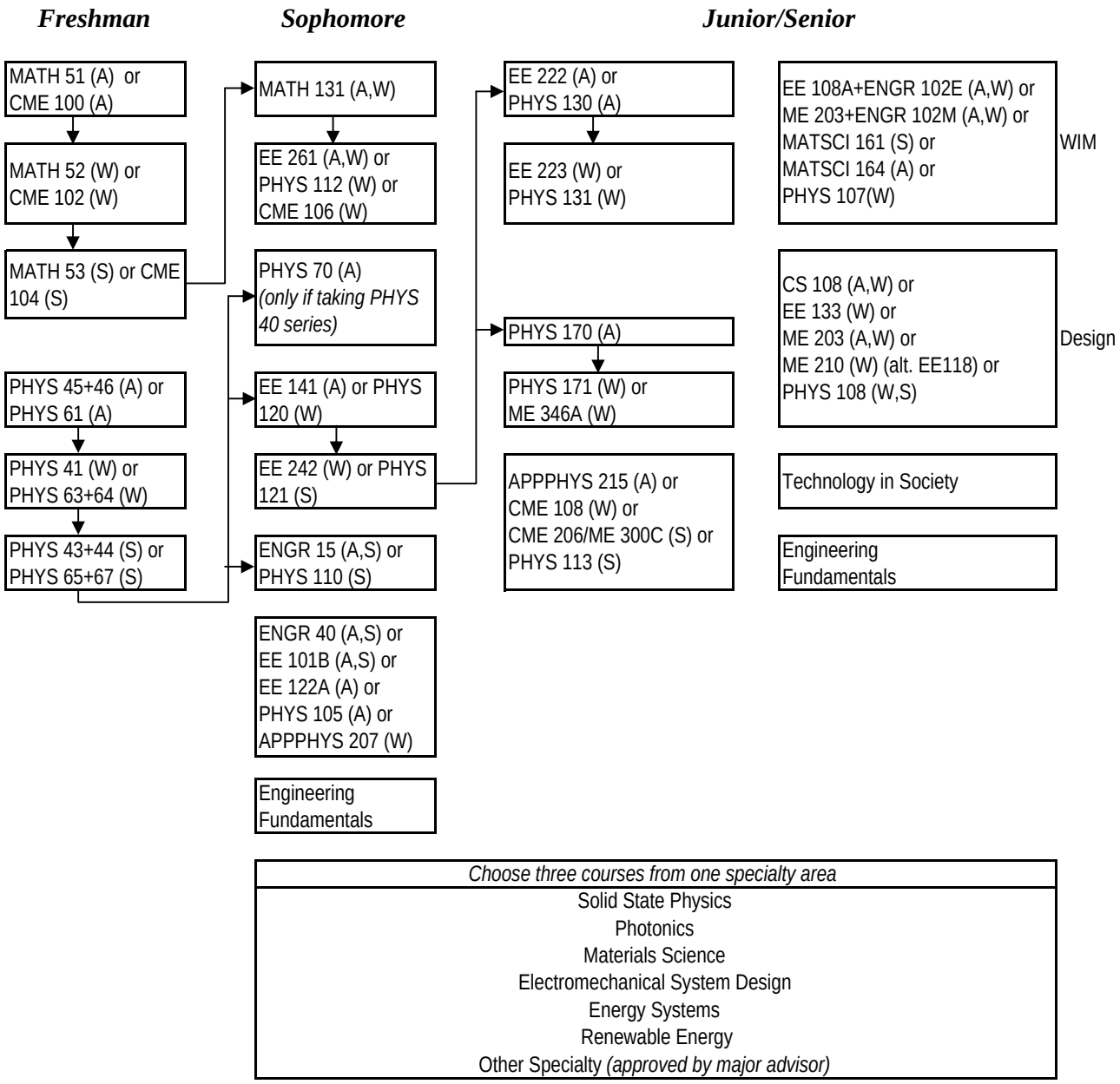
**Three Courses from one of the following Specialty Areas:**

1. In the Solid State Physics specialty, students have the opportunity to learn about the macroscopic physical properties of solids, including electrical, magnetic and optical properties, superconductivity, and heat transfer in solids. Students learn how these properties can be manipulated and applied in electronic devices. Choose from APPPHYS 272, APPHYS 273, EE 116, EE 216, MATSCI 199, PHYSICS 172.

2. The Photonics specialty provides the opportunity for students to learn about the emission, transmission, amplification, detection, modulation and switching of optical and infrared light. Students can apply this knowledge to optoelectronic devices such as lasers, photodetectors, waveguides and photonic crystals, or to quantum information science, with applications in quantum communication and quantum computing. Choose from EE 216, EE 231, EE232, EE234, EE 243, EE 268, MATSCI 199. PHYSICS 107 recommended as WIM course.
3. In the Materials Science specialty, students learn how to design and synthesize materials with particular structures at the nanometer and micrometer scale that provide special electrical, optical, magnetic or mechanical properties. Students can learn how to use these materials to make integrated circuits, light-emitting diodes, solar cells, fuel cells, microelectromechanical systems and other advanced devices. Choose three from any MATSCI courses numbered 151 to 199 (except 159Q) or PHYSICS 172. In addition, ENGR 31 or CHEM 31highly recommended.
4. The Electromechanical System Design specialty provides the opportunity for students to explore the process of design, analysis, and realization of modern electromechanical systems including "smart products" with embedded sensing and actuation. Take ME 80, ME 112, and ME 210 or EE 118. Take ME 203 and ENGR 102M as WIM Course. ME 101 and ME 103D also recommended.
5. The Energy Systems specialty provides the opportunity for students to explore how energy is manipulated in both device applications and for modern energy conversion systems including electrical power, transportation, and propulsion. Take: ME 131A, ME 131B, ME 140. Take ME 203 and ENGR 102M as WIM and/or Design Course. ME 103D and ME 70 also recommended.
6. In the Renewable Energy specialty, students explore energy conversion and storage technologies that are relevant in renewable energy systems, such as solar cells, wind turbines, batteries, fuel cells, and hydrogen production and storage. Choose from EE 293A, EE 293B, MATSCI 156, MATSCI 302, MATSCI 316, ME 260.
7. Other Specialty: With approval of advisor, a set of three courses in one area of concentration (e.g., astrophysics and astronautics; quantum information; biophysics).

# Engineering Physics

*Typical Sequence of Courses*



# Engineering Physics

*Electromechanical System Design Specialty Area*

| | *Fall* | | | *Winter* | | | *Spring* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/Sci | Engr | Class | Math/Sci | Engr | Class | Math/Sci | Engr |
| *Freshman* | CME 100 | 5 | | CME 102 | 5 | | CME 104 | 5 | |
| | PHYS 45/46 | 5 | | PHYS 41 | 4 | | PHYS 43/44 | 5 | |
| | *Subtotals* | *10* | *0* | *Subtotals* | *9* | *0* | *Subtotals* | *10* | *0* |
| | Total | | 10 | Total | | 9 | Total | | 10 |
| *Sophomore* | MATH 131P | 3 | | PHYS 112 | 4 | | ENGR 40 | | 3 |
| | PHYS 70 | 4 | | | | | PHYS 110 | 4 | |
| | EE141 | | 4 | EE242 | | 3 | ME 80 (Depth) | | 4 |
| | *Subtotals* | *7* | *4* | *Subtotals* | *4* | *3* | *Subtotals* | *4* | *7* |
| | Total | | 11 | Total | | 7 | Total | | 11 |
| *Junior* | ME 101 | | 3 | ME 112 (Depth) | | 4 | PHYS 113 | 4 | |
| | CS 106B or X | | 5 | ME 203 (Des/WIM) | | 3 | | | |
| | | | | ME 103D | | 1 | | | |
| | | | | E 102M (WIM) | | 1 | | | |
| | *Subtotals* | *0* | *8* | *Subtotals* | *0* | *9* | *Subtotals* | *4* | *0* |
| | Total | | 8 | Total | | 9 | Total | | 4 |
| *Senior* | EE 222 | | 3 | EE 223 | | 3 | Engr Course | | 3 |
| | PHYS 170 | 4 | | PHYS 171 | 4 | | Engr Course | | 3 |
| | | | | ME 210 (Depth) | | 4 | | | |
| | *Subtotals* | *4* | *3* | *Subtotals* | *4* | *7* | *Subtotals* | *0* | *6* |
| | Total | | 7 | Total | | 11 | Total | | 6 |

| | |
|---|---|
| *Total Math/Sci Units:* | 56 |
| *Engineering Units:* | 47 |
| *Third Engr Fund* | 3 (in addition to ENGR 40 and CS 106 already listed above) |
| *Total Engr:* | 50 |
| Total Math/Sci/Engr: | 106 |

* In the Freshman year, students can take the Math 50 series rather than the CME 100 series. If a student has a solid background in math and physics from high school, they can take the Physics 60 series rather than the Physics 40 series, in which case they do not take Phys70 in the Sophomore year.

# Engineering Physics

*Energy Systems Specialty Area*

| | *Fall* | | | *Winter* | | | *Spring* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/Sci | Engr | Class | Math/Sci | Engr | Class | Math/Sci | Engr |
| *Freshman* | CME 100 | 5 | | CME 102 | 5 | | CME 104 | 5 | |
| | PHYS 45/46 | 5 | | PHYS 41 | 4 | | PHYS 43/44 | 5 | |
| | *Subtotals* | *10* | *0* | *Subtotals* | *9* | *0* | *Subtotals* | *10* | *0* |
| | Total | | 10 | Total | | 9 | Total | | 10 |
| *Sophomore* | MATH 131P | 3 | | PHYS 112 | 4 | | ENGR 40 | | 3 |
| | PHYS 70 | 4 | | | | | PHYS 110 | 4 | |
| | EE 141 | | 4 | EE 242 | | 3 | ME 70 | | 3 |
| | *Subtotals* | *7* | *4* | *Subtotals* | *4* | *3* | *Subtotals* | *4* | *6* |
| | Total | | 11 | Total | | 7 | Total | | 10 |
| *Junior* | ME 101 | | 3 | ME 131B (Depth) | | 4 | ME 140 (Depth) | | 5 |
| | CS 106B or X | | 5 | ME 203 (WIM) | | 3 | PHYS 113 | 4 | |
| | ME 131A (Depth) | | 3 | ME 103D | | 1 | | | |
| | | | | E 102M (WIM) | | 1 | | | |
| | *Subtotals* | *0* | *11* | *Subtotals* | *0* | *9* | *Subtotals* | *4* | *5* |
| | Total | | 11 | Total | | 9 | Total | | 9 |
| *Senior* | EE 222 | | 3 | EE 223 | | 3 | | | |
| | PHYS 170 | 4 | | PHYS 171 | 4 | | | | |
| | | | | ME 210 (Design) | | 4 | | | |
| | *Subtotals* | *4* | *3* | *Subtotals* | *4* | *7* | *Subtotals* | *0* | *0* |
| | Total | | 7 | Total | | 11 | Total | | 0 |

| | | |
|---|---|---|
| *Total Math/Sci Units:* | 56 | |
| *Engineering Units:* | 48 | |
| *Third Engr Fund* | 3 | (in addition to ENGR 40 and CS 106 already listed above) |
| *Total Engr:* | 51 | |
| Total Math/Sci/Engr: | 107 | |

* In the Freshman year, students can take the Math 50 series rather than the CME 100 series. If a student has a solid background in math and physics from high school, they can take the Physics 60 series rather than the Physics 40 series, in which case they do not take Phys70 in the Sophomore year.

# Engineering Physics

*Materials Science Specialty Area*

| | *Fall* | | | *Winter* | | | *Spring* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/Sci | Engr | Class | Math/Sci | Engr | Class | Math/Sci | Engr |
| *Freshman* | CME 100 | 5 | | CME 102 | 5 | | CME 104 | 5 | |
| | PHYS 45/46 | 5 | | PHYS 41 | 4 | | PHYS 43/44 | 5 | |
| | *Subtotals* | *10* | *0* | *Subtotals* | *9* | *0* | *Subtotals* | *10* | *0* |
| | Total | | 10 | Total | | 9 | Total | | 10 |
| *Sophomore* | ENGR 31 | | 4 | ENGR 50 | | 4 | ENGR 40 | | 3 |
| | PHYS 70 | 4 | | | | | PHYS 110 | 4 | |
| | EE141 | | 4 | EE 242 | | 3 | MATSCI 152 (Depth) | | 3 |
| | MATH 131P | 3 | | | | | | | |
| | *Subtotals* | *7* | *8* | *Subtotals* | *0* | *7* | *Subtotals* | *4* | *6* |
| | Total | | 15 | Total | | 7 | Total | | 10 |
| *Junior* | EE 222 | | 3 | EE 223 | | 3 | MATSCI 199(Depth) | | 3 |
| | PHYS 170 | 4 | | PHYS 171 | 3 | | | | |
| | EE 261 | | 3 | | | | | | |
| | *Subtotals* | *4* | *6* | *Subtotals* | *3* | *3* | *Subtotals* | *0* | *3* |
| | Total | | 10 | Total | | 6 | Total | | 3 |
| *Senior* | MATSCI 193 | | 4 | CS 106B or X | | 5 | PHYS 108 | 3 | |
| | AP 215 | | 3 | MATSCI 161(WIM) | | 4 | (Design) | | |
| | | | | | | | MATSCI 162(Depth) | | 4 |
| | *Subtotals* | *0* | *7* | *Subtotals* | *0* | *9* | *Subtotals* | *3* | *4* |
| | Total | | 7 | Total | | 9 | Total | | 7 |

| | |
|---|---|
| *Total Math/Sci Units:* | 50 |
| *Total Engr:* | 53 |
| Total Math/Sci/Engr: | 103 |

* In the Freshman year, students can take the Math 50 series rather than the CME 100 series. If a student has a solid background in math and physics from high school, they can take the Physics 60 series rather than the Physics 40 series, in which case they do not take Phys70 in the Sophomore year.

# Engineering Physics

*Photonics Specialty Area*

| | *Fall* | | | *Winter* | | | *Spring* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/Sci | Engr | Class | Math/Sci | Engr | Class | Math/Sci | Engr |
| *Freshman* | CME 100 | 5 | | CME 102 | 5 | | CME 104 | 5 | |
| | PHYS 45/46 | 5 | | PHYS 41 | 4 | | PHYS 43/44 | 5 | |
| | *Subtotals* | *10* | *0* | *Subtotals* | *9* | *0* | *Subtotals* | *10* | *0* |
| | Total | | 10 | Total | | 9 | Total | | 10 |
| *Sophomore* | MATH 131P | 3 | | EE 261 | | 3 | ENGR 40 | | 3 |
| | PHYS 70 | 4 | | | | | PHYS 110 | 4 | |
| | EE141 | | 4 | EE 242 | | 3 | CS 106B or X | | 5 |
| | *Subtotals* | *7* | *4* | *Subtotals* | *0* | *6* | *Subtotals* | *4* | *8* |
| | Total | | 11 | Total | | 6 | Total | | 12 |
| *Junior* | EE 222 | | 3 | EE 223 | | 3 | MATSCI 199 | | 3 |
| | PHYS 170 | 4 | | PHYS 171 | 4 | | (Depth) | | |
| | | | | EE 101A | | 4 | EE101B | | 4 |
| | *Subtotals* | *4* | *3* | *Subtotals* | *4* | *7* | *Subtotals* | *0* | *7* |
| | Total | | 7 | Total | | 11 | Total | | 7 |
| *Senior* | EE 231 (Depth) | | 3 | EE 133(Design) | | 3 | | | |
| | AP 215 | | 3 | EE 243(Depth) | | 3 | | | |
| | | | | PHYS 107 (\ | 4 | | | | |
| | *Subtotals* | *0* | *6* | *Subtotals* | *4* | *6* | *Subtotals* | *0* | *0* |
| | Total | | 6 | Total | | 10 | Total | | 0 |

| | | |
|---|---|---|
| *Total Math/Sci Units:* | 52 | |
| *Engineering Units:* | 47 | |
| *Third Engr Fund* | 3 | (in addition to ENGR 40 and CS 106 already listed above) |
| *Total Engr:* | 50 | |
| Total Math/Sci/Engr: | 102 | |

* In the Freshman year, students can take the Math 50 series rather than the CME 100 series. If a student has a solid background in math and physics from high school, they can take the Physics 60 series rather than the Physics 40 series, in which case they do not take Phys70 in the Sophomore year.

# Engineering Physics

*Solid State Physics Specialty Area*

| | *Fall* | | | *Winter* | | | *Spring* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/Sci | Engr | Class | Math/Sci | Engr | Class | Math/Sci | Engr |
| *Freshman* | CME 100 | 5 | | CME 102 | 5 | | CME 104 | 5 | |
| | PHYS 45/46 | 5 | | PHYS 41 | 4 | | PHYS 43/44 | 5 | |
| | *Subtotals* | *10* | *0* | *Subtotals* | *9* | *0* | *Subtotals* | *10* | *0* |
| | Total | | 10 | Total | | 9 | Total | | 10 |
| *Sophomore* | MATH 131P | 3 | | EE 261 | | 3 | ENGR 40 | | 3 |
| | PHYS 70 | 4 | | | | | PHYS 110 | 4 | |
| | EE 141 | | 4 | EE 242 | | 3 | PHYS 113 | 4 | |
| | *Subtotals* | *7* | *4* | *Subtotals* | *0* | *6* | *Subtotals* | *8* | *3* |
| | Total | | 11 | Total | | 6 | Total | | 11 |
| *Junior* | EE 222 | | 3 | EE 223 | | 3 | EE 116 (Depth) | | 3 |
| | PHYS 170 | 4 | | PHYS 171 | 4 | | EE 101B | | 4 |
| | CS 106B or X | | 5 | EE 101A | | 4 | | | |
| | *Subtotals* | *4* | *8* | *Subtotals* | *4* | *7* | *Subtotals* | *0* | *7* |
| | Total | | 12 | Total | | 11 | Total | | 7 |
| *Senior* | EE 108A (WIM) | | 3 | EE 133(Design) | | 3 | EE 237(Depth) | | 3 |
| | ENGR 102E (WIM) | | 1 | EE 236(Depth) | | 3 | | | |
| | *Subtotals* | *0* | *4* | *Subtotals* | *0* | *6* | *Subtotals* | *0* | *3* |
| | Total | | 4 | Total | | 6 | Total | | 3 |

| | | |
|---|---|---|
| *Total Math/Sci Units:* | 52 | |
| *Engineering Units:* | 48 | |
| *Third Engr Fund* | 3 | (in addition to ENGR 40 and CS 106 already listed above) |
| *Total Engr:* | 51 | |
| Total Math/Sci/Engr: | 103 | |

* In the Freshman year, students can take the Math 50 series rather than the CME 100 series. If a student has a solid background in math and physics from high school, they can take the Physics 60 series rather than the Physics 40 series, in which case they do not take Phys70 in the Sophomore year.

# Engineering Physics

*Renewable Energy Specialty Area*

| | *Fall* | | | *Winter* | | | *Spring* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/Sci | Engr | Class | Math/Sci | Engr | Class | Math/Sci | Engr |
| *Freshman* | MATH 51 | 5 | | MATH 52 | 5 | | MATH 53 | 5 | |
| | PHYS 45/46 | 5 | | PHYS 41 | 4 | | PHYS 43/44 | 5 | |
| | *Subtotals* | *10* | *0* | *Subtotals* | *9* | *0* | *Subtotals* | *10* | *0* |
| | Total | | 10 | Total | | 9 | Total | | 10 |
| *Sophomore* | MATH 131P | 3 | | PHYS 112 | 4 | | ENGR 40 | | 3 |
| | PHYS 70 | 4 | | ENGR 50 | | 4 | PHYS 110 | 4 | |
| | EE 141 | | 4 | EE 242 | | 3 | | | |
| | *Subtotals* | *7* | *4* | *Subtotals* | *4* | *7* | *Subtotals* | *4* | *3* |
| | Total | | 11 | Total | | 11 | Total | | 7 |
| *Junior* | EE222 | | 3 | EE223 | | 3 | CS106BorX | | 5 |
| | MATSCI 156 (Depth) | | 4 | CME108 | | 4 | MATSCI 302(Depth) | | 3 |
| | | | | MATSCI 161(WIM) | | 4 | | | |
| | *Subtotals* | *0* | *7* | *Subtotals* | *0* | *11* | *Subtotals* | *0* | *8* |
| | Total | | 7 | Total | | 11 | Total | | 8 |
| *Senior* | PHYS 170 | 4 | | PHYS 171 | 4 | | | | |
| | EE 293A (Depth) | | 3 | EE 293B (Depth) | | 3 | | | |
| | | | | ME 210 (Design) | | 4 | | | |
| | *Subtotals* | *4* | *3* | *Subtotals* | *4* | *7* | *Subtotals* | *0* | *0* *0* |
| | Total | | 7 | Total | | 11 | Total | | 0 |

*Total Math/Sci Units:* 52

*Total Engr:* 50

Total Math/Sci/Engr: 102

* In the Freshman year, students can take the CME 100 series rather than the Math 50 series. If a student has a solid background in math and physics from high school, they can take the Physics 60 series rather than the Physics 40 series, in which case they do not take PHYS 70 in the Sophomore year.

# INSTRUCTIONS FOR DECLARING A MAJOR IN ENGINEERING: ENGINEERING PHYSICS (BS: EPHYS)

1. Make a pre-major advising appointment with Prof. Pat Burchat at **burchat@stanford.edu** in Physics to discuss math and physics requirements, and the selection of a specialty in Engineering Physics and an advisor.

2. Declare the Engineering Physics subplan on Axess: **select "Engineering" as your major and "Engineering Physics" as your subplan**.

3. Send an email notice to Doris Chan, Student Services Specialist, at **dschan@stanford.edu**. Her office is located in Durand 111. In your email, indicate a preference for a major advisor, if any. She will reply to confirm your advisor choice.

4. Print your unofficial Stanford transcript from Axess.

5. Download the Engineering Physics Program Sheet from the School of Engineering web site at **http://ughb.stanford.edu**. Complete the Program Sheet, indicating how you plan to fulfill the major requirements (or do this when you meet with your advisor).

6. Make an appointment with your advisor to discuss your program. Have your advisor sign the Program Sheet. Your program proposal may change as you progress in the program; submit revisions in consultation with your advisor. **(Submit an initial Program Sheet during the quarter in which you declare, and a final Program Sheet at least two quarters before you graduate.)**

7. Get AP or transfer credit approval from the SoE Dean's Office in 201 Terman. Return the signed forms to Doris Chan in Materials Science and Engineering, Durand 111.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download the online EPHYS program sheet from **ughb.stanford.edu** to ensure you are using an accurate major plan.

**Stanford University ♦ School of Engineering**

# Engineering Physics
# 2009–2010 Program Sheet

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirements**

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (Min. 21 units)* | | | | | | | |
| MATH or CME | 51 or 100 | | | | | 5 | |
| MATH or CME | 52 or 104 | | | | | 5 | |
| MATH or CME | 53 or 102 | | | | | 5 | |
| MATH | 131 | | | | | 3 | |
| MATH | | Advanced elective; see note 1 | | | | 3 or 4 | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total* | | |

*Science (15-18 units)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *School of Engineering Approved Science Courses* | | | | | | | |
| PHYS | 41 or 61 | Mechanics (required) | | | | 4 | |
| PHYS | 43+44 or 63+64 | Electricity and Magnetism plus lab (required) | | | | 5 | |
| PHYS | 45+46 or 65+67 | Light and Heat plus lab (required) | | | | 5 or 6 | |
| PHYS | 70 | See note 2 | | | | 4 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *SOE Science Unit Total* | | |
| | | | | | *Mathematics and Science Total* | | |

**Technology in Society Requirement** (1 course required; see UGHB, Fig. 3-3 for SoE approved list)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | 3 to 5 | |

**NOTES**

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, by the MSE Student Services Manager. Changes must be initialed in ink.

* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to Eng majors.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Grade Point Average (GPA) for all courses in Engineering Topics (Fundamentals and Depth combined) is 2.0.

* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/

* All courses listed on this form must only be included under one category. Delete courses/units not taken.

( 1 ) Recommended courses are EE 261, PHYSICS 112, or CME 106. Also qualified are EE263, any Math or Statistics course numbered 100 or above, and any CME course numbered 200 or above, except CME 206.

( 2 ) This course required only if taking the Physics 40 series (omit if taking Physics 60 series)

**Engineering Fundamentals** (three courses minimum; CS 106B or X recommended)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Engineering Fundamentals Total (3 courses required)* | | |

**Engineering Physics Depth**

| Dept | Course | Title | Transfer/AP Approval | | | Units | | Grade |
|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Eng | Phys | |
| ENGR or PHYS | 15 or 110 | Dynamics or Intermediate Mechanics | | | | 3 | 4 | |
| EE or PHYS | 141 or 120 | Int. Electricity & Magnetism | | | | 4 | 4 | |
| EE or PHYS | 242 or 121 | Electromagnetic Waves | | | | 3 | 4 | |
| APPPHYS | 215 | Numerical Meth Phys & Engrs (see note 3) | | | | 3–4 | 3–4 | |
| ENGR | 40 | Intro to Electronics (see note 4) | | | | 5 | 3 | |
| EE and ENGR | 108A and 102E | Tech/Prof Writing (WIM; see note 5) | | | | 4–5 | 4 | |
| EE | 222 | Applied Quantum Mechanics I (see note 6) | | | | 3 | 4 | |
| EE | 223 | Applied Quantum Mechanics II (see note 6) | | | | 3 | 4 | |
| PHYS | 170 | Thermodynamics, Kinetic Theory, & Stat. Mech. (see note 7) | | | | 0 | 4 | |
| PHYS | 171 | Thermodynamics, Kinetic Theory, & Stat. Mech. (see note 7) | | | | 0 | 4 | |
| | | Design course; choose one (see note 8) | | | | 3–4 | 3 | |
| | | Three courses from one speciality area | | | | 9–12 | 9–12 | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | *Engineering and Physics Depth Total* | | | | | | |

**Program Totals**

| | |
|---|---|
| *Math + Science + Physics Depth* *(45 units minimum)* | |
| *Engineering (Fundamentals + Depth) Units* *(50 units minimum in SoE)* | |

**Program Approvals**

*Advisor*

Printed Name: _____ Date: _____

Signature: _____

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 3 ) Alternative approved courses are CME 108, CME 206/ME 300C, OR PHYS 113

( 4 ) Alternative approved courses are EE 101B, EE 122A, PHYSICS 105, OR APPPHYS 207

( 5 ) Alternative approved WIM courses are ME 203 and ENGR 102M, MATSCI 161, MATSCI 164, OR PHYSICS 107

( 6 ) Alternative approved courses are PHYS 130 AND 131

( 7 ) Alternative approved course ME 346A

( 8 ) Approved design courses are CS 108, EE 133, ME203, ME 210 or EE 118, OR PHYSICS 108

# ENVIRONMENTAL ENGINEERING

## — ABET ACCREDITATION CRITERIA APPLY —

The environmental engineering profession works to protect and manage our air, water, and energy resources. Environmental engineers quantitatively analyze the environmental changes that inevitably result from human activities, designing strategies to remediate problems, minimize impacts, and measurably improve environmental quality.

The environmental engineering field is refreshingly multi-disciplinary in nature, combining fundamental principles drawn from physics, chemistry, geology and biology with analytical methods. Practitioners focus on developing devices, techniques and solutions that can effectively address a variety of real-world environmental problems.

### OBJECTIVES AND OUTCOMES FOR ENVIRONMENTAL ENGINEERING

**Objectives:**

1. *Principles and Skills:* Provide an understanding of engineering principles along with analytical, problem-solving, design, and communication skills to continue succeeding and learning in diverse careers.
2. *Preparation for Practice:* Prepare for successful engineering practice with a longer-term perspective that takes into account new tools, such as advanced information technology and biotechnology, and increasingly complex professional and societal expectations.
3. *Preparation for Graduate Study:* Prepare for possible graduate study in engineering or other fields.
4. *Preparation for Service:* Develop the awareness, background, and skills to become responsible citizens and leaders in service to society.

**Outcomes:**

(a) A proficiency in and ability to apply knowledge of engineering, mathematics through differential equations, probability and statistics, and science including physics and chemistry
(b) An ability to design and conduct experiments, as well as to analyze and interpret data
(c) An ability to design a system, component, or process to meet desired needs
(d) An ability to function on multi-disciplinary teams
(e) An ability to identify, formulate, and solve engineering problems
(f) An understanding of professional and ethical responsibility
(g) An ability to communicate effectively
(h) The broad education necessary to understand the impact of engineering solutions in a global and societal context
(i) A recognition of the need for, and an ability to engage in, life-long learning
(j) A knowledge of contemporary issues
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(l) Background for admission to engineering or other professional graduate programs

## THE CURRICULUM

The undergraduate environmental engineering curriculum consists of a set of core classes considered essential for the major, along with additional classes students can select from a list of breadth electives. This major was added to Stanford's undergraduate curriculum in 2000 and became an ABET-accredited environmental engineering degree in 2004.

Those undergraduates potentially interested in the Environmental Engineering major may want to examine the *Environmental and Water Studies* specialization of the Civil Engineering major as a possible alternative; a comparison of these two majors is presented below.

For more information on environmental engineering, please contact Sandra Wetzel in Room 316 of the Jerry Yang and Akiko Yamazaki Environment & Energy (Y2E2) building.

## RESEARCH EXPERIENCE FOR UNDERGRADUATES

The department of Civil and Environmental Engineering welcomes student participation in the VPUE undergraduate research programs. Interested students should check the VPUE website **(http://www.stanford.edu/dept/undergrad/vpue/)** and the CEE website **(http://cee.stanford.edu/)** for announcements regarding the application procedures. Annual program announcements typically appear in December and January with application due dates in February.

## A COMPARISON: ENVIRONMENTAL ENGINEERING VS. CIVIL ENGINEERING

Those students interested in environmental studies should be aware of the differences between choosing the Environmental Engineering major and the *Environmental and Water Studies* specialization of the Civil Engineering major. Noteworthy considerations include:

1. *Curricular Differences:* The Civil Engineering (CE) major requires ENGR 14 (Applied Mechanics), CEE101A (Mechanics of Materials), and CEE101C (Geotechnical Engineering), while the Environmental Engineering (EnvE) major does not. This is because these classes are essential background for the structures/construction area of Civil Engineering. The EnvE major lists CEE 64 (Air Pollution) as a required class (while CE does not) and offers 10 of Depth electives (vs. 6 units for CE).

2. *Professional Considerations:* Both the CE and EnvE degrees are ABET-accredited, which is a first step toward a professional engineering license. The EnvE degree was accredited by ABET in 2004.
3. *Philosophical Considerations:* Some faculty and students feel that "Civil Engineering" implies a broader background, and may thus lead to a broader range of job opportunities. But others argue that "Environmental Engineering" is a more accurate description for a course of study that emphasizes the environment. And finally, there are others who feel that the name itself makes little or no difference.

## EXPLORING ENVIRONMENTAL ENGINEERING AS A MAJOR

Attention, freshmen and sophomores: Are you thinking about an engineering major, or wondering whether an Environmental Engineering major is for you? If so, here is some advice on courses accessible early in your undergraduate career that will help you assess your interest in our major. If you end up joining our program, this early start on fulfilling requirements will pay off by giving you more flexibility in class scheduling for your junior and senior years.

1. For an introduction to Environmental Engineering, classes required for all of our declared majors which are readily accessible to you are:
   CEE 70: Environmental Science & Technology (S)
   CEE100: Managing Civil Engineering Projects (WIM)(S)
2. For electives providing additional exposure to the major, try:
   CEE 63: Weather and Storms (A)
   CEE 64: Air Pollution: from Urban Smog to Global Change (W)
   CEE166D: Water Resources and Water Hazards Field Trips (W)
   CEE173A: Energy Resources (A)
3. For any Engineering major, three Engineering Fundamentals must be taken. Early on, you should consider taking:
   ENGR 30: Engineering Thermodynamics (A,W; a req'd fundamental for EnvE)
   ENGR 60: Engineering Economy (A,W, Sum; a req'd fundamental for EnvE)
4. The following Science/Math classes are required for almost all majors within the School of Engineering:
   CHEM 31A or 31X: Chemical Principles (A)
   PHYSICS 41: Mechanics (W) or 4 units of AP Physics C [co-requisite: MATH 41]
   MATH 51: Linear Algebra & Differential Calculus (A,W,S,Sum) or CME 100 (A) [prerequisite: MATH 41, 42]
5. Finally, there are additional Science/Math classes required for students majoring in Environmental Engineering which can readily be taken early on:
   GES 1A or 1B or 1C: Introduction to Geology (A,W, S; one course required)
   STATS 110 (or STATS 60 or GES 160): Statistics (A,W,S)

# REQUIREMENTS: 2009-10 MAJOR IN ENVIRONMENTAL ENGINEERING

**MATHEMATICS AND SCIENCE (45 UNITS MINIMUM), INCLUDING:**

| Course | Title | Units | Qtr. |
|---|---|---|---|
| Math 41/42 | Calculus (or 10 units AP Calculus) | 10 | A/A,W |
| CME 100 & 102 | Math/Computational Methods for Engineers (or Math 51 & 53) | 10 | A.W |
| PHYSICS 41 | Mechanics | 4 | W |
| CHEM 31A or X | Chemical Principles (see note 1) | 4 | A, Sum |
| CHEM 33 | Structure and Reactivity (organic chemistry) (see note 2) | 4 | W,S,Sum |
| | One additional Physics or Chemistry course from Figure 3-2 (see note 2) | 3-4 | |
| GES 1A or B or C | Intro to Earth Sciences (different topic each quarter; count only 1) | 4-5 | AW,S |
| STATS 110 | Statistical Methods (or STATS 60 or GES 160 or ENGR 155C) | 4-5 | A,W,S |

(1) CHEM 31A, 31X or ENGR 31 is required.

(2) For students taking CHEM 31A, CHEM31B can be used to fulfill this requirement. CHEM 35 or 135 is recommended as valuable for those students planning to continue on to graduate school in environmental studies.

### Engineering Fundamentals (Three courses minimum, including the two listed below):

| | | | |
|---|---|---|---|
| ENGR 30 | Engineering Thermodynamics | 3 | A,W |
| ENGR 60 | Engineering Economy | 3 | A,W, Sum |

### Technology in Society: *One 3-5 unit course*

See Chapter 3, Figure 3-3 of this handbook for an approved list of courses that fulfill the TIS requirement for Environmental Engineering majors.

### Experimentation: *8 units required*

At least 7 units will be earned by fulfilling the Depth requirements below, and 1 unit from GES 1. See the chart later in this section for a list of applicable experimentation units.

### Environmental Engineering Depth: (Fundamentals + Depth = 68 Units Minimum)

At least 68 units of "Engineering Science" plus "Engineering Design" is required by ABET and by the Department. Note: The sum of "Engineering Science" plus "Engineering Design" units assigned to a course do not always equal the course unit total. Thus, more than 68 units of engineering courses may be needed to satisfy this requirement -- see chart later in this section for Engineering Science and Engineering Design units assigned to each course.

**REQUIRED DEPTH CORE: (47 UNITS)**

| Course | Title | Units | Qtr. |
|---|---|---|---|
| CEE 64* | Air Pollution: Urban Smog to Global Change | 3 | W |
| CEE 70 | Environmental Science and Technology | 3 | S |
| CEE 100 | Managing Civil Engineering Projects (*meets WIM requirement)* | 4 | S |
| CEE 101B | Mechanics of Fluids | 4 | S |
| CEE 101D* | Computations in CEE | 3 | A |
| CEE 160 | Mechanics of Fluids Laboratory | 2 | S |

| | | | |
|---|---|---|---|
| CEE 161A | Rivers, Streams and Canals | 4 | A |
| CEE 166A | Watersheds and Wetlands | 3 | A |
| CEE 166B | Floods and Droughts, Dams and Aqueducts | 3 | W |
| CEE 171 | Environmental Planning Methods | 3 | W |
| CEE 172 | Air Quality Management | 3 | W |
| CEE 177 | Aquatic Chemistry and Biology | 4 | A |
| CEE 179A | Water Chemistry Laboratory | 3 | W |
| *Design Experience: Choose CEE169 or, CEE179B or CEE 179C* | | 5 | S |

*Can count either towards the Math or Science requirement, or as engineering units.

**DEPTH ELECTIVE COURSES: (AT LEAST 10 ADDITIONAL UNITS FROM THE FOLLOWING LIST)**

| Course | Title | Units | Qtr. |
|---|---|---|---|
| CEE 63* | Weather and Storms | 3 | A |
| CEE 101C | Geotechnical Engineering (includes lab) | 4 | A |
| CEE 164 | Introduction to Physical Oceanography | 4 | W |
| CEE 165D | Water and Sanitation in Developing Countries | 3 | W |
| CEE 166D | Water Resources and Water Hazards Field Trips | 2 | W |
| CEE 169 | Environmental and Water Resource Engineering *(alternate years)* | 5 | S |
| CEE 172A | Indoor Air Quality *(alternate years)* | 2-3 | S |
| CEE 173A | Energy Resources | 4-5 | A |
| CEE 176A | Energy Efficient Buildings | 3-4 | W |
| CEE 176B | Electric Power: Renewables and Efficiency | 3-4 | S |
| CEE 178 | Introduction to Human Exposure Analysis | 3 | Sum |
| CEE 179C | Environmental Engineering Design *(alternate years* | 5 | S |
| CEE 199 | Undergrad Research in Civil & Env. Engineering | 1-4 | Any |

*Can count either towards the Math or Science requirement, or as engineering units.

### Other Elective Courses:

Choose additional courses from within the School of Engineering to reach a total of 68 units of Engineering Science+Design. Depending on which Engineering Fundamentals and Depth classes are taken, up to 8 additional units may be required. **Total Engineering Science and Engineering Design units (columns 1 and 2 in the tables below) from Fundamentals and Core (required courses and electives) combined must total at least 68 units in order to satisfy ABET requirements to graduate.**

### Engineering Science, Engineering Design, and Experimentation Units

**SCHOOL OF ENGINEERING COURSES**

| Course | Title | Engr Sci | Engr Dsgn | Expr | Total |
|---|---|---|---|---|---|
| ENGR 10 | Introduction to Engineering Analysis | 4 | - | - | 4 |
| ENGR 14 | Applied Mechanics: Statics | 2 | 1 | - | 3 |
| ENGR 15 | Dynamics | 2 | 1 | - | 3 |
| ENGR 20 | Introduction to Chemical Engineering | 2 | 1 | - | 3 |
| ENGR 30 | Engineering Thermodynamics | 3 | - | - | 3 |
| ENGR 40 | Introductory Electronics | 3 | 2 | 2 | 5 |
| ENGR 50/50M | Introductory Materials Science | 4 | - | - | 4 |
| ENGR 60 | Engineering Economy | 3 | - | - | 3 |
| ENGR 70 | Programming Methodology or Abstractions | 3 | 2 | - | 5 |

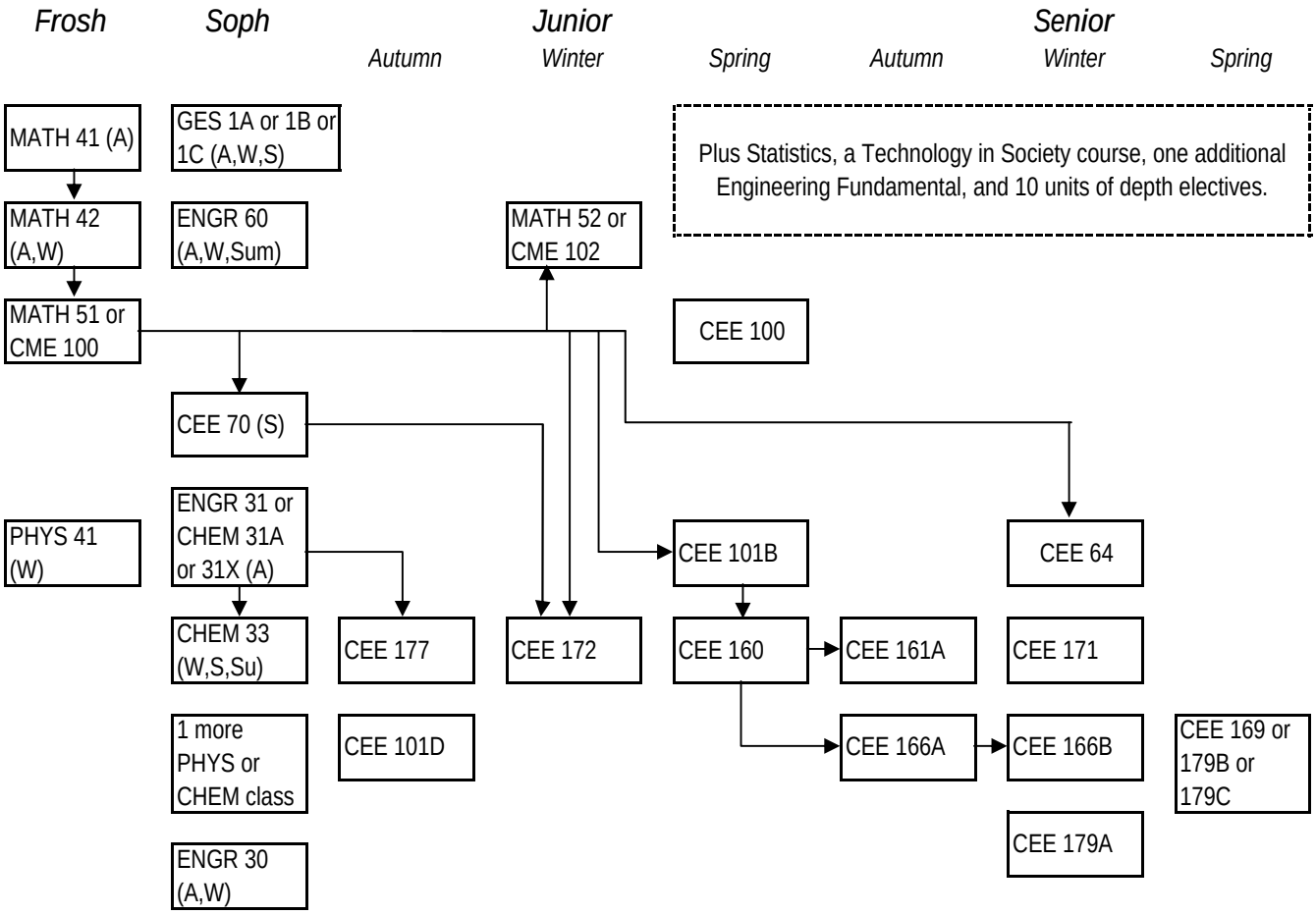
## DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING COURSES

| COURSE | TITLE | ENGR SCI | ENGR DSGN | EXPR | TOTAL |
|---|---|---|---|---|---|
| CEE 31/Q | Accessing Architecture through Drawing | 1 | 3 | - | 4 |
| CEE 44Q | Critical Thinking and Career Skills | 1 | 0 | 0 | 3 |
| CEE 46Q | Fail Your Way to Success | 2 | 1 | - | 3 |
| CEE 48N | Organizing Global Projects | 2 | 2 | - | 4 |
| CEE 63 | Weather & Storms | 3 | 0 | - | 3 |
| CEE 64 | Air Pollution: Urban Smog to Global Change | 3 | 0 | - | 3 |
| CEE 70 | Environmental Science & Technology | 2 | 1 | - | 3 |
| CEE 80N | Art of Structural Engineering | 2 | 2 | - | 4 |
| CEE 100 | Managing Sustainable Building Projects | 2.5 | 1.5 | 1 | 4 |
| CEE 101A | Mechanics of Materials | 3 | 1 | 1 | 4 |
| CEE 101B | Mechanics of Fluids | 3 | 1 | - | 4 |
| CEE 101C | Geotechnical Engineering | 2.5-3 | 0.5-1 | 0-1 | 3-4 |
| CEE 101D | Computations in CEE | 2 | 1 | - | 3 |
| CEE 102 | Legal Aspects of Engineering and Construction | 2 | 1 | - | 3 |
| CEE 110 | Building Information Modeling | 2 | 2 | 1 | 4 |
| CEE 111 | Multidisciplinary Modeling and Analysis | 1 | 3 | 2 | 4 |
| CEE 115 | Goals & Methods for Sustainable Build. Projects | 2 | 1 | - | 3 |
| CEE122A/B | Computer Integrated A/E/C | 0 | 2 | - | 2 |
| CEE 129 | Climate Impacts on Ports | 2-4 | 0 | 0 | 2-4 |
| CEE 130 | Arch. Design: 3D Modeling, Method., & Process | 1 | 3 | - | 4 |
| CEE 131A | Introduction to the Design Professions | 0 | 2 | - | 2 |
| CEE 134B | Architectural Studio: Special Topic | 2 | 2 | - | 4 |
| CEE 135A | Parametric Design | 2 | 2 | - | 4 |
| CEE 136 | Green Architecture | 2 | 2 | 0 | 4 |
| CEE 137B | Intermediate Architecture Studio | 0 | 5 | - | 5 |
| CEE 138A | Contemporary Architecture: | - | 3 | - | 3 |
| CEE 139 | Design Portfolio Methods | 0 | 0 | - | 2 |
| CEE 141A | Infrastructure Project Development | 2 | 1 | - | 3 |
| CEE 142A | Creating Sustainable Development | 2 | 1 | - | 3 |
| CEE 147 | Cases in Personality, Leadership & Negot. | 3 | 0 | 1 | 3 |
| CEE 151 | Negotiation | 3 | 0 | - | 3 |
| CEE 154 | Cases in Estimating Cost | 1 | 1 | 1 | 3 |
| CEE 156 | Building Systems Design | 1.5 | 2.5 | - | 4 |
| CEE 159 | Career Skills Seminar | - | - | - | 2 |
| CEE 160 | Mechanics of Fluids Laboratory | 1 | 1 | 2 | 2 |
| CEE 161A | Rivers, Streams and Canals (for 3 units) | 1.5 | 1.5 | - | 3 |
| CEE 161A | Rivers, Streams and Canals (for 4 units) | 2 | 2 | 1 | 4 |
| CEE 164 | Intro to Physical Oceanography | 4 | 0 | - | 4 |
| CEE 165D | Water and Sanitation in Developing Countries | 2 | 1 | - | 3 |
| CEE 166A | Watersheds and Wetlands | 2 | 1 | - | 3 |
| CEE 166B | Floods & Droughts, Dams & Aqueducts | 2 | 1 | - | 3 |
| CEE 166D | Water Resc. and Water Hazards Field Trips | 1 | 1 | - | 2 |
| CEE 169 | Environmental & Water Resources: Design | 0 | 5 | - | 5 |
| CEE 171 | Environmental Planning Methods | 2 | 1 | - | 3 |
| CEE 172 | Air Quality Management | 2 | 1 | - | 3 |
| CEE 172A | Indoor Air Quality | 1-2 | 1 | - | 2-3 |
| CEE 173A | Energy Resources | 4-5 | 0 | - | 4-5 |

| Course | Title | Engr Sci | Engr Dsgn | Expr | Total |
|---|---|---|---|---|---|
| CEE 175A | CA Coast: Science, Policy, and Law | 1 | 0 | - | 3-4 |
| CEE 176A | Energy Efficient Buildings | 2 | 1-2 | 0-1 | 3-4 |
| CEE 176B | Electric Power: Renewables and Efficiency | 2 | 1-2 | 0-1 | 3-4 |
| CEE 176F | Energy Systems Field Trips | 0.5-1 | 0.5-1 | 0 | 1-2 |
| CEE 177 | Aquatic Chemistry and Biology | 3 | 1 | - | 4 |
| CEE 178 | Introduction to Human Exposure Analysis | 2 | 1 | 1 | 3 |
| CEE 179A | Water Chemistry Laboratory | 3 | 0 | 3 | 3 |
| CEE 180 | Structural Analysis | 3 | 1 | - | 4 |
| CEE 181 | Design of Steel Structures | 0 | 4 | - | 4 |
| CEE 182 | Design of Reinforced Concrete Structures | 0 | 4 | - | 4 |
| CEE 183 | Integrated Building Design | 0 | 4 | - | 4 |
| CEE 190 | Near Surface Geophysics | 2 | 1 | - | 3 |
| CEE 195A/B | Structural Geology & Rock Mechanics | 2 | 1 | 1 | 3 |
| CEE 196 | Engineering Geology Practice | 2 | 1 | - | 3 |
| CEE 199 | Undergraduate Research in CEE | varies | varies | 0-4 | 1-4 |

# Environmental Engineering

*Typical Sequence of Courses*




* Arrows represent direct prerequisites
* Dashed-line boxes enclose alternates. These may indicate alternate years in which to take a given course, and/or alternate courses that may be taken at a given time.

# Environmental Engineering

*Early Start Program*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | STAT 60 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | CHEM 31A+ | 4 | - | - | CHEM 31B+ | 4 | - | - | CHEM 33 | 4 | - | - |
| | Unrstr Elctv # | - | - | 3 | Unrstr Elctv # | - | - | 3 | Writing | - | - | 4 |
| | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *0* | *8* |
| | Total | | | 16 | Total | | | 16 | Total | | | 17 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CEE 101D | - | 3 | - | PHYSICS 41 | 4 | - | - | CEE 70 | - | 3 | - |
| | CME 100^^ | 5 | - | - | CME 102^^ | 5 | - | - | Engr Fund | - | 3 | - |
| | Unrstr Elctv # | - | - | 3 | Engr Elctv #^ | - | 3 | - | Writing | - | - | 4 |
| | *Subtotals* | *5* | *3* | *8* | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *0* | *6* | *9* |
| | Total | | | 16 | Total | | | 17 | Total | | | 15 |
| *Junior* | ENGR 60 | - | 3 | - | ENGR 30* | - | 3 | - | CEE 101B* | - | 4 | - |
| | CEE177 | - | 4 | - | CEE 64 | - | 3 | - | CEE 160 | - | 2 | - |
| | GER | - | - | 4 | EnvE Depth | - | 4 | - | CEE 100 | - | 4 | - |
| | GES 1 | 5 | - | - | CEE 171 | - | 3 | - | TIS Course | - | - | 4 |
| | *Subtotals* | *5* | *7* | *4* | *Subtotals* | *0* | *13* | *0* | *Subtotals* | *0* | *10* | *4* |
| | Total | | | 16 | Total | | | 13 | Total | | | 14 |
| *Senior* | CEE166A | - | 3 | - | CEE166B | - | 3 | - | CEE 169** | - | 5 | - |
| | CEE161A* | - | 4 | - | CEE 172* | - | 3 | - | EnvE Depth | - | 3 | - |
| | EnvE Depth | - | 3 | - | CEE 179A | - | 3 | - | GER | - | - | 5 |
| | GER | - | - | 4 | GER | - | - | 5 | | | | |
| | *Subtotals* | *0* | *10* | *4* | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *0* | *8* | *5* |
| | Total | | | 14 | Total | | | 14 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 46 |
| Total Engineering Units: | 69 |
| Total Other Units: | 66 |
| Total Units: | 181 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter.

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the EnvE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Can take Math 51 and 53 instead of CME 100 and 102, if desired.

\+ If Chem 31X or Engr 31 is substituted for Chem 31A, then replace Chem 31B with another chem or physics class.

* These classes are all typically offered MWF10.

** In alternate years, when CEE169 is not offered, take CEE179B or C in the spring to fulfill the capstone design experience.

# Environmental Engineering

*Regular Program*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | STAT 60 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | GER | - | - | 4 | PHYSICS 41 | 4 | - | - | Unrstr Elctv # | - | - | 3 |
| | Unrstr Elctv # | - | - | 3 | Unrstr Elctv # | - | - | 3 | Writing | - | - | 4 |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *5* | *0* | *11* |
| | Total | | | 16 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CHEM 31A+ | 4 | - | - | CHEM 31B+ | 4 | - | - | CHEM 33 | 4 | - | - |
| | MATH 51^^ | 5 | - | - | MATH 53^^ | 5 | - | - | CEE 70 | - | 3 | - |
| | Engr Elctv #^ | - | 3 | - | Eng Fund | - | 3 | - | Writing | - | - | 4 |
| | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *4* | *3* | *9* |
| | Total | | | 17 | Total | | | 17 | Total | | | 16 |
| *Junior* | ENGR 30* | - | 3 | - | EnvE Depth | - | 4 | - | CEE 101B* | - | 4 | - |
| | CEE 177 | - | 4 | - | CEE 64 | - | 3 | - | CEE 160 | - | 2 | - |
| | GES 1 | 5 | - | - | CEE 171 | - | 3 | - | CEE 100 | - | 4 | - |
| | CEE 101D | - | 3 | - | GER | - | - | 4 | GER | - | - | 5 |
| | *Subtotals* | *5* | *10* | *0* | *Subtotals* | *0* | *10* | *4* | *Subtotals* | *0* | *10* | *5* |
| | Total | | | 15 | Total | | | 14 | Total | | | 15 |
| *Senior* | ENGR 60 | - | 3 | - | CEE 166B | - | 3 | - | CEE 169** | - | 5 | - |
| | EnvE Depth | - | 3 | - | CEE 172* | - | 3 | - | TIS Course | - | - | 4 |
| | CEE 161A* | - | 4 | - | CEE 179A | - | 3 | - | EnvE Depth | - | 3 | - |
| | CEE 166A | - | 3 | - | GER | - | - | 5 | | | | |
| | *Subtotals* | *0* | *13* | *0* | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *0* | *8* | *4* |
| | Total | | | 13 | Total | | | 14 | Total | | | 12 |

| | |
|---|---|
| Total Math & Science Units: | 46 |
| Total Engineering Units: | 69 |
| Total Other Units: | 66 |
| Total Units: | 181 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter.

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the EnvE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Can take CME 100 and 102 instead of Math 51 and 53, if desired.

\+ If Chem 31X or Engr 31 is substituted for Chem 31A, then replace Chem 31B with another chem or physics class.

* These classes all are typically offered MWF10.

** In alternate years, when CEE169 is not offered, take CEE179B or C in the spring to fulfill the capstone design experience.

# Environmental Engineering

*Autumn Quarter Junior Year Abroad*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv # | - | - | 3 | PHYSICS 41 | 4 | - | - | CEE 70 | - | 3 | - |
| | Writing | - | - | 4 | Engr Elctv #^ | - | 3 | - | Unrstr Elctv # | - | - | 3 |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *3* | *4* | *Subtotals* | *5* | *3* | *7* |
| | Total | | | 16 | Total | | | 16 | Total | | | 15 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CHEM 31A+ | 4 | - | - | CHEM 31B+ | 4 | - | - | CHEM 33 | 4 | - | - |
| | CEE101D++ | - | 3 | - | ENGR 60 | - | 3 | - | CEE 100 | - | 4 | - |
| | Writing | - | - | 4 | MATH 53 | 5 | - | - | GES 1 | 4 | - | - |
| | *Subtotals* | *4* | *3* | *9* | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *8* | *4* | *5* |
| | Total | | | 16 | Total | | | 17 | Total | | | 17 |
| *Junior* | GER ^^ | - | - | 5 | CEE 64 | - | 3 | - | CEE 101B* | - | 4 | - |
| | GER ^^ | - | - | 4 | ENGR 30* | - | 3 | - | CEE 160 | - | 2 | - |
| | Unrstr Elctv | - | - | 3 | CEE 171 | - | 3 | - | STAT 60 | 5 | - | - |
| | *--- Autumn Quarter Abroad ---* ^^ | | | | EnvE Depth | - | 4 | - | GER | - | - | 5 |
| | *Subtotals* | *0* | *0* | *12* | *Subtotals* | *0* | *13* | *0* | *Subtotals* | *5* | *6* | *5* |
| | Total | | | 12 | Total | | | 13 | Total | | | 16 |
| *Senior* | EnvE Depth | - | 3 | - | CEE 166B | - | 3 | - | CEE 169** | - | 5 | - |
| | CEE 177 | - | 4 | - | CEE 179A | - | 3 | - | TIS Course | - | - | 4 |
| | CEE 161A* | - | 4 | - | CEE 172* | - | 3 | - | EnvE Depth | - | 3 | - |
| | CEE 166A | - | 3 | - | GER | - | - | 4 | Eng Fund^^ | - | 3 | - |
| | *Subtotals* | *0* | *14* | *0* | *Subtotals* | *0* | *9* | *4* | *Subtotals* | *0* | *11* | *4* |
| | Total | | | 14 | Total | | | 13 | Total | | | 15 |

| | |
|---|---|
| Total Math & Science Units: | 45 |
| Total Engineering Units: | 69 |
| Total Other Units: | 66 |
| Total Units: | 180 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter.

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Most Overseas programs offer classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter. Some Overseas programs also offer Engr 40 or 50.

\+ If Chem 31X or Engr 31 is substituted for Chem 31A, then replace Chem 31B with another chem or physics class.

++ It is advisable to take CEE101D (or 177) in Autumn of sophomore year, to avoid overcrowding with required CEE classes in Autumn of senior year.

* These classes all are typically offered MWF10.

** In alternate years, when CEE169 is not offered, take CEE179B or C in the spring to fulfill the capstone design experience.

# Environmental Engineering

*Winter Quarter Junior Year Abroad*

| | Fall | | | | Winter | | | | Spring | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv # | - | - | 3 | PHYSICS 41 | 4 | - | - | CEE 70 | - | 3 | - |
| | Writing | - | - | 4 | Engr Elctv #^ | - | 3 | - | Unrstr Elctv # | - | - | 3 |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *3* | *4* | *Subtotals* | *5* | *3* | *7* |
| | Total | | | 16 | Total | | | 16 | Total | | | 15 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CHEM 31A+ | 4 | - | - | CHEM 31B+ | 4 | - | - | CHEM 33 | 4 | - | - |
| | ENGR 60 | - | 3 | - | CEE 64++ | - | 3 | - | EnvE Depth | - | 3 | - |
| | Writing | - | - | 4 | MATH 53 | 5 | - | - | STAT 60 | 5 | - | - |
| | *Subtotals* | *4* | *3* | *9* | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *9* | *3* | *5* |
| | Total | | | 16 | Total | | | 17 | Total | | | 17 |
| *Junior* | ENGR 30* | - | 3 | - | GER ^^ | - | - | 5 | CEE 101B* | - | 4 | - |
| | CEE 177 | - | 4 | - | GER ^^ | - | - | 4 | CEE 160 | - | 2 | - |
| | GES 1 | 5 | - | - | Unrstr Elctv | - | - | 3 | CEE 100 | - | 4 | - |
| | CEE 101D | - | 3 | - | *--- Winter Quarter Abroad ---* ^^ | | | | TIS Course | - | - | 4 |
| | *Subtotals* | *5* | *10* | *0* | *Subtotals* | *0* | *0* | *12* | *Subtotals* | *0* | *10* | *4* |
| *Senior* | Total | | | 15 | Total | | | 12 | Total | | | 14 |
| | CEE 161A* | - | 4 | - | CEE 166B | - | 3 | - | CEE 169** | - | 5 | - |
| | CEE 166A | - | 3 | - | CEE 171 | - | 3 | - | Engr Fund^^ | - | 3 | - |
| | EnvE Depth | - | 3 | - | CEE179A | - | 3 | - | EnvE Depth | - | 4 | - |
| | GER | - | - | 5 | CEE 172* | - | 3 | - | GER | - | - | 4 |
| | *Subtotals* | *0* | *10* | *5* | *Subtotals* | *0* | *12* | *0* | *Subtotals* | *0* | *12* | *4* |
| | Total | | | 15 | Total | | | 12 | Total | | | 16 |

| | |
|---|---|
| Total Math & Science Units: | 46 |
| Total Engineering Units: | 69 |
| Total Other Units: | 66 |
| Total Units: | 181 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter.

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Most Overseas programs offer classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter. Some Overseas programs also offer Engr 40 or 50.

\+ If Chem 31X or Engr 31 is substituted for Chem 31A, then replace Chem 31B with another chem or physics class.

++ It is advisable to take CEE 64 (or 172) in winter of sophomore year, to avoid overcrowding with required CEE classes in Winter of senior year.

* These classes all are typically offered MWF10.

** In alternate years, when CEE169 is not offered, take CEE179B or C in the spring to fulfill the capstone design experience.

# Environmental Engineering

*Spring Quarter Junior Year Abroad*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv # | - | - | 4 | PHYSICS 41 | 4 | - | - | CEE 70 | - | 3 | - |
| | Writing | - | - | 3 | Engr Elctv #^ | - | 3 | - | Unrstr Elctv # | - | - | 3 |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *3* | *4* | *Subtotals* | *5* | *3* | *7* |
| | Total | | | 16 | Total | | | 16 | Total | | | 15 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | CHEM 31A+ | 4 | - | - | CHEM 31B+ | 4 | - | - | CEE 101B++ | - | 4 | - |
| | CEE 101D | - | 3 | - | CEE 64 | - | 3 | - | CEE 160++ | - | 2 | - |
| | Writing | - | - | 4 | MATH 53 | 5 | - | - | STAT 60 | 5 | - | - |
| | *Subtotals* | *4* | *3* | *9* | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *5* | *6* | *5* |
| | Total | | | 16 | Total | | | 17 | Total | | | 16 |
| *Junior* | ENGR 30* | - | 3 | - | EnvE Depth | - | 4 | - | GER ^^ | - | - | 5 |
| | CEE 177 | - | 4 | - | CEE 171 | - | 3 | - | GER ^^ | - | - | 4 |
| | EnvE Depth | - | 3 | - | CEE 172* | - | 3 | - | Unrstr Elctv | - | - | 3 |
| | GES 1 | 5 | - | - | CHEM 33 | 4 | - | - | *--- Spring Quarter Abroad ---* | | ^^ | |
| | *Subtotals* | *5* | *10* | *0* | *Subtotals* | *4* | *10* | *0* | *Subtotals* | *0* | *0* | *12* |
| | Total | | | 15 | Total | | | 14 | Total | | | 12 |
| *Senior* | ENGR 60 | - | 3 | - | Engr Fund^^ | - | 3 | - | CEE 100 | - | 4 | - |
| | CEE 161A* | - | 4 | - | CEE 166B | - | 3 | - | CEE 169** | - | 5 | - |
| | CEE 166A | - | 3 | - | CEE 179A | - | 3 | - | EnvE Depth | - | 3 | - |
| | GER | - | - | 4 | GER | - | - | 5 | TIS Course | - | - | 4 |
| | *Subtotals* | *0* | *10* | *4* | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *0* | *12* | *4* |
| | Total | | | 14 | Total | | | 14 | Total | | | 16 |

| | |
|---|---|
| Total Math & Science Units: | 46 |
| Total Engineering Units: | 69 |
| Total Other Units: | 66 |
| Total Units: | 181 |

***Notes:***

Courses in this row can be rearranged to accommodate Writing in any quarter.

\# Students should explore majors of interest to them using these unrestricted electives. Courses in the School of Engineering can count towards the CE major; see description of "Other Elective Courses" for details.

^ Enough coursework from within the School of Engineering is needed to reach a total of 68 Engineering Science+Engineering Design Units; see description of "Other Elective Courses" for details.

^^ Most Overseas programs offer classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter. Some Overseas programs also offer Engr 40 or 50.

\+ If Chem 31X or Engr 31 is substituted for Chem 31A, then replace Chem 31B with another chem or physics class.

++ CEE101B and CEE160 must be taken in spring of Sophomore year to do a Spring quarter overseas as a Junior.

* These classes all are typically offered MWF10.

** In alternate years, when CEE169 is not offered, take CEE179B or C in the spring to fulfill the capstone design experience.

# INSTRUCTIONS FOR DECLARING MAJOR IN ENVIRONMENTAL ENGINEERING

1. Enter your major declaration as Environmental Engineering in **Axess**
2. Pick up your academic folder from your freshman/sophomore adviser and print out your Stanford transcript (unofficial is fine) from **Axess**.
3. Download and complete your major **Program Sheet**, which you can obtain from the UGHB website at **`http://ughb.stanford.edu/`**. Be sure to fill in all courses that you have taken and those which you plan to take. You will have the opportunity to revise this later, so please fill in as many courses as you can.
4. Bring your academic folder, transcript and completed program sheet to the CEE Student Services office iin Room 316 of the Jerry Yang and Akiko Yamazaki Environment & Energy [Y2E2] Building and request to have a CEE advisor assigned to you. You may request a specific advisor if you wish. Office hours are 10:00 am to noon and 2:00 to 4:00 pm, Monday through Friday.
5. Meet with your CEE undergraduate advisor and have him/her review and sign your program sheet.
6. Return your signed program sheet to the CEE Student Services Specialist, who upon receiving your signed sheet will approve your major declaration in Axess.
7. You are encouraged to meet with your CEE undergraduate adviser at least once a quarter to review your academic progress. Changes to your program sheet can be made by printing out a revised sheet, obtaining your undergraduate adviser's signature, and returning the approved sheet to the CEE Student Services Office. NOTE – ***Confirm that your program sheet is up to date at least one quarter prior to graduation.***
8. Other information:

    - Procedures for requesting transfer credits and program deviations are described in detail in at the beginning of Chapter 4: "Policies and Procedures." The relevant forms are in the back of the Handbook in the "Forms" section, or on the UGHB site under the "Petitions" link. The online forms may be filled out electronically. If you are requesting transfer credits or program deviations, you should bring your completed petition form with your transcript to the CEE Student Services office. Attach your program sheet on file in CEE.

    - Check with the CEE Student Services Office to make sure that you are on the CEE UG student email list for important announcements about department events and activities.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download the online EnvE program sheet from **`ughb.stanford.edu`** to ensure you are using an accurate major plan.

**Stanford University ♦ School of Engineering**

# Environmental Engineering
# 2009–2010 Program Sheet

**— ABET Acceditation Criteria Apply —**

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Mathematics* | | | | | | | | | | |
| Math | 41 | Calculus (or AP credit) | | | | 5 | | | | |
| Math | 42 | Calculus (or AP credit) | | | | 5 | | | | |
| CME | 100 | Vector Calculus (or Math 51) (req'd) (note 1) | | | | 5 | | | | |
| CME | 102 | Math/Comp. Methods (or Math 53) (req'd) (note 1) | | | | 5 | | | | |
| | | Statistical Methods (STATS 60, 110, GES 160, CEE 203 *or* CME 106 | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Mathematics Unit Total* | | | | | |
| *Science* | | | | | | | | | | |
| PHYS | 41 | Mechanics (req'd) (or AP credit) | | | | 4 | | | | 0 |
| CHEM | 31 | Chemical Principles (req'd) (see note 2) | | | | 4 | | | | 0 |
| CHEM | 33 | Structure and Reactivity (req'd) | | | | 4 | | | | 0 |
| GES | 1A/B/C | Intro to Geology (1 course req'd) | | | | 4 to 5 | | | | 1 |
| | | One other physics or chemistry class (3-4 units) | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Science Unit Total* | | | | | |
| | | | | | *Mathematics and Science Unit Total (45 units minimum)* | | | | | |

**Technology in Society Requirement** (1 course required; see UGHB, Fig. 3-3 for SoE approved list)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |

**NOTES**

* Engineering Science, Design, and Experimentation units do not apply to shaded areas.
* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to Engr majors.
* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.
* All courses listed on this form must be taken for a letter grade if offered by the instructor.
* Minimum Combined GPA for all courses in Engineering Topics (Engr Science & Engr Design courses) is 2.0.
* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's office.Transfer credits in Engr Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/t
* All courses listed on this form must only be included under one category. Delete courses not taken.

( 1 ) Either CME 100 & 102 *OR* Math 51 & 53 are required.

( 2 ) This chemistry requirement may be satisfied by either Chem 31A, Chem 31X, or Engr 31 (OR by AP Chem, if 4 units of credit are given AND chemistry placement exam allows direct entry into Chem 33).

*program sheet continues on page 2*

# Environmental Engineering Program Sheet (continued)

**Engineering Topics** (Engr Science + Engr Design combined must equal 68 units. See note 3)

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Engineering Fundamentals (3 courses required)* | | | | | | | | | | |
| ENGR | 30 | Engineering Thermodynamics (req'd) | | | | 3 | | 3 | 0 | 0 |
| ENGR | 60 | Engineering Economy (req'd) | | | | 3 | | 3 | 0 | 0 |
| ENGR | | *Fundamentals Elective* | | | | | | | | |
| | | | | | *Engineering Fundamentals Unit Total* | | | | | |
| *Engineering Depth* | | | | | | | | | | |
| CEE | 64 | Air Pollut'n:Urban Smog/Global Change (req'd) | | | | 3 | | 3 | 0 | 0 |
| CEE | 70 | Environ. Science & Technology (req'd) | | | | 3 | | 2 | 1 | 0 |
| CEE | 100 | Man'g Sustainable Bldg Proj (req'd) WIM | | | | 4 | | 2.5 | 1.5 | 1 |
| CEE | 101B | Mechanics of Fluids (req'd) | | | | 4 | | 3 | 1 | 0 |
| CEE | 160 | Mechanics of Fluids Laboratory (req'd) | | | | 2 | | 1 | 1 | 2 |
| CEE | 161A | Rivers,Streams and Canals (req'd) | | | | 4 | | 2 | 2 | 1 |
| CEE | 166A | Watersheds and Wetlands (req'd) | | | | 3 | | 2 | 1 | 0 |
| CEE | 166B | Floods Droughts, Dams Aqueducts (req'd) | | | | 3 | | 2 | 1 | 0 |
| CEE | 171 | Environmental Planning Methods (req'd) | | | | 3 | | 2 | 1 | 0 |
| CEE | 172 | Air Quality Management (req'd) | | | | 3 | | 2 | 1 | 0 |
| CEE | 177 | Aquatic Chemistry and Biology (req'd) | | | | 4 | | 3 | 1 | 0 |
| CEE | 179A | Water Chemistry Lab (req'd) | | | | 3 | | 3 | 0 | 3 |
| | | Capstone design class (CEE169,179B, or 179C) | | | | 5 | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

**Program Totals (ABET Requirements)**

| | | |
|---|---|---|
| *Mathematics and Science* | *(45 units minimum)* | |
| *Engineering Topics (Engr Science + Engr Design)* | *(68 units minimum)* | |
| *Experimentation* | *(8 units minimum)* | |

**Program Approvals**

*Advisor*
Printed Name: _____ Date: _____
Signature: _____

*Departmental*
Printed Name: _____ Date: _____
Signature: _____

*School of Engineering (signature not required prior to graduation)*
Printed Name: _____ Date: _____
Signature: _____

**NOTES (continued from page 1)**

( 3 ) In order to satisfy ABET requirements for graduation, the EnvEng major must take enough courses so that the combined Engineering Science and Design units from Fundamentals and Depth courses add up to a minimum of 68 units. See Unit Allocation list at ughb.stanford.edu to assess the number of assigned Science/Design units for unlisted courses.

# MANAGEMENT SCIENCE AND ENGINEERING

The Department of Management Science and Engineering is concerned with how best to organize resources – people, money, and materials – in our information-intensive, technology-based economy. The degree programs in MS&E prepare students to solve practical problems based on fundamental engineering principles. The department has strong research and teaching programs in decision and risk analysis, economics, engineering management, entrepreneurship, finance, information, operations research, organizations, production and manufacturing, strategy, systems analysis, and technology policy.

The undergraduate curriculum in Management Science and Engineering provides students training in the fundamentals of engineering systems analysis to prepare them to plan, design, and implement complex economic and technological management systems where a scientific or engineering background is necessary or desirable. Graduates will be prepared for work in a variety of career paths, including facilities and process management, investment banking, management consulting, or graduate study in industrial engineering, operations research, economics, public policy, medicine, law, or business.

### OBJECTIVES AND OUTCOMES FOR MANAGEMENT SCIENCE & ENGINEERING

**Objectives:**

*Principles and Skills:* Provide our students with a basic understanding of management science and engineering principles, including analytical problem solving and communication skills.

*Preparation for Practice:* Prepare our students for practice in a field that sees rapid changes in tools, problems, and opportunities.

*Preparation for Continued Growth:* Prepare our students for graduate study and self development over an entire career, and

*Preparation for Service:* Develop in our students the awareness, background, and skills necessary to become responsible citizens, employees, and leaders

**Outcomes:**

An ability to apply knowledge of math, science, and engineering;
An ability to design and conduct experiments;
An ability to design a system or components to meet desired needs;
An ability to identify, formulate, and solve engineering problems;
An ability to use techniques, skills, and modern engineering tools necessary for engineering practice;
An ability to function on multidisciplinary teams;
An ability to communicate effectively;
A recognition of the need for and an ability to engage in life-long learning;
Background necessary for admission to top professional graduate engineering or business programs;
An understanding of professional and ethical responsibility;
The broad education necessary to understand the impact of engineering solutions in a global and societal context; and
A knowledge of contemporary issues pertinent to the field of management science and engineering.

# PROGRAM DESCRIPTION

The program builds on the foundational courses for engineering including calculus, engineering fundamentals, and physics or chemistry. The department core, taken for all concentrations, includes courses in computer science, information, organization theory, mathematical modeling, optimization, probability, statistics, and finance or production. Through the core, all students in the program are exposed to the breadth of faculty interests, and are in a good position to choose a concentration during the junior year.

The five concentrations are designed to allow a student to explore one area of the department in greater depth. They are:

1. *Financial and Decision Engineering:* Focuses on the design and analysis of financial and strategic plans. It features accounting, decision analysis, economics, finance, investment science, and stochastic models.
2. *Operations Research:* Provides a more mathematical program, based on algorithms, theory, and applications in economics and operations.
3. *Organization, Technology, and Entrepreneurship:* Focuses on the understanding and design of organizations, particularly technology-based issues. It features courses on innovation, product development, and entrepreneurship as well as work and manufacturing systems, and information systems and human-computer interaction.
4. *Production and Operations Management:* Focuses on the design and analysis of manufacturing, production and service systems.
5. *Policy and Strategy:* Focuses on the design and analysis of public policies and corporate strategies, especially those with technology-based issues. It features grounding in microeconomics and modeling approaches as well as courses with a policy focus in topics such as national security, energy and environment, and health care and courses with a strategy focus in topics such as entrepreneurship, innovation, and product development.

The program for students in all concentrations builds on a strong engineering foundation. The required mathematics courses include calculus of single and multiple variables, linear algebra, probability, statistics, and stochastic models. At least eleven units of science are required, including two courses in chemistry or physics. The required and elective mathematics and science requirements can be met by the approved courses, listed earlier in this handbook, or by PHYSICS 21, 22, 23, 24, 25, or 26, PSYCH 55 (cognitive psychology) or 70 (social psychology), or AP credit for chemistry, mathematics, or physics (AP units must be approved by the SoE Dean's office in 201 Terman).

The program includes three Engineering Fundamental courses, in addition to the two engineering fundamental courses included in the department core, ENGR 60 and MS&E 111/ENGR 62. One of the fundamentals must be CS 106A, one is elective, and the other is either ENGR 40, which provides some background and lab experience in electrical engineering, ENGR 25, which presents basic science and engineering principles of biotechnology, or ENGR 80, which provides an overview of biological engineering focused on engineering analysis and design of biological processes.

The Technology in Society requirement is satisfied by a subset of the courses approved by the School of Engineering, particularly those that emphasize social responsibility (refer to the TIS table in this section or the asterisked items in Figure 3-3). Some of these courses are also included in some of the concentrations; any given course can be used to satisfy either the Technology in Society or depth requirement, but not both.

The Writing in the Major (WIM) requirement can be met by three restricted electives in the program, MS&E 152W, 193W, or 197. It is up to the students to ensure that their programs include at least one of them, either in their concentrations or their Technology in Society courses. Students are welcome to take more than one WIM course, and WIM courses can be used to satisfy other requirements.

The department core comprises courses in computer science, deterministic optimization, information, organization theory, a senior project, and finance or production. Students in Financial and Decision Engineering must take two finance courses including MS&E 142. Students in Production and Operations Management must take MS&E 260. Students in Operations Research must take both MS&E 142 and MS&E 260.

Some of the concentrations include courses with prerequisites (ECON 1 or PSYCH 1) not included in the degree program, but those courses could be used to satisfy the General Education Requirements (GERs).

Although there are prerequisites for most MS&E courses, we encourage students to take some MS&E courses in their freshman and sophomore year to learn more about the department. Introductory courses without prerequisites include MS&E 107, 152, and 180. Introductory courses with calculus prerequisites include: E60, MS&E 111, and MS&E 120.

For information about an MS&E minor, see the "Minors and Honors" section in this Handbook.
In addition to the B.S. degree, the MS&E Department offers Master of Science and Doctor of Philosophy degrees in Management Science and Engineering.
If you would like more information about our degree programs, please visit Lori Cottle, the MS&E Student Services Manager, in Terman Engineering Center Room 306. Students are encouraged to plan their academic programs as early as possible, ideally in the freshman or sophomore year. Please do not wait until you are declaring a major to consult with us. This is particularly important if you would like to study overseas or pursue another major or minor.

## RESEARCH EXPERIENCE FOR UNDERGRADUATES

Our Research Experience for Undergraduates (REU) program offers students the opportunity to work closely with a faculty member during the summer quarter, and get paid to do so full-time. We give priority to our declared majors for REU positions. Information is emailed to all declared majors when applications become available during the winter quarter.

## REQUIREMENTS: BACHELOR OF SCIENCE DEGREE IN MS&E

**MATH AND SCIENCE (45 UNITS MINIMUM)**

| COURSE | TITLE | UNITS | QTR. |
|---|---|---|---|
| **MATH (all listed courses; 32 units minimum)** | | | |
| MATH 41 | Single Variable Calculus (AP/IB credit may be used) | 5 | A |
| MATH 42 | Single Variable Calculus (AP/IB credit may be used) | 5 | A,W |
| MATH 51 | Linear Algebra and Diff. Calculus of Several Vars. | 5 | A,W,S |
| MATH 53 | Ordinary Differential Equations with Linear Algebra | 5 | A,W,S |
| STATS 110 | Statistical Methods in Engineering and the Physical Sciences | 4-5 | A |
| *or* STATS 200 | Introduction to Statistical Inference | 3 | W |
| MS&E 120 | Probabilistic Analysis | 5 | A |
| MS&E 121 | Introduction to Stochastic Modeling | 4 | W |

| | | | |
|---|---|---|---|
| **Science (11 units minimum)** | | | |
| *One of the following three eight-unit sequences:* | | | |
| CHEM 31B/X | Chemical Principles (AP/IB credit may be used) | 4 | A,W |
| *and* CHEM 33 | Structure and Reactivity | 4 | W,S |
| PHYS 21&22 | Mechanics and Heat & Lab (AP/IB credit may be used) | 4 | A |
| *and* PHYS 23&24 | Electricity and Optics & Lab (AP/IB credit may be used) | 4 | W |
| PHYS 41 | Mechanics (AP Physics C /IB credit may be used) | 4 | W |
| *and* PHYS 43 | Electricity and Magnetism (AP Physics C/IB credit may be used) | 4 | S |
| *And also* Science Elective from SoE approved list (Fig. 3-2), or PSYCH 55, or PSYCH 70 | | 3 | A,W,S |

Additional Math or Science elective, if needed to reach 45 total units, from the SoE approved lists, or PSYCH 55 or 70.

**TECHNOLOGY IN SOCIETY (ONE COURSE, 3-5 UNITS)**

| COURSE | TITLE | UNITS | QTR. |
|---|---|---|---|
| STS 101/101Q | Science, Technology, and Contemporary Society | 4-5 | A |
| STS 110 | Ethics and Public Policy | 5 | W |
| STS 115 | Ethical Issues in Engineering | 4 | S |
| COMM 120 | Digital Media in Society | 5 | S |
| COMM 169 | Computers and Interfaces: Psychological and Social Responsibility Issues | 5 | W |
| CS 181 | Computers, Ethics, and Public Policy | 3-4 | S |
| MS&E 181 | Issues in Technology and Work for a Post-Industrial Economy | 3 | A |
| MS&E 193 | Technology in National Security | 3 | A |

**ENGINEERING FUNDAMENTALS (AT LEAST 3 COURSES; 11-15 UNITS)**

| COURSE | TITLE | UNITS | QTR |
|---|---|---|---|
| CS 106A | Programming Methodologies (AP/IB credit may be used) | 5 | A,W,S |
| ENGR 25 | Biotechnology | 3 | S |
| *or* ENGR 40 | Introductory Electronics | 5 | A,S |
| *or* ENGR 80 | Introduction to Bioengineering | | S |
| One other engineering fundamental from SoE approved list (E60 and E62 may not be used) | | 3-5 | A,W,S |

**WRITING IN THE MAJOR (ONE COURSE)**

MS&E 152W, MS&E 193W, and MS&E 197, taken as TIS or depth, fulfill requirement.

**ENGINEERING DEPTH: CORE (7 COURSES; 25-29 UNITS)**

| COURSE | TITLE | UNITS | QTR. |
|---|---|---|---|
| CS 106B/X or | Programming Abstractions | 5 | A,W,S |
| CS 103 or | Mathematical Foundations of Computing | 5 | W |
| CME 108 | Introduction to Scientific Computing | 3-4 | W |
| ENGR 60 | Engineering Economy | 3 | A,W |
| MS&E 108 | Senior Project | 5 | W |
| MS&E 111 | Introduction to Optimization | 4 | A,S |
| MS&E 130 *or* | Information Systems and Networks *or* | 3 | S |
| MS&E 134 | Organizations and Information Systems | 4 | W |
| MS&E 142 *or* | Investment Science *or* | 3 | A |
| MS&E 260 | Analysis of Production and Operating Systems | 4 | A |
| MS&E 180 | Organizations: Theory and Management | 4 | A,S |

## ENGINEERING DEPTH: CONCENTRATION (24-32 UNITS)

**Choose one of the following five concentrations**:

### FINANCIAL AND DECISION ENGINEERING (7 COURSES; 27-30 UNITS)

| COURSE | TITLE | UNITS | QTR. |
|---|---|---|---|
| *Students must choose MS&E 142 in Engineering Depth – Core (above)* | | | |
| ECON 50 | Economic Analysis I | 5 | A,W,S |
| ECON 51 | Economic Analysis II | 5 | W,S |
| MS&E 140 | Accounting for Managers and Entrepreneurs | 4 | A,W |
| MS&E 152 | Introduction to Decision Analysis (WIM) | 4 | S |
| MS&E 245G *or*<br>MS&E 247S | Finance I *or*<br>International Investments | 4<br>3 | A<br>Sum |
| *Two of the following seven courses:* | | | |
| ENGR 145 | Technology Entrepreneurship | 4 | A,W |
| *or* FINANCE 323 | International Financial Management | 4 | W |
| *or* MS&E 107 | Interactive Management Science | 3 | A |
| *or* MS&E 223 | Simulation | 3 | S |
| *or* MS&E 250A | Engineering Risk Analysis | 3 | W |
| *or* MS&E 260 | Production and Operating Systems | 4 | A |

### OPERATIONS RESEARCH (8 COURSES; 24-27 UNITS)

| COURSE | TITLE | UNITS | QTR. |
|---|---|---|---|
| MATH 113 | Linear Algebra and Matrix Theory | 3 | A,W |
| MATH 115 | Functions of a Real Variable | 3 | A,W |
| MS&E 112 | Network and Integer Optimization | 3 | W |
| MS&E 142 | Investment Science (cannot also be used for core) | 3 | A |
| *or* MS&E 260 | Production and Operating Systems (cannot also be used for core) | 4 | A |
| MS&E 152 | Introduction to Decision Analysis | 3-4 | S |
| MS&E 241 | Economic Analysis | 3-4 | W |
| MS&E 251 | Stochastic Decision Models | 3 | W |
| STATS 202 | Data Analysis | 3 | A |

### ORGANIZATION, TECHNOLOGY, AND ENTREPRENEURSHIP (7 COURSES; 24-29 UNITS)

| COURSE | TITLE | UNITS | QTR. |
|---|---|---|---|
| *At least one of the following three courses:* | | | |
| ECON 50 | Economic Analysis I | 5 | W,S |
| PSYCH 70 | Introduction to Social Psychology | 4 | S |
| SOC 114 | Economic Sociology | 5 | A |
| *At least two of the following three courses:* | | | |
| ENGR 145 | Technology Entrepreneurship | 4 | A,W |
| MS&E 175 | Innovation, Creativity, and Change | 4 | W |
| MS&E 181 | Issues in Technology and Work | 4 | S |
| *At least 4 of the following 7 courses (may also include omitted course from above: ENGR 145, MS&E 175, or MS&E 181):* | | | |
| *Organizations and Technology:* | | | |
| CS 147 | Introduction to Human-Computer Interaction Design | 3-4 | A |
| MS&E 134 | Organizations and Information Systems (cannot also be used for core) | 4 | W |
| MS&E 184 | Technology and Work | 3 | S |
| MS&E 185 | Global Work | 4 | S |
| MS&E 189 | Social Networks | 3-4 | A |
| MS&E 269 | Quality Engineering (not given 2009-10) | 4 | |
| *Entrepreneurship and Innovation:* | | | |
| MS&E 140 | Accounting for Managers and Entrepreneurs | 3-4 | A,W |

| | | | |
|---|---|---|---|
| MS&E 179 | Entrepreneurship and Strategy | 4 | S |
| MS&E 266 | Management of New Product Development | 3-4 | W |

**POLICY AND STRATEGY (7 COURSES; 27-32 UNITS)**

| COURSE | TITLE | UNITS | QTR. |
|---|---|---|---|
| ECON 50 | Economic Analysis I | 5 | A,W,S |
| ECON 51 | Economic Analysis II | 5 | A,W |
| MS&E 190 | Policy and Strategy Analysis | 5 | S |
| *At least four of the following nine courses, including at least one course in policy and at least one course in strategy:* | | | |
| *Policy:* | | | |
| MS&E 193 | Technology and National Security | 3 | A |
| MS&E 197 | Ethics and Public Policy | 5 | W |
| MS&E 243 | Energy and Environmental Policy Analysis | 3 | S |
| MS&E 248 | Economics of Natural Resources | 3-4 | A |
| MS&E 292 | Health Policy Modeling | 3 | W |
| *Strategy:* | | | |
| ENGR 145 | Technology Entrepreneurship | 4 | A,W |
| MS&E 175 | Innovation, Creativity, and Change | 3-4 | W |
| MS&E 266 | Management of New Product Development | 3-4 | W |

**PRODUCTION AND OPERATIONS MANAGEMENT (7 COURSES; 26-30 UNITS)**

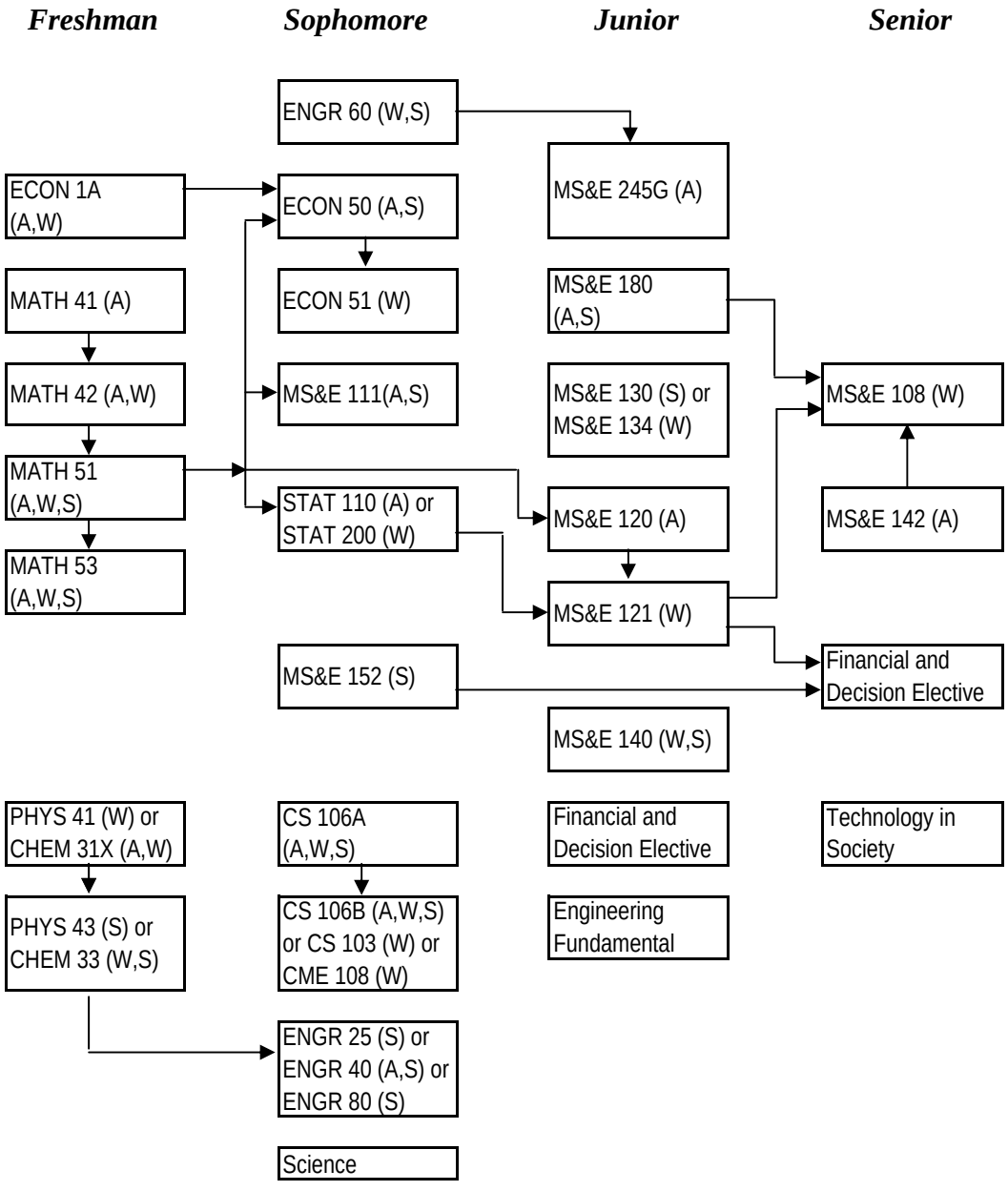
| COURSE | TITLE | UNITS | QTR. |
|---|---|---|---|
| *Students must choose MS&E 160 in Engineering Depth – Core (above)* | | | |
| ECON 50 | Economic Analysis I | 5 | A,W,S |
| ECON 51 | Economic Analysis II | 5 | W,S |
| MS&E 140 | Accounting for Managers and Entrepreneurs | 3-4 | A,W |
| MS&E 152 | Introduction to Decision Analysis | 4 | S |
| *Three of the following nine courses:* | | | |
| MS&E 142 | Investment Science | 3 | A |
| *or* MS&E 245G | Finance I | 4 | A |
| MS&E 262 | Supply Chain Management | 3 | S |
| MS&E 263 | Internet-Enabled Supply Chains (not given 2009-10) | 3 | |
| MS&E 264 | Sustainable Product Development and Manufacturing | 3 | A |
| MS&E 265 | Supply Chain Logistics | 4 | S |
| MS&E 266 | Management of New Product Development | 3-4 | W |
| MS&E 268 | Operations Strategy | 3 | S |
| MS&E 269 | Quality Engineering (not given 2009-10) | 4 | |

Engineering fundamentals, engineering depth (core), and engineering depth (concentration) must total a minimum of 60 units.

Courses used to satisfy the math, science, technology in society, or engineering fundamental requirements may not also be used to satisfy an engineering depth requirement.

# MS&E: Financial and Decision Engineering

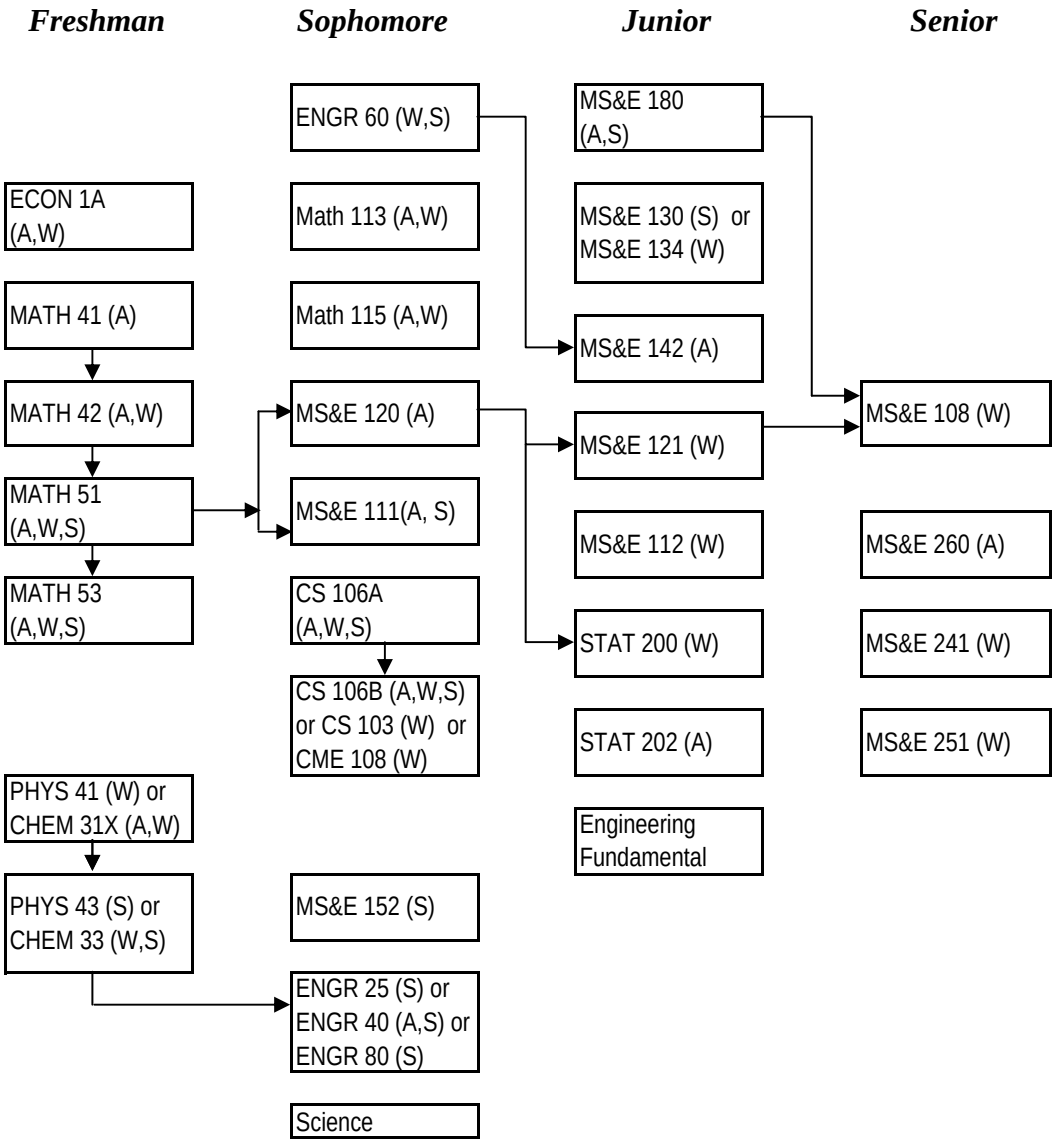
*Typical Sequence of Courses*




* Arrows represent direct prerequisites

# MS&E: Operations Research

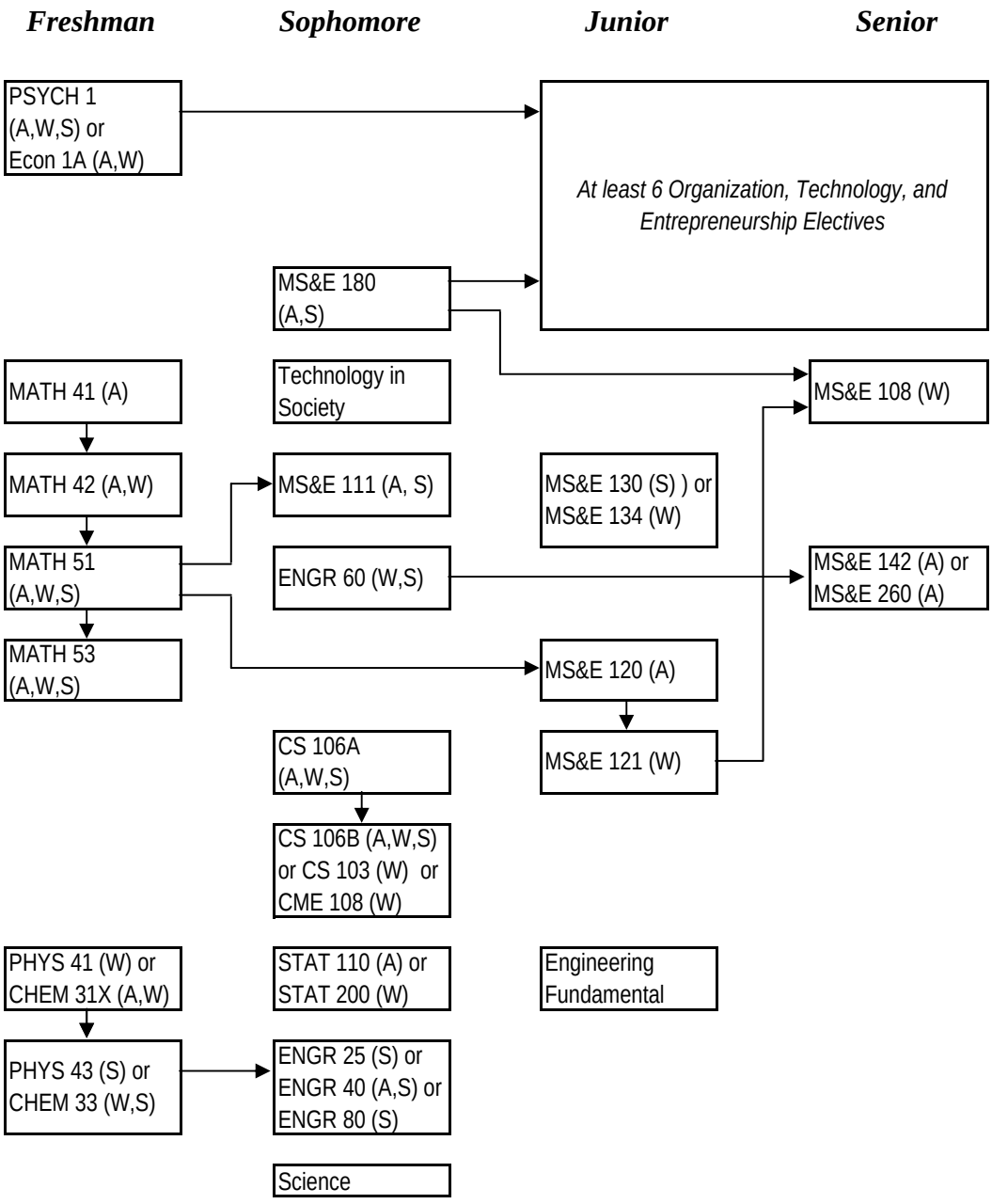
*Typical Sequence of Courses*




* Arrows represent direct prerequisites

# MS&E: Organization, Technology, and Entrepreneurship

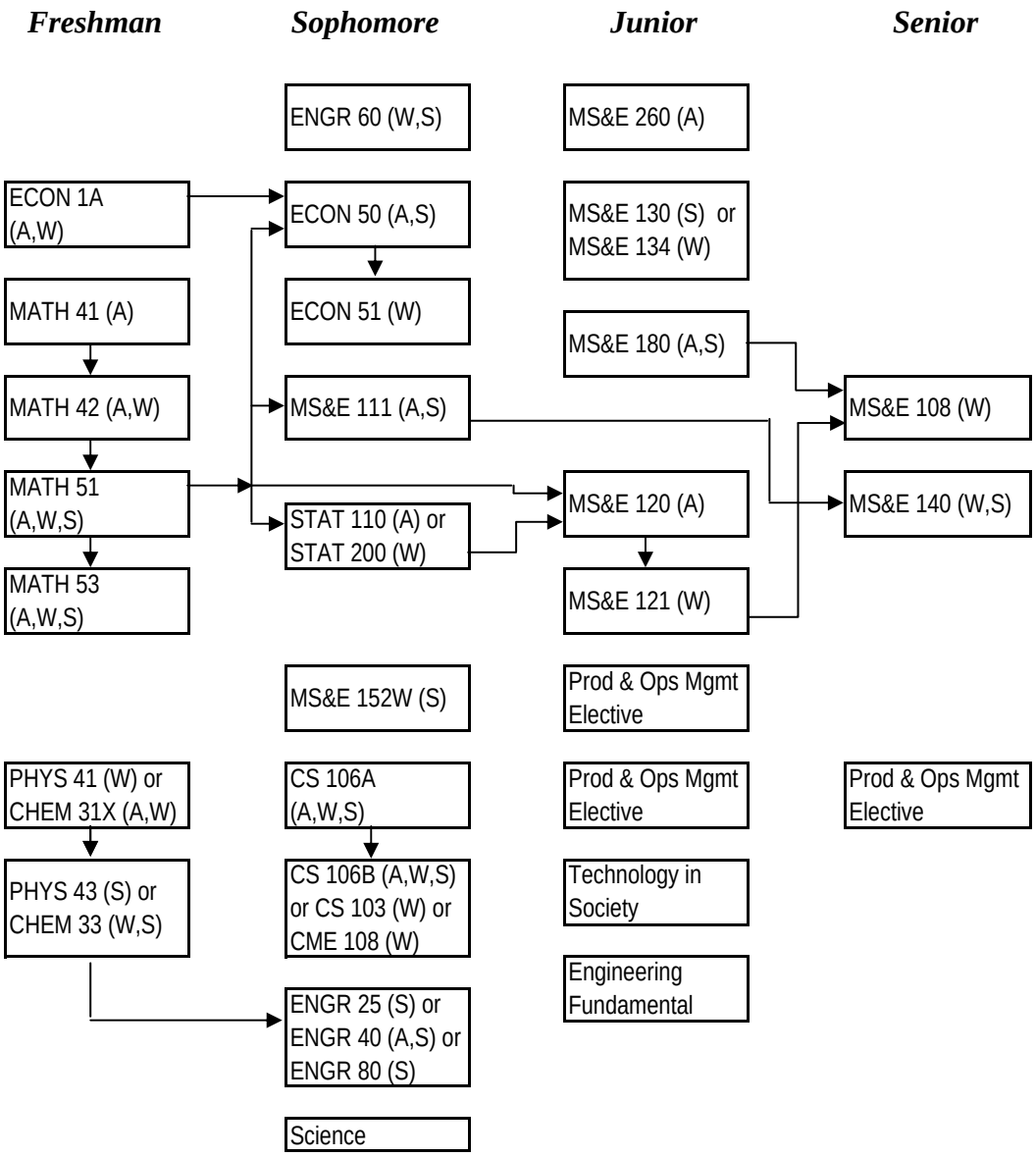
*Typical Sequence of Courses*




* Arrows represent direct prerequisites

# MS&E: Production and Operations Management

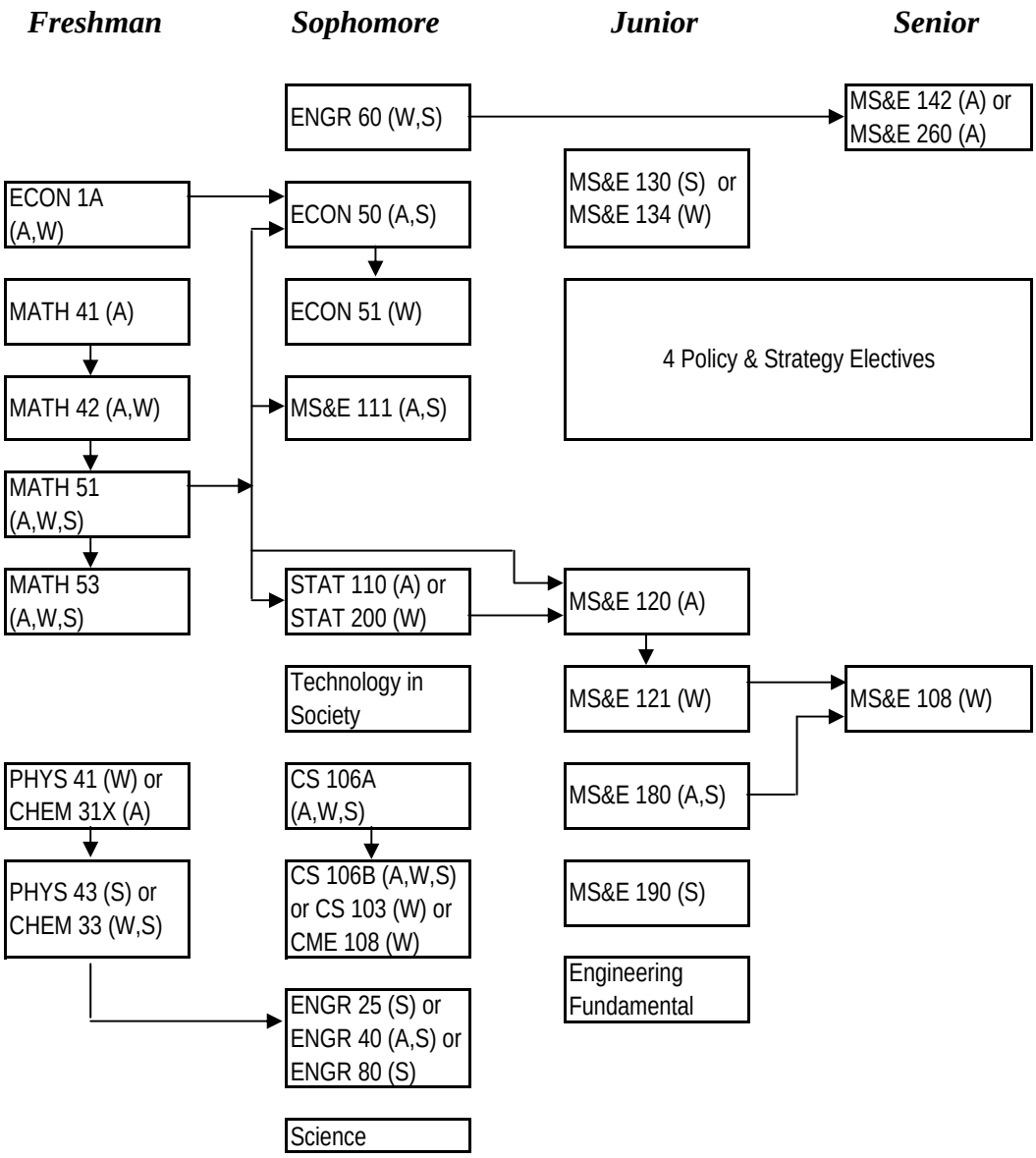
*Typical Sequence of Courses*




* Arrows represent direct prerequisites

# MS&E: Policy & Strategy

*Typical Sequence of Courses*




* Arrows represent direct prerequisites

# Management Science & Engineering

*Sample Program Without AP/IB Math Credit*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | PWR 1 | - | - | 4 |
| | Electives | - | - | 6 | ECON 1/PSYCH 1 | - | - | 5 | MATH 51 | 5 | - | - |
| | *Subtotals* | *5* | *0* | *10* | *Subtotals* | *5* | *0* | *9* | *Subtotals* | *5* | *0* | *8* |
| | Total | | | 15 | Total | | | 14 | Total | | | 13 |
| *Sophomore* | MATH 53 | 5 | - | - | PHYS23&24/CH31X | 4 | - | - | Science/CHEM 33 | 4 | - | - |
| | STATS 110/200 | 5 | - | - | ENGR 60 | - | 3 | - | CS 106A | - | 5 | - |
| | PHYS 21&22/Sci | 4 | - | - | ECON 51/Concen | - | 5 | - | PWR 2 | - | - | 4 |
| | ECON 50/Concen | - | 5 | - | GER - DB-HUM | - | - | 4 | MS&E 152W/MS&E 180 | - | 4 | - |
| | *Subtotals* | *14* | *5* | *0* | *Subtotals* | *4* | *8* | *4* | *Subtotals* | *4* | *9* | *4* |
| | Total | | | 19 | Total | | | 16 | Total | | | 17 |
| *Junior* | MS&E 111 | - | 4 | - | MS&E 121 | 4 | - | - | E25/E40/E80 | | 3 | - |
| | MS&E 120 | 5 | - | - | MS&E 134/Concen | - | 4 | - | Fund. Elective | | 3 | - |
| | MS&E 180/Concen | - | 4 | - | Concentration/TIS | - | 4 | - | GER - EC1 | - | - | 4 |
| | Concentration | - | 3 | - | CS 103/106B/CME 108 | - | 4 | - | Elective | - | - | 5 |
| | *Subtotals* | *5* | *11* | *0* | *Subtotals* | *4* | *12* | *0* | *Subtotals* | *0* | *6* | *9* |
| | Total | | | 16 | Total | | | 16 | Total | | | 15 |
| *Senior* | MS&E 142 or 260 | - | 4 | - | MS&E 108 | - | 5 | - | Electives | - | - | 15 |
| | TIS/Concentration | - | 4 | - | Concentration | - | 4 | - | | | | |
| | Concentration | - | 4 | - | GER - EC2 | - | - | 3 | | | | |
| | *Subtotals* | *0* | *12* | *0* | *Subtotals* | *0* | *9* | *3* | *Subtotals* | *0* | *0* | *15* |
| | Total | | | 12 | Total | | | 12 | Total | | | 15 |

| | |
|---|---|
| Total Math & Science Units: | 46 |
| Total Engineering Units: | 72 |
| Total Other Units: | 62 |
| **Total Units:** | 180 |

# Management Science & Engineering

Sample Program With AP/IB Math Credit

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | MATH 51 | 5 | - | - | CHEM 31X/PHYS 41 | 4 | - | - | Elective | - | - | 3 |
| | Electives | - | - | 6 | ECON 1/PSYCH 1 | - | - | 5 | CHEM 33/PHYS 43 | 4 | - | - |
| | | | | | PWR 1 | - | - | 4 | MATH 53 | 5 | - | - |
| | *Subtotals* | *5* | *0* | *10* | *Subtotals* | *4* | *0* | *13* | *Subtotals* | *9* | *0* | *7* |
| | Total | | | 15 | Total | | | 17 | Total | | | 16 |
| *Sophomore* | STATS 110/200 | 5 | - | - | CS 106A | - | 5 | - | E25/E40/E80 | - | 3 | - |
| | Science Elective | 3 | - | - | ENGR 60 | - | 3 | - | CS 106B | - | 5 | - |
| | ECON 50/Concen | - | 5 | - | ECON 51/Concen | - | 5 | - | MS&E 111 | - | 4 | - |
| | GER - EC1 | - | - | 3 | PWR 2 | - | - | 4 | MS&E 152W (or MS&E 180) | - | 4 | - |
| | *Subtotals* | *8* | *5* | *3* | *Subtotals* | *0* | *13* | *4* | *Subtotals* | *0* | *16* | *0* |
| | Total | | | 16 | Total | | | 17 | Total | | | 16 |
| *Junior* | MS&E 120 | 5 | - | - | MS&E 121 | 4 | - | - | Fundamental | | 3 | - |
| | MS&E 180/Concen | - | 4 | - | MS&E 134/Elect | - | 4 | - | MS&E 130/Elect | - | - | 3 |
| | Concentration | - | 3 | - | Concentration/TIS | - | 4 | - | GER - EC2 | - | - | 4 |
| | Concentration | - | 3 | - | GER - DB-HUM | - | - | 3 | Elective | - | - | 4 |
| | *Subtotals* | *5* | *10* | *0* | *Subtotals* | *4* | *8* | *3* | *Subtotals* | *0* | *3* | *11* |
| | Total | | | 15 | Total | | | 15 | Total | | | 14 |
| *Senior* | MS&E 142 or 260 | - | 4 | - | MS&E 108 | - | 5 | - | Electives | - | - | 15 |
| | TIS/Concentration | - | 4 | - | Concentration | - | 4 | - | | | | |
| | Elective | - | - | 4 | Elective | - | - | 3 | | | | |
| | *Subtotals* | *0* | *8* | *4* | *Subtotals* | *0* | *9* | *3* | *Subtotals* | *0* | *0* | *15* |
| | Total | | | 12 | Total | | | 12 | Total | | | 15 |

| | |
|---|---|
| Total Math & Science Units: | 35 |
| Total Engineering Units: | 72 |
| Total Other Units: | 73 |
| **Total Units:** | 180 |

# INSTRUCTIONS FOR DECLARING MAJOR IN MANAGEMENT SCIENCE AND ENGINEERING

We encourage students to declare as early as possible if they are seriously considering the major. The process consists of discussing your plans with the Student Services Manager and meeting prospective advisors until you find a faculty member you want to work with. The MS&E major offers a wide variety of options and students can receive much better guidance once they have declared. Paperwork for the declaration process is available at

**http://www.stanford.edu/dept/MSandE/academics/bsdeclare.html.**

1. Complete the MS&E counseling form, available at **http://www.stanford.edu/dept/MSandE/academics/bsdeclare.html**.
2. Go into Axess and declare MS&E as your major. Your declaration will be routed to Lori Cottle, Student Services Officer, for approval. Online approval will be given after steps 1-5 are completed.
3. Meet with Lori Cottle in Terman 306 for a tentative advisor assignment or choose an advisor from the MS&E list of available advisors, available at **http://www.stanford.edu/dept/MSandE/academics/bsdeclare.html**.
4. Take the counseling form and an unofficial copy of your transcript or Axess grade printout to your new faculty advisor for a declaration advising session.
5. Bring the completed, signed form to Lori Cottle in Terman 306, who will then approve your online declaration. You will be sent an automatic email from the system after final approval has been given.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download the online MS&E program sheet from **ughb.stanford.edu** to ensure you are using an accurate major plan.

**Stanford University ♦ School of Engineering**

# Management Science & Engineering

**Concentration: _____**

## 2009-2010 Program Sheet

***Final Version of the completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirements**

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (32 units minimum)* | | | | | | | |
| MATH | 41 | Single Variable Calculus | | | | 5 | |
| MATH | 42 | Single Variable Calculus | | | | 5 | |
| MATH | 51 | Multi-Variable Calculus (req'd) | | | | 5 | |
| MATH | 53 | ODE with Linear Algebra (req'd) | | | | 5 | |
| MS&E | 120 | Probabilistic Analysis (req'd) | | | | 5 | |
| MS&E | 121 | Intro to Stochastic Modeling (req'd) | | | | 4 | |
| STAT | | 110 or 200 (req'd) | | | | 5 | |
| | | | | | *Mathematics Unit Total (32 units minimum)* | | |
| *Science (11 units minimum; see Note 1)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Science Unit Total (11 units minimum)* | | |
| | | | | | *Mathematics and Science Unit Total (45 units minimum)* | | |

**Technology in Society Requirement** *(1 course req'd; see note 2)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**NOTES**

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.
* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to Eng
* All courses listed on this form must be taken for a letter grade if offered by the instructor.
* Minimum Combined Grade Point Average for all courses in Engineering Fundamentals and Engineering Depth is 2.0.
* Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's office. Transfer credits in Engineering Depth must be approved by the Department. Transfer credit information and petitions are available at http://ughb.stanford.edu.
* All courses listed on this form must only be included under one category. Delete courses not taken.

( 1 ) Eleven units of science required; must include PHYS 43/45, or PHYS 21/22/23/24, or CHEM 31X/33, or CHEM 31B/33.

( 2 ) MS&E-approved TIS courses: STS 101/201, 101Q, 110, 115, COMM 120, 169, CS 181, MS&E 181, 193.

*program sheet continues on page 2*

## Management Science and Engineering Program Sheet (continued)

### Engineering Fundamentals and Engineering Depth

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Engineering Fundamentals (3 courses required)* | | | | | | | |
| CS | 106A | Programming Methodology (req'd) | | | | 5 | |
| ENGR | | 25 or 40 or 80 (req'd) | | | | | |
| ENGR | | | | | | | |
| | | | | | *Engineering Fundamentals Unit Total* | | |
| *Engineering Depth (7 courses required; no course may be listed more than once; no double-counting)* | | | | | | | |
| | | CS 103, 106B/X, or CME 108 (req'd) | | | | | |
| ENGR | 60 | Engineering Economy (req'd) | | | | 3 | |
| MS&E | 108 | Senior Project (req'd) | | | | 5 | |
| MS&E | 111 | Intro to Optimization (req'd) | | | | 4 | |
| MS&E | | 130 or 134 (req'd) | | | | | |
| MS&E | | 142 or 260 (req'd) | | | | | |
| MS&E | 180 | Organizations (req'd) | | | | 4 | |
| *Engineering Depth Concentration (7-8 courses required; see note 3)* | | | | | | | |
| Circle one concentration: F&DE OR OTE POM T&P | | | | | | | |
| | | | | | | | |
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| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Engineering Unit Total* | | |

**Program Totals**

| | |
|---|---|
| *Mathematics and Science (45 units minimum)* | |
| *Engineering Fundamentals and Engineering Depth (between 60 and 72 units)* | |

### Program Approvals

*Advisor/Student Services*

Advisor Name: _____ Date: _____

Signature: _____

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 3 ) The "Writing in the Major" requirement will normally be fulfilled through a course taken in the concentration or for the Technology in Society requirement.

# MATERIALS SCIENCE AND ENGINEERING

Materials Science and Engineering (MSE) is concerned with the relation between the structure, processing and properties of useful materials. One important goal of this work involves the development of processes for altering the structure of materials and thereby controlling their properties. This field brings together, in a unified discipline, developments in Physics, Chemistry and Biology that can be, and in fact are, applied to modern materials of technological, engineering, and scientific significance. Materials scientists and engineers utilize a distinctive suite of characterization techniques that probe materials structure down to the atomic level. Moreover, our faculty is becoming increasingly involved with nano-technology, energy-related materials and bio-chemical processing.

Students who are interested in both science and its application to important technological problems should consider a career in Materials Science and Engineering. The Undergraduate Program described here has a dual function. It provides basic training for those who wish to become materials engineers, and it provides a foundation for more advanced work in the field. Such advanced study enables students to respond effectively to technological change. Able undergraduate Materials Science and Engineering students are encouraged to take at least one year of graduate study in the Stanford co-terminal degree program (see Chapter 7: Other Degree Programs) to extend their coursework and to obtain training in research. Conterminal degree programs are also recommended for any related undergraduate majors. Current research strengths of the department include nano-scale materials, energy and environmental materials, transmission electron microscopy, microelectronic materials science, structure and properties of thin film materials, semiconductors, magnetic materials, photovoltaic and photonic materials, mechanics and mechanical properties of solids, synthesis and applications of nanostructured materials, and computer modeling of materials behavior and processing of metals and alloys.

## MAJOR REQUIREMENTS FOR MSE UNDERGRADUATES

On the School of Engineering (SoE) side, mathematics is required through Math 51 and 52, (or CME 100/ENGR154 and CME 104/ENGR155B); AND Math 53 (or CME 102/ENGR155A). Science consists of either a full year of physics or chemistry, with a quarter of study in the other subject. One Technology in Society (TIS) course, and three engineering fundamental courses, with MATSCI 50 or 50M required, wrap up the SoE requirements.

On the Department of Materials Science and Engineering (MSE depth) side, the core curriculum is made up of the MATSCI 150 series of lecture courses that are designed primarily for undergraduate students, and the MATSCI 190 series that represents more advanced courses. Starting this year, four of the core courses, MATSCI 153, 154, 155 and 157 are required out of the six for the MSE Fundamentals. The curriculum also provides much needed research exposure to the students through the MATSCI 160 series of laboratory courses, of which four are required for the MSE Depth. Students will also choose one Focus Area Option for more in-depth study from ten option groups of courses. We are introducing a new option area in Nanoscience this year.

Please note that undergraduates may complete a major in Materials Science and Engineering using the requirements in any one handbook that is published while they are undergraduates.

## RESEARCH EXPERIENCE FOR UNDERGRADUATES

It is possible for students to participate in current research projects with the department faculty and their research groups. The department plans to continue its summer research program through a grant from the Vice Provost for Undergraduate Education in the 2009-2010 year. Information about individual programs may be obtained from the MSE department home page. Arrangements may also be made by direct consultation with the relevant professor. Please contact Prof. Seung Min Han at smhan@stanford.edu for any questions.

Students who wish to receive further information about the programs in Materials Science and Engineering should contact:

Professor Bob Sinclair (**bobsinc@stanford.edu**) or
Professor. Seung Min Han (**smhan@stanford.edu**)
Department of Materials Science and Engineering (MSE)
496 Lomita Mall, William F. Durand Building
Stanford University
Stanford, CA 94305-4034

# REQUIREMENTS FOR UNDERGRADUATES IN MATERIALS SCIENCE AND ENGINEERING

## School of Engineering (SoE) Requirements

This group of requirements (math, science, TIS, and Engineering Fundamentals) is monitored by the SoE and is required for all engineering majors. Petitions to transfer credit, deviate from the requirements, or approve appropriate AP credit must be made to the SoE Dean's Office of Student Affairs in Terman 201.

### Mathematics and Science (40 units combined, minimum)

- Math (20 units minimum): Must include Math 51 and 52 or CME100/ENGR 154 and CME 104/ENGR 155B AND Math 53 or CME 102/ENGR 155A (See Figure 3-1 for SoE approved list of courses)
- Science (20 units minimum): Must include a full year of either physics or chemistry, with at least one quarter of study in the other subject. AP credit is also acceptable and must be approved by the Dean's office (see Chapter 3, Figure 3-2 for a list of SoE approved courses).

### Technology in Society (One course; 3-5 units)

See the "Approved Courses" section of this handbook, Chapter 3, Figure 3-4, for courses that fulfill the TIS requirement.

### School of Engineering (SoE) Fundamentals

**(Three courses minimum: ENGR 50 or 50M and two electives)**

| Course | Title | Units |
|---|---|---|
| ENGR 14 *OR* 15 | Applied Mechanics: Statics *or*:Dynamics | 3 |
| ENGR 20 | Introduction to Chemical Engineering | 3 |
| ENGR 25 | Biotechnology | 3 |
| ENGR 30 | Engineering Thermodynamics | 3 |
| ENGR 40 | Introductory Electronics | 5 |
| ENGR 50 *OR* 50M | Introduction to Materials Science, Nanotechnology *OR* | 4 |
| (required)<br>ENGR 60 *OR* 62 | Biomaterials Emphasis<br>Engineering Economy *or* Introduction to Optimization | 3-4 |
| ENGR 70A *OR* | Programming Methodology *OR* Methodology (same as CS 106A | 5 |
| 70B *OR* 70X<br>ENGR 80 | *OR* CS 106B *OR* 106X)<br>Introduction to Bioengineering | 3 |
| | | |

**TOTAL SCHOOL OF ENGINEERING UNITS 53-59**

## Departmental Requirements: MSE Fundamentals, Depth, & Focus Area Options

These requirements are specified and monitored by the department of Materials Science and Engineering. Petitions for exceptions must be made to the department.

The MATSCI 150 series represents a stand alone curriculum which is recommended for undergraduates. The 190 series courses can be substituted for the equivalent 150 series courses, or can be taken as follow-on courses. MATSCI 153, 154, 155 and 157 are required MSE fundamentals.

**MSE FUNDAMENTALS** (24 UNITS FROM SIX OF THE FOLLOWING LECTURE-BASED COURSES)

| Course | Title | Units |
|---|---|---|
| *Undergraduate Core Courses:* | | |
| ENGR 50/50M *OR* MATSCI 70N** | Introduction to Materials Science *OR* Building Future – Invention and Innovation with Engineering Materials ** See note below | 4 |
| MATSCI 151 | Microstructure and Mechanical Properties | 4 |
| MATSCI 152 | Electronic Materials Engineering | 4 |
| MATSCI 153 | Nanostructure and Characterization (required) | 4 |
| MATSCI 154 | Solid State Thermodynamics*** (required) | 4 |
| MATSCI 155 | Nanomaterials Synthesis (required) | 4 |
| MATSCI 156 | Solar Cells, Fuel Cells, and Batteries: Materials for the Energy Solution | 4 |
| MATSCI 157 | Quantum Mechanics of Nanoscale Materials (required) | 4 |
| *Advanced Level Courses:* | | |
| MATSCI 190 | Organic and Biological Materials | 4 |
| MATSCI 192 | Materials Chemistry | 4 |
| MATSCI 193 | Atomic Arrangements in Solids | 4 |
| MATSCI 194 | Thermodynamics and Phase Equilibria | 4 |
| MATSCI 195 | Waves and Diffraction in Solids | 4 |
| MATSCI 196 | Imperfections in Crystalline Solids | 4 |
| MATSCI 197 | Rate Processes in Materials | 4 |
| MATSCI 198 | Mechanical Properties of Materials | 4 |
| MATSCI 199 | Electronic and Optical Properties of Solids | 4 |

** Students may choose to count the second ENGR 50/50M course (one must be taken as an SoE fundamental requirement) OR MATSCI 70N as part of the MSE fundamental requirements.

*** ENGR 30 can be substituted for MATSCI 154, but cannot be used for both engineering fundamentals and MSE fundamentals requirements.

**MSE DEPTH** (16 UNITS FROM FOUR OF THE FOLLOWING LABORATORY-BASED COURSES)

| Course | Title | Units |
|---|---|---|
| MATSCI 160 | Nanomaterials Laboratory | 4 |
| MATSCI 161 | Nanocharacterization Laboratory (satisfies WIM requirement) | 4 |
| MATSCI 162 | X-Ray Diffraction Laboratory | 4 |
| MATSCI 163 | Mechanical Behavior Laboratory | 4 |
| MATSCI 164 | Electronic & Photonic Materials and Devices Lab (satisfies WIM req't) | 4 |

## FOCUS AREA OPTIONS (CHOOSE 10 UNITS FROM ONE OF THE FOLLOWING 9 OPTION AREAS)

### BIOENGINEERING OPTION

| Course | Title | Units |
|---|---|---|
| BIOE 220 | Imaging Anatomy | 3 |
| BIOE 281 | Biomechanics of Movement | 3 |
| BIOE 284A/B | Cardiovascular Bioengineering | 3-6 |
| BIOE 333 | Interfacial Phenomena and Bionanotechnology | 3 |
| BIOE 381 | Orthopaedic Bioengineering | 3 |
| MATSCI 190 | Organic and Biological Materials | 4 |
| MATSCI 380 | Nano-Biotechnology | 3 |
| MATSCI 381 | Biomaterials in Regenerative Medicine | 3 |

### CHEMICAL ENGINEERING OPTION

| Course | Title | Units |
|---|---|---|
| CHEM 171 | Physical Chemistry | 3 |
| CHEMENG 130 | Separation Processes | 3 |
| CHEMENG 140 | Microelectronics Processing Technology | 3 |
| CHEMENG 150 | Biochemical Engineering | 3 |
| CHEMENG 160 | Polymer Science and Engineering | 3 |

### CHEMISTRY OPTION

| Course | Title | Units |
|---|---|---|
| CHEM 151, 153 | Inorganic Chemistry I & II | 6 |
| CHEM 171, 173, 175 | Physical Chemistry | 9 |
| CHEM 181, 183, 185 | Biochemistry I, II & III | 9 |

### ELECTRONICS AND PHOTONICS OPTION

| Course | Title | Units |
|---|---|---|
| EE 101A/B | Circuits I/II | 4-8 |
| EE 102A/B | Signal Processing and Linear Systems I/II | 4-8 |
| EE 116 | Semiconductor Device Physics | 3 |
| EE 134 | Introduction to Photonics | 4 |
| EE 136 | Introduction to Nanophotonics and Nanostructures | 3 |
| EE 141 | Engineering Electromagnetics | 4 |

### ENERGY TECHNOLOGY OPTION

| Course | Title | Units |
|---|---|---|
| EE 293A/B | Fundamentals of Energy Processes | 3-6 |
| MATSCI 302 | Solar Cells | 3 |
| ME 260 | Fuel Cell Science Technology | 3 |

### MATERIALS CHARACTERIZATION TECHNIQUES OPTION

| Course | Title | Units |
|---|---|---|
| MATSCI 320 | Nanocharacterization of Materials | 3 |
| MATSCI 321 | Transmission Electron Microscopy | 3 |
| MATSCI 323 | Thin Film and Interface Microanalysis | 4 |
| MATSCI 325 | X-Ray Diffraction | 3 |
| MATSCI 326 | X-Ray Science and Techniques | 3 |

**MECHANICAL BEHAVIOR AND DESIGN OPTION**

| Course | Title | Units |
|---|---|---|
| AA 240A/B | Analysis of Structures | 6 |
| AA 256 | Mechanics of Composites | 3 |
| MATSCI 198 | Mechanical Properties of Materials | 4 |
| MATSCI 358 | Fracture and Fatigue of Engineering Materials | 3 |
| ME 80 *OR*<br>CEE 101A | Strength of Materials *OR*<br>Mechanics of Materials | 4 |
| ME 203 | Manufacturing and Design (was ME 103) | 3-4 |
| ME 294 | Medical Device Design | 3 |

**NANOSCIENCE OPTION**

| Course | Title | Units |
|---|---|---|
| BIOE 333 | Interfacial Phenomena and Bionanotechnology | 3 |
| EE 136 | Introduction to Nanophotonics and Nanostructures | 3 |
| ENGR 240 | Introduction to Micro and Nano Electromechanical Systems | 3 |
| MATSCI 316 | Nanoscale Science, Engineering and Technology | 3 |
| MATSCI 320 | Nano-characterization of Materials | 3 |
| MATSCI 380 | Nano-Biotechnology | 3 |

**PHYSICS OPTION**

| Course | Title | Units |
|---|---|---|
| PHYSICS 70 | Foundations of Modern Physics | 4 |
| PHYSICS 110 | Intermediate Mechanics | 4 |
| PHYSICS 120, 121 | Intermediate Electricity and Magnetism | 8 |
| PHYSICS 130, 131 | Quantum Mechanics | 8 |
| PHYSCIS 134 | Advanced Topics in Quantum Mechanics | 4 |
| PHYSICS 170, 171 | Thermodynamics, Kinetic Theory & Statistical Mechanics | 8 |
| PHYSICS 172 | Solid State Physics | 3 |

**SELF-DEFINED OPTION** (MUST CONTAIN 10 UNITS)

Student may petition for approval of a self-defined option containing a minimum of 10 units that comprise a cohesive program of study.

**MSE MAJOR: MINIMUM UNIT TOTAL***

Combined units from the following group of courses **MUST TOTAL A MINIMUM OF 60 UNITS**:

SoE Fundamentals (10-14 units)

MSE Fundamentals (24 units)

MSE Depth (16 units)

Focus Area Options (10 units)

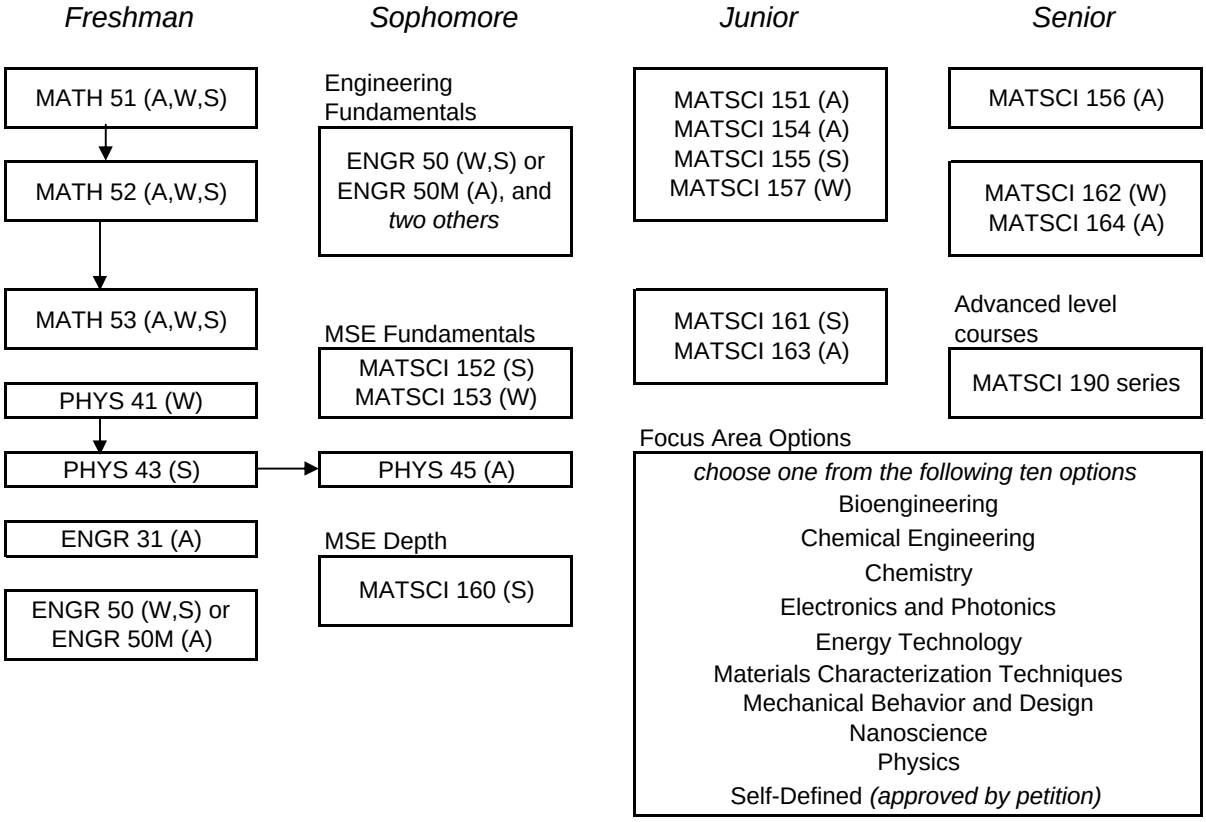
*If the focus area option contains only 9 units, but the combined MSE major unit total is at 60 or more, it will be allowed and no petition is necessary.

NO UNITS CAN BE COUNTED UNDER MORE THAN ONE CATEGORY

By adding these 60 units to the 40 required math and science units and the minimum of 3 units for the Technology in Society course, your Materials Science undergraduate major will require a minimum of 103 units of the 180 you need to graduate. Your advanced placement math and science units from high school can count toward the 40 units of basic math and science, thereby allowing you more electives during your Stanford career.

# Materials Science and Engineering

*Typical Sequence of Courses*



# Materials Science and Engineering

*Sample 4-Year Plan*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 51 | 5 | - | - | MATH 52 | 5 | - | - | MATH 53 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | E31 | 4 | - | - | Chem 33 | 4 | - | - | PHYS 43 | 4 | - | - |
| | Fr. Seminar | - | - | 4 | PHYS 41 | 4 | - | - | PWR 1 | - | - | 4 |
| | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *13* | *0* | *4* | *Subtotals* | *9* | *0* | *8* |
| | Total | | | 17 | Total | | | 17 | Total | | | 17 |
| *Sophomore* | E50M | - | 4 | - | MATSCI 153 | - | 4 | - | MATSCI 152 | - | 4 | - |
| | PHYS 45 | 4 | - | - | Engr. Fund | - | 3 | - | MATSCI 160 | - | 4 | - |
| | Engr. Fund | - | 3 | - | Soph. Seminar | - | - | 3 | PWR 2 | - | | 4 |
| | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | *Subtotals* | *4* | *7* | *5* | *Subtotals* | *0* | *7* | *8* | *Subtotals* | *0* | *8* | *9* |
| | Total | | | 16 | Total | | | 15 | Total | | | 17 |
| *Junior* | MATSCI 151 | - | 4 | - | MATSCI 157 | - | 4 | - | MATSCI 155 | - | 4 | - |
| | MATSCI 154 | - | 4 | - | Option Sequence | - | 3 | - | MATSCI 161 | - | 4 | - |
| | MATSCI 163 | - | 4 | - | GER | - | - | 4 | GER | - | - | 4 |
| | GER | - | - | 3 | GER | - | - | 3 | GER | - | - | 3 |
| | *Subtotals* | *0* | *12* | *3* | *Subtotals* | *0* | *7* | *7* | *Subtotals* | *0* | *8* | *7* |
| | Total | | | 15 | Total | | | 14 | Total | | | 15 |
| *Senior* | MATSCI 156 | - | 4 | - | MATSCI 162 | - | 4 | - | Option Sequence | | 4 | - |
| | MATSCI 164 | - | 4 | - | Tech in Society | - | 3 | - | 190s series | - | 4 | - |
| | Option Sequence | - | 3 | - | GER | - | - | 3 | GER | - | - | 3 |
| | *Subtotals* | *0* | *11* | *0* | *Subtotals* | *0* | *7* | *3* | *Subtotals* | *0* | *8* | *3* |
| | Total | | | 11 | Total | | | 10 | Total | | | 11 |

| | |
|---|---|
| AP Math Units: | 5 |
| UG Math & Science Units: | 35 |
| Total Engineering Units: | 75 |
| Total Other Units: | 65 |
| **Total Units:** | 180 |

# INSTRUCTIONS FOR DECLARING MAJOR IN MATERIALS SCIENCE AND ENGINEERING

- Declare major in Axess**.***
- Send email notice to Doris Chan, Student Services Specialist, at **dschan@stanford.edu,** notifying her of your major declaration and preference for a major advisor, if any.
- Download the MSE program sheet from **http://ughb.stanford.edu/** and fill it out. Print your unofficial Stanford transcript from Axess and attach to it.
- Meet with your major advisor to review the program sheet; have your advisor sign your program sheet to indicate your program is approved.
- Get Transfer/AP credit approval from the SoE Dean's Office of Student Affairs in Terman 201 if applicable.
- Return completed program sheet to Doris Chan at Durand Building, Room 111.

*We recommend that the major program sheet be completed within the same quarter of your major declaration (no later than the end of junior year), in order to assure that you graduate on time.*

*Stanford requires the declaration of a major by the end of sophomore year. The department will, of course, accept later declarations from students who change majors.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download the online MSE program sheet from **ughb.stanford.edu** to ensure you are using an accurate major plan.

**Stanford University ♦ School of Engineering**

# Materials Science and Engineering
# 2009–2010 Program Sheet

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirements

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Unit | Grade |
|---|---|---|---|---|---|---|---|
| *Mathematics (20 units minimum)* | | | | | | | |
| MATH | 51 and 52 or CME 100/ENGR 154 and CME 104/ENGR 155B (required) | | | | | 10 | |
| MATH | 53 or CME 102/ENGR 155A (required) | | | | | 5 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (20 units minimum)* | | |

*Science (20 units minimum; see note 1)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Science Unit Total (20 units minimum)* | | |
| | | | | | *Math and Science (40 units minimum)* | | |

**Technology in Society Requirement** (1 course required; see Figure 3-3 in UGHB for SoE approved list)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**Engineering Fundamentals** (3 courses required; see note 2)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENGR | 50 or 50M | Introduction to Materials Science (required) | | | | 4 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Engineering Fundamentals Total* | | |

**NOTES**

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.

* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to Eng

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Minimum Grade Point Average (GPA) for all courses in Engineering Fundamentals and Materials Science and Engineering Depth (combined) is 2.0.

* Transfer and AP credits in Math, Science, Engr. Funds., & TIS must be approved by the SoE Dean's Office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.

* All courses listed on this form must only be included under one category; no double-counting.

( 1 ) Must include a full year of physics or chemistry, with at least one quarter of study in the other subject.

( 2 ) If both ENGR 50 and 50M are taken, one may be used for Engr Funds and the other for MatSci Fundamentals.

*program sheet continues on page 2*

# Materials Science and Engineering Program Sheet (continued)

**MSE Engineering Depth** *(50 units minimum)*

| Dept | Course | Title | Transfer/AP Approval ✓ if Transfer | Initials | Date | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| *MSE Fundamentals (choose six lecture courses for 24 units)* | | | | | | | |
| MATSCI | 153 | Nanostructure and Characterization (required) | | | | 4 | |
| MATSCI | 154 | Solid State Thermodynamics (required) | | | | 4 | |
| MATSCI | 155 | Nanomaterials Synthesis (required) | | | | 4 | |
| MATSCI | 157 | Quantum Mechanics of Nanoscale Materials (required) | | | | 4 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Materials Science Fundamentals Unit Total (24 units)* | | |
| *MSE Depth (choose four laboratory courses for 16 units)* | | | | | | | |
| MATSCI | 161 or 164 | Satisfies Writing in the Major (WIM) requirement | | | | 4 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Engineering Depth Unit Total (16 units)* | | |
| *Focus Option Area (10 units minimum; select from one of the ten Options Areas)* | | | | | | | |
| | | See note 3 | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Option Area Unit Total (10 units minimum)* | | |
| | | | | | *Materials Science Engineering Depth Total (50 units minimum)* | | |

**Program Totals**

| | |
|---|---|
| *Mathematics and Science (40 units minimum)* | |
| *TIS and Engineering Fundamentals (13 units minimum)* | |
| *Materials Science and Engineering Depth (50 units minimum)* | |

## Program Approvals

*Advisor*

Printed Name: _____ Date: _____

Signature: _____

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES**

( 3 ) If the focus area option contains only 9 units, but the combined MSE major unit total is 60 or more, it will be allowed and no petition is necessary.

# MECHANICAL ENGINEERING

— ABET ACCREDITATION CRITERIA APPLY —

The undergraduate program in Mechanical Engineering at Stanford exposes each student to intellectual and practical experiences, and provides an environment that allows for the accumulation of knowledge and self discovery. Ultimately each graduate will acquire the ability to apply this knowledge to a variety of societal needs. Graduates have many options, from entry-level work as mechanical engineers to graduate studies in either an engineering discipline or in another field where a broad engineering background is useful. Regardless of the ultimate career choice, graduates leave the program with a solid grounding in the principals and practice of mechanical engineering, equipped to embark upon a lifetime of learning, while employing new concepts, technologies and methodologies.

## STANFORD UNIVERSITY/ÉCOLE CENTRALE PARIS JUNIOR YEAR ABROAD PROGRAM

Although not formally part of the Overseas Studies Program, Stanford mechanical engineering undergraduates can receive credit for study abroad at École Centrale Paris. École Centrale Paris is one of the best known science and engineering schools in France and Europe. Stanford students are enrolled in engineering program classes with French and International students. Instruction is mostly in French. For more information, see the "Overseas Studies" section of this handbook or contact Prof. Mark Cappelli, Bldg. 520-520J, or at **cap@stanford.edu**.

## RESEARCH EXPERIENCE FOR UNDERGRADUATES

The Mechanical Engineering department offers a Summer Undergraduate Research Institute (**http://me.stanford.edu/current/ug/ug_research.html**). The 2009 program will include student research training in team settings (e.g., students working together on larger projects directed by staff and faculty), and in individually-directed research settings (e.g., the student will work closely with a faculty advisor or senior graduate student).

The program is open only to Stanford Undergraduate students who will be in their senior year (or earlier) in the fall quarter following the summer research experience. Students do not necessarily have to be declared ME majors. There is no formal application for participation in the ME SURI.

Students who are interested in participating in the ME program should seek out research opportunities directly with affiliated ME faculty and secure a commitment/position for the summer by the end of May. Sponsoring faculty will contact the program administrator once a commitment to a student is made. Students can also contact the program administrator, Prof. Mark Cappelli (**cap@stanford.edu**, or (650) 725-2020), directly for more information.

## PROFESSIONAL LICENSING

Professional licensing is an important aspect of professional responsibility. Although civil engineers may find professional registration more important in securing employment, mechanical engineers should seriously consider pursuing licensing as well. A professional license can be important if you work as a consultant or at a small start-up. An engineer working for a start-up or small technical company must fill a much wider spectrum of professional roles than would be the case working for a larger company. Those roles would typically include certifying drawings and other technical materials that require a license as a professional engineer.

In addition to certifying the accuracy of technical materials produced by yourself or your company, a professional license is important if you have to testify as an expert witness or perform other functions related to the legal system. In many states, including California, you cannot legally use the title "engineer" unless you are a licensed Professional Engineer. In fact the California law requires that "…only a person appropriately licensed with the Board may practice or offer to practice mechanical engineering."

To attain a professional license you must take the Fundamentals of Engineering (F.E.) examination administered by the California Board for Professional Engineers and Land Surveyors (http://www.dca.ca.gov/pels/) or equivalent body in the state in which you plan to practice. The examination may be taken at any time, but most people find it easier to pass when completing their undergraduate work and more difficult later on. After passing the F.E. examination you will be eligible to receive an Engineer in Training (E.I.T.) certificate. At least two more years of practical experience and a further examination are required for a full license.

**OBJECTIVES AND OUTCOMES FOR MECHANICAL ENGINEERING**

**Objectives:**

1. Understand basic principles, mathematics and science, and mechanical systems with an ability to analyze, model, synthesize, ideate, iterate, prototype, and implement engineering solutions in a broad range of fields.
2. Understand product development and manufacturing with the capability to work effectively in multidisciplinary teams, provide leadership and technical expertise, and be effective communicators.
3. Prepare for graduate study in engineering or other professional fields.
4. Develop an ethical approach to engineering with concern for society and the environment, and the ability to provide understandable technical expertise to non-technical individuals.

**Outcomes:**

(a) An ability to apply knowledge of mathematics, science, and engineering
(b) An ability to design and conduct experiments, as well as to analyze and interpret data
(c) An ability to design a system, component, or process to meet desired needs
(d) An ability to function on multi-disciplinary teams
(e) An ability to identify, formulate, and solve engineering problems
(f) An understanding of professional and ethical responsibility
(g) An ability to communicate effectively
(h) The broad education necessary to understand the impact of engineering solutions in a global and societal context
(i) A recognition of the need for and an ability to engage in life-long learning
(j) A knowledge of contemporary issues
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(l) The ability to apply advanced mathematics through multivariate calculus and differential equations
(m) The ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems

# REQUIREMENTS

## Mathematics and Science

The program requires a minimum 45 units of Math and Science combined. A minimum of 24 units of mathematics are required, which **must** include a course in Differential Equations (e.g., CME102/ENGR 155A or MATH 53 is required). In addition a course in statistics (CME 106, STATS 110 or STATS 116) is **required.** A minimum of 21 units of science are required, which must include both chemistry and physics, with a depth in at least one (a **depth** is defined as three courses). Although CHEM 31X is equivalent to taking CHEM 31A and CHEM 31B, we recommend ME students take CHEM 31X. Students who choose to take CHEM31A/B should note that these two courses combined are considered 1 quarter worth of chemistry. See the Mathematics and Science Requirement section of this handbook for details.

**Physics Depth:** Students without advanced placement in Physics take PHYSICS 41, 43, & 45. Students with advanced placement should refer to the chart below for placement details. Note that only AP Physics C, not AP Physics B, will place a student out of a 40-series class requirement.

| | |
|---|---|
| Score of 4 or 5 in Light & Heat (AP Physics C) | Take Physics 41 & 43 |
| Score of 4 or 5 in Mechanics (AP Physics C) | Take Physics 43 & 45 |
| Score of 4 or 5 in Electricity & Magnetism (AP Physics C) | Take Physics 41 & 45 |
| Score of 4 or 5 for both Mechanics & Electricity & Magnetism (AP Physics C) | Take Physics 45 |

### Engineering Fundamentals: Three courses required (Fr, So, Jr)

| Course | Title | Engr. Sci | Engr. Desgn. | Expr. | Total | Qtr | Year |
|---|---|---|---|---|---|---|---|
| 1) ENGR 40 | Introductory Electronics (req'd) | 3 | 2 | - | 5 | AS | So,Jr |
| 2) ENGR 70A | Programming Methodology (req'd) | 3 | 2 | - | 5 | AWSSu | Fr,So |
| 3) Fundamental Elective | See Figure 3-4 in Chapter 3 for list of approved options & applicable ENGR Science and Design units | | | | | | |

### Technology in Society (TIS): One course required from approved list:

| | | |
|---|---|---|
| ME | 190* | Ethical Issues in Mechanical Engineering (RECOMMENDED) |
| STS | 101 | Science, Technology & Contemporary Society |
| STS | 110 | Ethics and Public Policy |
| STS | 115* | Ethical Issues in Engineering |
| POLISCI | 114S* | International Security in a Changing World (formerly STS 138) |
| CS | 181 | Computers, Ethics, and Public Policy (formerly CS 201) |

*Not offered in 2009-10

Note: Although the SoE states that students taking part in the Stanford Center for Technology and Innovation (SCTI) program may waive the TIS requirement, this option is not open to ME majors.

### Mechanical Engineering Depth Requirements (55-56 units from the following list)

Note: A minimum of 68 units consisting of a combination of Engineering Science and Engineering Design units from ME Depth and Engineering Fundamentals courses, and 8 or more Experimentation units, must be taken in order to satisfy ABET and SoE graduation requirements.

| Course | Title | Engr. Sci | Engr. Dsgn. | Expr. | Total | Qtr | Year |
|---|---|---|---|---|---|---|---|
| ENGR 14 | Applied Mechanics: Statics | 2 | 1 | - | 3 | AWS | Fr,So |
| ENGR 15 | Dynamics | 2 | 1 | - | 3 | AS | So, Jr |
| ENGR 30 | Engineering Thermodynamics | 3 | - | - | 3 | AW | So,Jr |
| ENGR102M* | Tech/Professional Writing for ME | - | - | - | 1 | AW | So,Jr |
| ME70 | Introductory Fluids Engineering | 4 | - | 1 | 4 | WS | So,Jr |
| ME80 | Strength of Materials | 2 | 2 | 1 | 4 | AS | Jr,Sr |
| ME101 | Visual Thinking | - | 3 | - | 3 | AWS | So,Jr |
| ME103D | Engineering Drawing | - | 1 | - | 1 | AW | So,Jr |
| ME112 | Mechanical Engineering Design | 1 | 3 | - | 4 | W | Jr,Sr |
| ME113 | Mechanical Engineering Design | - | 4 | - | 4 | S | Jr,Sr |
| ME131A/B | Heat Transfer & Fluid Mechanics | 4/4 | -/- | 2/1 | 8 | AW | Jr,Sr |
| ME140 | Advanced Thermal Systems | 4 | 1 | 2 | 5 | S | Jr,Sr |
| ME161 | Dynamic Systems | 3 | 1 | - | 4 | A | |
| ME203* | Manufacturing & Design | - | 4 | 1 | 4 | AW | Jr,Sr |

**Options to complete the ME Degree: Select two courses from the MS depth/breadth options listed in the Mechanical Engineering Graduate Student Handbook. You may pick up a copy from the ME Student Services Office, or download it here: `http://me.stanford.edu/current/ms/grad_handbook.html?id=1`**

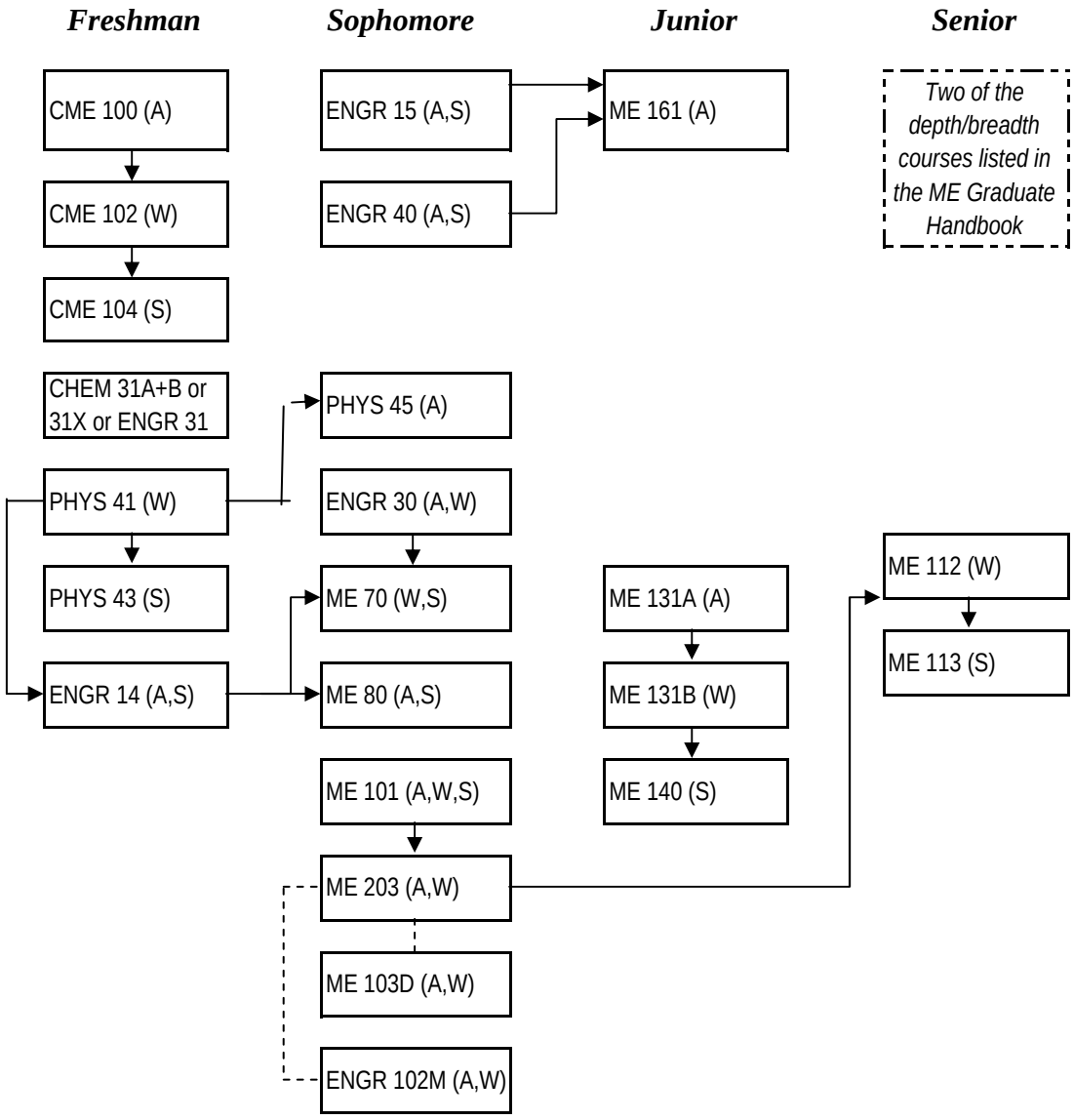
*ME 203 and ENGR 102M must be taken concurrently to fulfill the "Writing in the Major" requirement.

**NOTES:**

1. The Committee on Departmental Petitions of the Department of Mechanical Engineering Student Services Office must approve any deviation from the Engineering Depth (ME) requirement. Such petitions must be prepared on the School of Engineering petition forms (see the forms section at `ughb.stanford.edu` or in this handbook), approved by the advisor, and submitted by **the third week of the quarter before the expected graduation quarter**. For example, for a June graduation, a student must submit the petition by the third week of Winter quarter.
2. Courses listed in the Depth requirements may not be used to satisfy the engineering fundamentals requirement.
3. It is recommended that students review prerequisites for all courses before planning their course sequence
4. Petitions to deviate from School of Engineering requirements (i.e., math, science, Engineering Fundamentals, TIS) must be approved by the Dean's office in 201 Terman.

# Mechanical Engineering

*Typical Sequence of Courses*




* Solid arrows represent direct prerequisites.
* Dashed lines represent co-requisites.
* Dashed-line boxes enclose alternates. These may indicate alternate years in which to take a given course, or alternate courses that may be taken at a given time.

# Mechanical Engineering

*Plan A (begins with Math 41; typical start in Engineering coursework)*

***Recommended Plan***

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv | - | - | 3 | PHYSICS 41 | 4 | - | - | PHYSICS 43+ | 4 | - | - |
| | Writing | - | - | 4 | Unrstr Elctv | - | - | 3 | GER^ | - | - | 4 |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *0* | *8* |
| | Total | | | 16 | Total | | | 16 | Total | | | 17 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | PHYSICS 45+ | 4 | - | - | CME102/Math 52 | 5 | - | - | CME104/Math 53 | 5 | - | - |
| | ENGR 14 | - | 3 | | ENGR 30 | | 3 | | ME 70 | - | 4 | - |
| | Writing | - | - | 4 | Statistics* | 4 | - | - | ENGR 15 | - | 3 | - |
| | *Subtotals* | *4* | *3* | *9* | *Subtotals* | *9* | *3* | *5* | *Subtotals* | *5* | *7* | *5* |
| | Total | | | 16 | Total | | | 17 | Total | | | 17 |
| *Junior* | ME 131A | - | 4 | - | ME131B | - | 4 | - | ME140 | - | 5 | - |
| | ENGR 40 | - | 5 | - | ME101 | - | 3 | - | ME 80 | - | 4 | - |
| | CHEM 31A/X | 4 | - | - | Chem31B/Sci+ | 4 | - | | Science Elctv+ | 1 | - | - |
| | | | | | CS 106A | - | 5 | - | TIS Course | - | - | 4 |
| | *Subtotals* | *4* | *9* | *0* | *Subtotals* | *4* | *12* | *0* | *Subtotals* | *1* | *9* | *4* |
| | Total | | | 13 | Total | | | 16 | Total | | | 14 |
| *Senior* | ME 203 | - | 4 | - | ME 112 | - | 4 | - | ME 113 | - | 4 | - |
| | ME 103D | - | 1 | - | ME Depth | - | 4 | - | ME Depth | - | 3 | - |
| | ENGR 102M | - | 1 | - | GER^ | - | - | 4 | GER^ | - | - | 5 |
| | ME 161 | - | 4 | - | | - | - | - | | - | - | - |
| | GER^ | - | - | 4 | | | | | | | | |
| | *Subtotals* | *0* | *10* | *4* | *Subtotals* | *0* | *8* | *4* | *Subtotals* | *0* | *7* | *5* |
| | Total | | | 14 | Total | | | 12 | Total | | | 12 |

| | |
|---|---|
| Total Math & Science Units: | 50 |
| Total Engineering Units: | 68 |
| Total Other Units: | 62 |
| Total Units: | 180 |

***Notes:***

Courses in row can be rearranged to accommodate Writing in any quarter. (E15 is offered A or S; see * for Stats scheduling)

* Statistcs class chosen depends on which quarter is available for this class. Stat 110 is offered in the Autumn; CME106 in the Winter. [Stat 116 is offered Autumn and Spring, but requires Math 52 as a prerequisite.]

After Phys 41/43/45 plus Chem 31A&B or X, need 5 more units of science. (Chem 31A and Chem 31B together count as one quarter).

\+ Note: GES 1A (Aut) is only SoE-approved 5-unit science course. If other 4-unit science is taken, a PHYSICS lab may be taken for final science unit.

^ GERs in DB-Math, DB-Science, and DB-EngrApplSci will automatically be fulfilled via MechE major reqmts; only need to take DB-Hum, DB-SocSci, and 2 Education for Citizenship GERs.

# Mechanical Engineering

*Plan A (begins with Math 41; late start in Engineering coursework)*

| | Fall | | | | Winter | | | | Spring | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | Unrstr Elctv | - | - | 3 | PHYSICS 41 | 4 | - | - | PHYSICS 43+ | 4 | - | - |
| | Writing | - | - | 4 | Unrstr Elctv | - | - | 3 | GER^ | - | - | 4 |
| | *Subtotals* | *5* | *0* | *11* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *0* | *8* |
| | Total | | | 16 | Total | | | 16 | Total | | | 17 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | PHYSICS 45+ | 4 | - | - | CME102/Math 52 | 5 | - | - | CME104/Math 53 | 5 | - | - |
| | CHEM 31A/X | 4 | - | - | Chem31B/Sci+ | 4 | - | | ENGR 14 | - | 3 | - |
| | Writing | - | - | 4 | Statistics* | 4 | - | - | GER^ | - | - | 4 |
| | *Subtotals* | *8* | *0* | *9* | *Subtotals* | *13* | *0* | *5* | *Subtotals* | *5* | *3* | *9* |
| | Total | | | 17 | Total | | | 18 | Total | | | 17 |
| *Junior* | ENGR 40 | - | 5 | - | ENGR 30 | - | 3 | - | ENGR 15 | - | 3 | - |
| | CS106A | - | 5 | | ME 203 | - | 4 | - | ME 70 | - | 4 | - |
| | ME101 | - | 3 | - | ME 103D | - | 1 | - | ME 80 | - | 4 | - |
| | | | | | ENGR 102M | - | 1 | - | TIS Course | - | - | 4 |
| | | | | | GER^ | - | - | 5 | | | | |
| | *Subtotals* | *0* | *13* | *0* | *Subtotals* | *0* | *9* | *5* | *Subtotals* | *0* | *11* | *4* |
| | Total | | | 13 | Total | | | 14 | Total | | | 15 |
| *Senior* | ME 131A | - | 4 | - | ME 131B | - | 4 | - | ME 140 | - | 5 | - |
| | ME 161 | - | 4 | - | ME 112 | - | 4 | - | ME 113 | - | 4 | - |
| | Science Elctv+ | 1 | - | - | ME Depth | - | 4 | - | ME Depth | - | 3 | - |
| | GER^ | - | - | 4 | | | | | | | | |
| | *Subtotals* | *1* | *8* | *4* | *Subtotals* | *0* | *12* | *0* | *Subtotals* | *0* | *12* | *0* |
| | Total | | | 13 | Total | | | 12 | Total | | | 12 |

| | |
|---|---|
| Total Math & Science Units: | 50 |
| Total Engineering Units: | 68 |
| Total Other Units: | 62 |
| Total Units: | 180 |

***Notes:***

Courses in row can be rearranged to accommodate Writing in any quarter. (See * for Stats scheduling)

* Statistcs class chosen depends on which quarter is available for this class. Stat 110 is offered in the Autumn; CME106 in the Winter. [Stat 116 is offered Autumn and Spring, but requires Math 52 as a prerequisite.]

\+ After Phys 41/43/45 plus Chem 31A&B or X, need 5 more units of science. (Chem 31A and Chem 31B together count as one quarter). Note: GES 1A (Aut) is only SoE-approved 5-unit science course. If other 4-unit science is taken, a PHYSICS lab may be taken for final science unit.

^ GERs in DB-Math, DB-Science, and DB-EngrApplSci will automatically be fulfilled via MechE major reqmts; only need to take DB-Hum, DB-SocSci, and 2 Education for Citizenship GERs.

# Mechanical Engineering

*Plan B (begins with CME 100 or Math 51; early start in Engineering coursework)*

***Recommended Plan***

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | CME100/Math 51 | 5 | - | - | CME102/Math 52 | 5 | - | - | CME104/Math 53 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | CHEM 31A/X | 4 | - | - | PHYSICS 41 | 4 | - | - | PHYSICS 43+ | 4 | - | - |
| | Writing | - | - | 4 | Unrstr Elctv | - | - | 3 | ENGR 14 | - | 3 | - |
| | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *3* | *4* |
| | Total | | | 17 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | PHYSICS 45+ | 4 | - | - | Chem31B/Sci+ | 4 | - | | ENGR 40 | - | 5 | - |
| | ME 80 | - | 4 | - | ME 101 | - | 3 | - | ME 70 | - | 4 | - |
| | Writing | - | - | 4 | ENGR 30 | - | 3 | - | ENGR 15 | - | 3 | - |
| | *Subtotals* | *4* | *4* | *9* | *Subtotals* | *4* | *6* | *5* | *Subtotals* | *0* | *12* | *5* |
| | Total | | | 17 | Total | | | 15 | Total | | | 17 |
| *Junior* | ME 131A | - | 4 | - | ME131B | - | 4 | - | ME140 | - | 5 | - |
| | ME 203 | - | 4 | - | CS 106A | - | 5 | - | Unrstr Elctv | - | - | 3 |
| | ME 103D | - | 1 | - | CME 106 | 4 | - | | Science Elctv+ | 1 | - | - |
| | ENGR 102M | - | 1 | - | | | | | TIS Course | - | - | 4 |
| | GER^ | - | - | 4 | | | | | | | | |
| | *Subtotals* | *0* | *10* | *4* | *Subtotals* | *4* | *9* | *0* | *Subtotals* | *1* | *5* | *7* |
| | Total | | | 14 | Total | | | 13 | Total | | | 13 |
| *Senior* | ME 161 | - | 4 | - | ME 112 | - | 4 | - | ME 113 | - | 4 | - |
| | ME Depth | - | 4 | - | ME Depth | - | 3 | - | GER^ | - | - | 5 |
| | GER^ | - | - | 4 | GER^ | - | - | 4 | | | | |
| | *Subtotals* | *0* | *8* | *4* | *Subtotals* | *0* | *7* | *4* | *Subtotals* | *0* | *4* | *5* |
| | Total | | | 12 | Total | | | 11 | Total | | | 9 |

| | |
|---|---|
| Total Math & Science Units: | 40 * |
| Total Engineering Units: | 68 |
| Total Other Units: | 62 |
| Total Units: | 170 * |

***Notes:***

Courses in row can be rearranged to accommodate Writing in any quarter. (E15 is offered A or S; see * for Stats scheduling)

* Units totals do not include the 10 units of AP Math BC credit associated with placement into CME100.

\+ After Phys 41/43/45 plus Chem 31A&B or X, need 5 more units of science. (Chem 31A and Chem 31B together count as one quarter). Note: GES 1A (Aut) is only SoE-approved 5-unit science course. If other 4-unit science is taken, a PHYSICS lab may be taken for final science unit.

^ GERs in DB-Math, DB-Science, and DB-EngrApplSci will automatically be fulfilled via MechE major reqmts; only need to take DB-Hum, DB-SocSci, and 2 Education for Citizenship GERs.

# Mechanical Engineering

*Autumn or Winter^^ quarter Junior Year abroad; starts with Math 41*

| | Fall | | | | Winter | | | | Spring | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | | | | | PHYSICS 41 | 4 | - | - | PHYSICS 43+ | 4 | - | - |
| | Writing | - | - | 4 | Unrstr Elctv | - | - | 3 | CS106A | - | 5 | - |
| | *Subtotals* | *5* | *0* | *8* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *5* | *4* |
| | Total | | | 13 | Total | | | 16 | Total | | | 18 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | PHYSICS 45+ | 4 | - | - | CME102/Math 52 | 5 | - | - | CME104/Math 53 | 5 | - | - |
| | CHEM 31A/X | 4 | - | - | Chem31B/Sci+ | 4 | - | | E14 | - | 3 | - |
| | Writing | - | - | 4 | Statistics* | 4 | - | - | E15 | - | 3 | - |
| | *Subtotals* | *8* | *0* | *9* | *Subtotals* | *13* | *0* | *5* | *Subtotals* | *5* | *6* | *5* |
| | Total | | | 17 | Total | | | 18 | Total | | | 16 |
| *Junior* | GER^# | - | - | 5 | ENGR 30 | - | 3 | - | ME 101 | - | 3 | - |
| | GER^# | - | - | 4 | ME 203 | - | 4 | - | ME 70 | - | 4 | - |
| | Elctv (or E40) | - | - | 3 | ME 103D | - | 1 | - | ME 80 | - | 4 | - |
| | *--- (Autumn Quarter Abroad) ---* # ^^ | | | | ENGR 102M | - | 1 | - | ENGR 40 # | - | 5 | - |
| | | | | | TIS Course | - | - | 4 | | | | |
| | *Subtotals* | *0* | *0* | *12* | *Subtotals* | *0* | *9* | *4* | *Subtotals* | *0* | *16* | *0* |
| | Total | | | 12 | Total | | | 13 | Total | | | 16 |
| *Senior* | ME 131A | - | 4 | - | ME 131B | - | 4 | - | ME 140 | - | 5 | - |
| | ME 161 | - | 4 | - | ME 112 | - | 4 | - | ME 113 | - | 4 | - |
| | Science Elctv+ | 1 | - | - | ME Depth | - | 4 | - | ME Depth | - | 3 | - |
| | GER^# | - | - | 4 | GER^# | - | - | 4 | | | | |
| | *Subtotals* | *1* | *8* | *4* | *Subtotals* | *0* | *12* | *4* | *Subtotals* | *0* | *12* | *0* |
| | Total | | | 13 | Total | | | 16 | Total | | | 12 |

| | |
|---|---|
| Total Math & Science Units: | 50 |
| Total Engineering Units: | 68 |
| Total Other Units: | 62 |
| Total Units: | 180 |

***Notes:***

Courses in row can be rearranged to accommodate Writing in any quarter. (E15 is A or S; see * for Stats scheduling)

* Statistcs class chosen depends on which quarter is available for this class. Stat 110 is offered in the Autumn; CME106 in the Winter. [Stat 116 is offered Autumn and Spring, but requires Math 52 as a prerequisite.]

\+ After Phys 41/43/45 plus Chem 31A&B or X, need 5 more units of science. (Chem 31A and Chem 31B together count as one quarter). Note: GES 1A (Aut) is only SoE-approved 5-unit science course. If other 4-unit science is taken, a PHYSICS lab may be taken for final science unit.

^ GERs in DB-Math, DB-Science, and DB-EngrApplSci will automatically be fulfilled via MechE major reqmts; only need to take DB-Hum, DB-SocSci, and 2 Education for Citizenship (EC) GERs.

\# Most Overseas programs offer classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter. Some Overseas programs also offer Engr 40.

^^ For Winter quarter abroad, swap the Autumn and Winter course listings for Junior year.

# Mechanical Engineering

*Spring quarter Junior Year abroad; starts with Math 41*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | MATH 41 | 5 | - | - | MATH 42 | 5 | - | - | MATH 51 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | | | | | PHYSICS 41 | 4 | - | - | PHYSICS 43+ | 4 | - | - |
| | Writing | - | - | 4 | Unrstr Elctv | - | - | 3 | CS106A | - | 5 | - |
| | *Subtotals* | *5* | *0* | *8* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *5* | *4* |
| | Total | | | 13 | Total | | | 16 | Total | | | 18 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | PHYSICS 45+ | 4 | - | - | CME102/Math52 | 5 | - | - | CME104/Math53 | 5 | - | - |
| | CHEM 31A/X | 4 | - | - | Chem31B/Sci+ | 4 | - | | E14 | - | 3 | - |
| | Writing | - | - | 4 | Statistics* | 4 | - | - | E15 | - | 3 | - |
| | *Subtotals* | *8* | *0* | *9* | *Subtotals* | *13* | *0* | *5* | *Subtotals* | *5* | *6* | *5* |
| | Total | | | 17 | Total | | | 18 | Total | | | 16 |
| *Junior* | ENGR 30 | - | 3 | - | ME 101 | - | 3 | - | GER^# | - | - | 5 |
| | ENGR 40 # | - | 5 | - | ME 203 | - | 4 | - | GER^# | - | - | 4 |
| | ME 80 | - | 4 | - | ME 103D | - | 1 | - | Elctv (or E40) | - | - | 3 |
| | TIS Course | - | - | 4 | ENGR 102M | - | 1 | - | *--- (Spring Quarter Abroad) ---* # | | | |
| | | | | | ME 70 | - | 4 | - | | | | |
| | *Subtotals* | *0* | *12* | *4* | *Subtotals* | *0* | *13* | *0* | *Subtotals* | *0* | *0* | *12* |
| | Total | | | 16 | Total | | | 13 | Total | | | 12 |
| *Senior* | ME 131A | - | 4 | - | ME 131B | - | 4 | - | ME 140 | - | 5 | - |
| | ME 161 | - | 4 | - | ME 112 | - | 4 | - | ME 113 | - | 4 | - |
| | Science Elctv+ | 1 | - | - | ME Depth | - | 4 | - | ME Depth | - | 3 | - |
| | GER^# | - | - | 4 | GER^# | - | - | 4 | | | | |
| | *Subtotals* | *1* | *8* | *4* | *Subtotals* | *0* | *12* | *4* | *Subtotals* | *0* | *12* | *0* |
| | Total | | | 13 | Total | | | 16 | Total | | | 12 |

| | |
|---|---|
| Total Math & Science Units: | 50 |
| Total Engineering Units: | 68 |
| Total Other Units: | 62 |
| Total Units: | 180 |

***Notes:***

Courses in row can be rearranged to accommodate Writing in any quarter. (E15 is A or S; see * for Stats scheduling)

* Statistcs class chosen depends on which quarter is available for this class. Stat 110 is offered in the Autumn; CME106 in the Winter. [Stat

\+ After Phys 41/43/45 plus Chem 31A&B or X, need 5 more units of science. (Chem 31A and Chem 31B together count as one quarter). Note: GES 1A (Aut) is only SoE-approved 5-unit science course. If other 4-unit science is taken, a PHYSICS lab may be taken for final science unit.

^ GERs in DB-Math, DB-Science, and DB-EngrApplSci will automatically be fulfilled via MechE major reqmts; only need to take DB-Hum, DB-SocSci, and 2 Education for Citizenship (EC) GERs.

\# Most Overseas programs offer classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter. Some Overseas programs also offer Engr 40.

^^ For Winter quarter abroad, swap the Autumn and Winter course listings for Junior year.

# Mechanical Engineering

*Spring quarter Junior Year abroad; starts with CME 100 (or Math 51)*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | CME100/Ma51 | 5 | - | - | CME102/Math52 | 5 | - | - | CME104/Math53 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | CHEM 31A/X | 4 | - | - | PHYSICS 41 | 4 | - | - | PHYSICS 43+ | 4 | - | - |
| | Writing | - | - | 4 | Unrstr Elctv | - | - | 3 | ENGR 14 | - | 3 | - |
| | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *3* | *4* |
| | Total | | | 17 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | PHYSICS 45+ | 4 | - | - | Chem31B/Sci+ | 4 | - | | ENGR 40 | - | 5 | - |
| | ME 80 | - | 4 | - | ME 101 | - | 3 | - | ME 70 | - | 4 | - |
| | Writing | - | - | 4 | ENGR 30 | - | 3 | - | ENGR 15 | - | 3 | - |
| | *Subtotals* | *4* | *4* | *9* | *Subtotals* | *4* | *6* | *5* | *Subtotals* | *0* | *12* | *5* |
| | Total | | | 17 | Total | | | 15 | Total | | | 17 |
| *Junior* | ME 131A | - | 4 | - | ME131B | - | 4 | - | GER ^# | - | - | 5 |
| | ME 203 | - | 4 | - | CS 106A | - | 5 | - | GER^# | - | - | 4 |
| | ME 103D | - | 1 | - | CME 106 | 4 | - | | Unrstr Elctv | - | - | 3 |
| | ENGR 102M | - | 1 | - | | | | | *--- (Spring Quarter Abroad) ---* # | | | |
| | ME 161 | - | 4 | - | | | | | | | | |
| | *Subtotals* | *0* | *14* | *0* | *Subtotals* | *4* | *9* | *0* | *Subtotals* | *0* | *0* | *12* |
| | Total | | | 14 | Total | | | 13 | Total | | | 12 |
| *Senior* | ME Depth | - | 4 | - | ME 112 | - | 4 | - | ME 113 | - | 4 | - |
| | Science Elctv+ | 1 | - | - | ME Depth | - | 3 | - | ME 140 | - | 5 | - |
| | TIS Course | - | - | 4 | GER^# | - | - | 4 | | | | |
| | GER^# | - | - | 4 | | | | | | | | |
| | *Subtotals* | *1* | *4* | *8* | *Subtotals* | *0* | *7* | *4* | *Subtotals* | *0* | *9* | *0* |
| | Total | | | 13 | Total | | | 11 | Total | | | 9 |

| | |
|---|---|
| Total Math & Science Units: | 40 * |
| Total Engineering Units: | 68 |
| Total Other Units: | 62 |
| Total Units: | 170 * |

***Notes:***

Courses in row can be rearranged to accommodate Writing in any quarter. (E15 is offered A or S; see * for Stats scheduling)

* Units totals do not include the 10 units of AP Math BC credit associated with placement into CME100 (or Math 51).

\+ After Phys 41/43/45 plus Chem 31A&B or X, need 5 more units of science. (Chem 31A and Chem 31B together count as one quarter). Note: GES 1A (Aut) is only SoE-approved 5-unit science course. If other 4-unit science is taken, a PHYSICS lab may be taken for final science unit.

^ GERs in DB-Math, DB-Science, and DB-EngrApplSci will automatically be fulfilled via MechE major reqmts; only need to take DB-Hum, DB-SocSci, and 2 Education for Citizenship GERs.

\# Most Overseas programs offer classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter.

# Mechanical Engineering

*Autumn quarter Senior Year abroad; starts with CME 100 (or Math 51)*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other | Class | Math/ Sci. | Engr | Other |
| *Freshman* | CME100/Math 51 | 5 | - | - | CME102/Math 52 | 5 | - | - | CME104/Math 53 | 5 | - | - |
| | IHUM | - | - | 4 | IHUM | - | - | 4 | IHUM | - | - | 4 |
| | CHEM 31A/X | 4 | - | - | PHYSICS 41 | 4 | - | - | PHYSICS 43+ | 4 | - | - |
| | Writing | - | - | 4 | Unrstr Elctv | - | - | 3 | ENGR 14 | - | 3 | - |
| | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *7* | *Subtotals* | *9* | *3* | *4* |
| | Total | | | 17 | Total | | | 16 | Total | | | 16 |
| *Sophomore* | Language | - | - | 5 | Language | - | - | 5 | Language | - | - | 5 |
| | PHYSICS 45+ | 4 | - | - | Chem31B/Sci+ | 4 | - | | ENGR 40 | - | 5 | - |
| | ME 80 | - | 4 | - | ME 101 | - | 3 | - | ME 70 | - | 4 | - |
| | Writing | - | - | 4 | ENGR 30 | - | 3 | - | ENGR 15 | - | 3 | - |
| | *Subtotals* | *4* | *4* | *9* | *Subtotals* | *4* | *6* | *5* | *Subtotals* | *0* | *12* | *5* |
| | Total | | | 17 | Total | | | 15 | Total | | | 17 |
| *Junior* | ME 131A | - | 4 | - | ME131B | - | 4 | - | ME140 | - | 5 | - |
| | ME 203 | - | 4 | - | CS 106A | - | 5 | - | ME Depth | - | 4 | - |
| | ME 103D | - | 1 | - | CME 106 | 4 | - | | Science Elctv+ | 1 | - | - |
| | ENGR 102M | - | 1 | - | | | | | TIS Course | - | - | 4 |
| | ME 161 | - | 4 | - | | | | | | | | |
| | *Subtotals* | *0* | *14* | *0* | *Subtotals* | *4* | *9* | *0* | *Subtotals* | *1* | *9* | *4* |
| | Total | | | 14 | Total | | | 13 | Total | | | 14 |
| *Senior* | GER ^# | - | - | 5 | ME 112 | - | 4 | - | ME 113 | - | 4 | - |
| | GER^# | - | - | 4 | ME Depth | - | 3 | - | GER^# | - | - | 4 |
| | Unrstr Elctv | - | - | 3 | GER^# | - | - | 4 | | | | |
| | *--- (Autumn Quarter Abroad) ---* # | | | | | | | | | | | |
| | *Subtotals* | *0* | *0* | *12* | *Subtotals* | *0* | *7* | *4* | *Subtotals* | *0* | *4* | *4* |
| | Total | | | 12 | Total | | | 11 | Total | | | 8 |

| | |
|---|---|
| Total Math & Science Units: | 40 * |
| Total Engineering Units: | 68 |
| Total Other Units: | 62 |
| Total Units: | 170 * |

***Notes:***

Courses in row can be rearranged to accommodate Writing in any quarter. (E15 is offered A or S; see * for Stats scheduling)

* Units totals do not include the 10 units of AP Math BC credit associated with placement into CME100 (or Math 51).

\+ After Phys 41/43/45 plus Chem 31A&B or X, need 5 more units of science. (Chem 31A and Chem 31B together count as one quarter). Note: GES 1A (Aut) is only SoE-approved 5-unit science course. If other 4-unit science is taken, a PHYSICS lab may be taken for final science unit.

^ GERs in DB-Math, DB-Science, and DB-EngrApplSci will automatically be fulfilled via MechE major reqmts; only need to take DB-Hum, DB-SocSci, and 2 Education for Citizenship GERs.

\# Most Overseas programs offer classes that meet the DB-SocSci, DB-Hum, and/or EC-GlobalCom GERs. Students should save these GERs for their overseas quarter.

# INSTRUCTIONS FOR DECLARING MAJOR IN MECHANICAL ENGINEERING (BS-ME)

1. Print a copy of your transcript from Axess.
2. Download and complete an ME program sheet from the School of Engineering UGHB web site (**http://ughb.stanford.edu**). Please include courses you plan to take as well as those you have already taken. You may pick up a major declaration form from the Mechanical Engineering Student Services Office (Building 530, room 125).
3. Please contact the ME Undergraduate Peer Advisor at **mepeeradvisor@lists.stanford.edu** for an appointment to go over your program sheet and select an advisor.
4. Discuss the program with your advisor and have him/her approve and sign your completed program sheet and major declaration form.
5. Return all completed documents and transcripts to the Student Services Office, Building 530, room 125.
6. E-mail Christine Crapps **(crapps@stanford.edu)** to let her know that you have declared your major so that she may approve it.
7. Attend the quarterly ME Declaration lunch to finalize the process. For more information on the lunch, please speak with Christine Crapps.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download the online ME program sheet from **ughb.stanford.edu** to ensure you are using an accurate major plan.

**Stanford University ♦ School of Engineering**

# Mechanical Engineering
# 2009–2010 Program Sheet

**— ABET Acceditation Criteria Apply —**

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

**Mathematics and Science Requirement**

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Mathematics (24 units minimum; see note 1)* | | | | | | | | | | |
| | | | | | | | | | | |
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| | | | | | | | | | | |
| | | | | | *Mathematics Unit Total* | | *(24 units minimum)* | | | |

*Science (21 units minimum; see note 2)*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Science Unit Total* | | *(21 units minimum)* | | | |
| | | | | | *Mathematics and Science Unit Total* | | *(45 units minimum)* | | | |

**Technology in Society Requirement** (1 course required: see note 3 for approved list)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 3-5 | | | | |

**NOTES**

* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to E majors.
* Engineering Science, Design, and Experimentation units do not apply to shaded areas.
* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.
* All courses listed on this form must be taken for a letter grade if offered by the instructor.
* Minimum Combined Grade Point Average for all courses in Engineering Topics (Eng Sci and Eng Des courses) is 2.0.
* Transfer and AP credits in Math, Science, Funds., & TIS must be approved by the SoE Dean's office. Transfer credits in Mechanical Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.
* All courses listed on this form must be listed under only one category; no double-counting.

( 1 ) Must take one Statistics course: CME 106, STATS 110 or STATS 116; Must also take one ODE course: CME 102/ENGR 155A or MATH 53

( 2 ) Must include a full year (3 quarters) in either Physics or Chemistry, plus one quarter in the other. CHEM31A/B counts as one quarter. CHEM 31X or ENGR 31 recommended. Note on additional science options: GES 1A (Aut) is the only SoE-approved science course given for 5 units.

( 3 ) Must choose TIS course from the following ME-approved courses: ME 190 (recommended) or STS 101, 110, 115, POLISCI 114S, or CS 201.

# Mechanical Engineering Program Sheet (continued)

**Engineering Topics** (Engr Science + Engr Design combined must equal 68 units. See note 4)

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade | ABET Units | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | Total | | Engr Sci | Engr Des | Experiment |
| *Engineering Fundamentals (3 courses required)* | | | | | | | | | | |
| ENGR | 40 | Intro Electronics (req'd) | | | | 5 | | 3 | 2 | 2 |
| ENGR | 70A | Programming Methodology (req'd) | | | | 5 | | 3 | 2 | 0 |
| ENGR | | *Fundamentals Elective* | | | | | | | | |
| | | | | | *Engineering Fundamentals Unit Total* | | | | | |
| *Engineering Depth (Be advised, no course may be listed twice on the sheet. No double-counting.)* | | | | | | | | | | |
| ENGR | 14 | Applied Mechanics: Statics (req'd) | | | | 3 | | 2 | 1 | 0 |
| ENGR | 15 | Dynamics (req'd) | | | | 3 | | 2 | 1 | 0 |
| ENGR | 30 | Engineering Thermodynamics (req'd) | | | | 3 | | 3 | 0 | 0 |
| ME | 70 | Introductory Fluids Engineering (req'd) | | | | 4 | | 4 | 0 | 1 |
| ME | 101 | Visual Thinking (req'd) | | | | 3 | | 0 | 3 | 0 |
| ME | 103D | Engineering Drawing (req'd) | | | | 1 | | 0 | 1 | 0 |
| ME | 80 | Strength of Materials (req'd) | | | | 4 | | 2 | 2 | 1 |
| ME | 112 | Mechanica Engineering Design (req'd) | | | | 4 | | 1 | 3 | 0 |
| ME | 113 | Mechanical Engineering Design (req'd) | | | | 4 | | 0 | 4 | 0 |
| ME | 131A | Heat Transfer (req'd) | | | | 4 | | 4 | 0 | 2 |
| ME | 131B | Fluid Mechanics (req'd) | | | | 4 | | 4 | 0 | 1 |
| ME | 140 | Advanced Thermal Systems (req'd) | | | | 5 | | 4 | 1 | 2 |
| ME | 161 | Dynamic Systems (req'd) | | | | 4 | | 3 | 1 | 0 |
| ENGR | 102M | Tech/Prof. Writing (req'd) WIM (see note 5) | | | | 1 | | 0 | 0 | 0 |
| ME | 203 | Manufacturing & Design (req'd) WIM (see note 5) | | | | 4 | | 0 | 4 | 1 |
| *Options to complete ME-BS degree:See note 6; 6 units minimum* | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | *Depth Totals:* | | | Engr Sci | Engr Des | Experiment |
| | | | | | | | | | | |

*Mathematics and Science* *(45 units minimum)*

*Engineering Topics (Engr Science + Engr Design)* *(68 units minimum)*

*Experimentation* *(8 units minimum)*

**Program Approvals**

*Advisor*

Printed Name: _____ Date: _____

Signature: _____

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

( 4 ) In order to satisfy ABET requirements for graduation, the ME major must take enough courses so that the combined Engr Science and Design units from Fundamentals and Depth courses add up to a minimum of 68

( 5 ) Fulfills the "Writing in the Major" requirement. ENGR102M and ME203 must be taken concurrently.

( 6 ) Select 2 courses from the MS depth/breadth options listed in the Mechanical Engineering Graduate Student Handbook. All courses from this list are assigned ENGR Science units equivalent to the amount of units the course is taken for. Copies available in Bldg 530 Rm125 or download at: http://me.stanford.edu/current/ms/grad_handbook.html?id=1

# PRODUCT DESIGN

Product Design focuses on the experience of product conception and design for the benefit of society. It encourages creativity, craftsmanship, and personal expression, while serving larger goals of common good. Students studying Product Design generally follow the Mechanical Engineering curriculum and focus on a process that resolves constraints arising from technical, human, aesthetic and business concerns. The course work provides the skills necessary to carry projects from initial concept to completion of working prototypes.

Students who also complete the requirements for Mechanical Engineering will receive the ME degree and a transcript that says "Has completed all the requirements of Product Design."

## REQUIREMENTS

### Mathematics

20 units minimum (one course in statistics recommended, e.g. STATS 60)

### Science

22 units minimum

At least 15 units must be from School of Engineering approved list. [1]

Required: one year of Physics 40 series

At least 7 units must be from behavioral science

Behavioral Science

| | |
|---|---|
| PSYCH 1 (required) | 5 units |
| PSYCH Elective (courses numbered 20-95) | 2-5 units |

### Engineering Fundamentals

| | |
|---|---|
| ENGR 40 (required) | 5 units |
| ENGR 70A (required) | 5 units |
| Fundamental elective [2] | 3-5 units |

### Technology in Society (TIS)

| | |
|---|---|
| ME 120 | 3-4 units |

**Engineering Depth (51 units)**

| | |
|---|---|
| ENGR 14 | 3 units |
| ENGR 102M [4] | 1 unit |
| ME 80 | 4 units |
| ME 101 | 3 units |
| ME 103D | 1 unit |
| ME 110A | 1 unit |
| ME 112 | 4 units |
| ME 115A[3] | 3 units |
| ME 115B | 3 units |
| ME 115C | 3 units |
| ME 116 | 4 units |
| ME 203 [4] | 4 units |
| ME 216A | 4 units |
| ME 216B | 4 units |
| ARTSTUDI 60 | 3 units |
| ARTSTUDI 160 | 3 units |
| One Studio Art courses | 3 units |

**Notes:**

1. The School of Engineering list of approved science courses can be found in Chapter 3, Figure 3-2.
2. Choose one more fundamental from: ENGR 10, 15, 20, 25, 30, 50, 50M, 60, 62
3. One ME 115 course requirement waived if student takes a quarter abroad
4. ME 203 and ENGR 102M must be taken concurrently to fulfill the "Writing in the Major" requirement.

# Product Design

*(Typical 4-Year Plan with an overseas quarter)*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | | | MATH 42 | 5 | | | MATH 51 | 5 | | |
| | PHYSICS 45 | 4 | | | PHYSICS 41 | 4 | | | PHYSICS 43 | 4 | | |
| | IHUM | | | 4 | IHUM | | | 4 | IHUM | | | 4 |
| | | | | | Writing | | | 4 | PSYCH 1 | | | 5 |
| | *Subtotals* | *9* | *0* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *9* |
| | Total | | | 13 | Total | | | 17 | Total | | | 18 |
| *Sophomore* | Language | | | 5 | Language | | | 5 | Language | | | 5 |
| | ENGR 14 | | 4 | | ME 101 | | 3 | | ME 120 | | 3 | |
| | ARTSTUDI 60 | | | 3 | ME 110A | | 1 | | PSYCH elective | | | 3 |
| | ENGR 40 | | 5 | | STATS 60 | 5 | | | ARTSTUDI elective | | | 3 |
| | | | | | Writing | | | 4 | GER | | | 3 |
| | *Subtotals* | *0* | *9* | *8* | *Subtotals* | *5* | *4* | *9* | *Subtotals* | *0* | *3* | *14* |
| | Total | | | 17 | Total | | | 18 | Total | | | 17 |
| *Junior* | ME115A | | 3 | | ME 115B | | 3 | | Overseas studies | | | 12 |
| | ME 203* | | 4 | | ENGR 70A | | 5 | | (waive ME115C) | | | |
| | ME 103D | | 1 | | ARTSTUDI 160 | | | 3 | | | | |
| | ENGR 102M* | | 1 | | GER | | | 3 | | | | |
| | ME80 | | 3 | | | | | | | | | |
| | GER | | | 3 | | | | | | | | |
| | *Subtotals* | *0* | *12* | *3* | *Subtotals* | *0* | *8* | *6* | *Subtotals* | *0* | *0* | *12* |
| | Total | | | 15 | Total | | | 14 | Total | | | 12 |
| *Senior* | ME 116 | | 4 | | ME 216A | | 4 | | ME 216B | | 4 | |
| | ENGR Fund | | 3 | | ME 112 | | 4 | | GER | | | 3 |
| | Sci Elective | 3 | | | GER | | | 3 | Elective | | | 3 |
| | Elective | | | 4 | Elective | | | 4 | Elective | | | 3 |
| | *Subtotals* | *3* | *7* | *4* | *Subtotals* | *0* | *8* | *7* | *Subtotals* | *0* | *4* | *9* |
| | Total | | | 14 | Total | | | 15 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 35 |
| Total Engineering Units: | 55 |
| Total Other Units: | 93 |
| Total Units: | 183 |

*Notes:*

* ME 203 must be taken concurrently with ENGR 102M to fulfill the "Writing in the Major" requirement.

# Product Design

*(Typical 4-Year Plan without an overseas quarter)*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 41 | 5 | | | MATH 42 | 5 | | | MATH 51 | 5 | | |
| | ENGR 14 | | 3 | | PHYSICS 41 | 4 | | | PHYSICS 43 | 4 | | |
| | IHUM | | | 4 | IHUM | | | 4 | IHUM | | | 4 |
| | | | | | Writing | | | 4 | PSYCH 1 | | | 5 |
| | *Subtotals* | *5* | *3* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *9* | *0* | *9* |
| | Total | | | 12 | Total | | | 17 | Total | | | 18 |
| *Sophomore* | Language | | | 5 | Language | | | 5 | Language | | | 5 |
| | PHYSICS 45 | 4 | | | ME 101 | | 3 | | ME 120 | | 3 | |
| | ARTSTUDI 60 | | | 3 | ME 110A | | 1 | | PSYCH elective | | | 3 |
| | ENGR 40 | | 5 | | STATS 60 | 5 | | | ARTSTUDI elective | | | 3 |
| | | | | | Writing | | | 4 | | | | |
| | *Subtotals* | *4* | *5* | *8* | *Subtotals* | *5* | *4* | *9* | *Subtotals* | *0* | *3* | *11* |
| | Total | | | 17 | Total | | | 18 | Total | | | 14 |
| *Junior* | ME115A | | 3 | | ME 115B | | 3 | | ME115C | | 3 | |
| | ME 203* | | 4 | | ENGR 70A | | 5 | | Eng. Fund. | | 3 | |
| | ME 103D | | 1 | | ARTSTUDI 160 | | | 3 | Sci. Elective | 3 | | |
| | ENGR 102M* | | 1 | | GER | | | 3 | Elective | | | 3 |
| | ME80 | | 3 | | | | | | | | | |
| | GER | | | 3 | | | | | | | | |
| | *Subtotals* | *0* | *12* | *3* | *Subtotals* | *0* | *8* | *6* | *Subtotals* | *3* | *6* | *3* |
| | Total | | | 15 | Total | | | 14 | Total | | | 12 |
| *Senior* | ME 116 | | 4 | | ME 216A | | 4 | | ME 216B | | 4 | |
| | Sci Elective | 3 | | | ME 112 | | 4 | | GER | | | 3 |
| | Elective | | | 3 | GER | | | 3 | Elective | | | 3 |
| | GER | | | 4 | Elective | | | 3 | Elective | | | 3 |
| | *Subtotals* | *3* | *4* | *7* | *Subtotals* | *0* | *8* | *6* | *Subtotals* | *0* | *4* | *9* |
| | Total | | | 14 | Total | | | 14 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units: | 38 |
| Total Engineering Units: | 57 |
| Total Other Units: | 83 |
| Total Units: | 178 |

*Notes:*

* ME 203 must be taken concurrently with ENGR 102M to fulfill the "Writing in the Major" requirement.

# Product Design

*(Typical 4-Year Plan with AP Units and an overseas quarter)*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 51 | 5 | | | MATH 52 | 5 | | | PHYS 43 | 4 | | |
| | PHYS 45 | 4 | | | PHYS 41 | 4 | | | PSYCH 1 | | | 5 |
| | IHUM | | | 4 | IHUM | | | 4 | IHUM | | | 4 |
| | | | | | Writing | | | 4 | | | | |
| | *Subtotals* | *9* | *0* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *4* | *0* | *9* |
| | Total | | | 13 | Total | | | 17 | Total | | | 13 |
| *Sophomore* | Language | | | 5 | Language | | | 5 | Language | | | 5 |
| | ENGR 14 | | 4 | | ME 101 | | 3 | | ME 120 | | 3 | |
| | ARTSTU60 | | | 3 | ME 110A | | 1 | | PSYCH elective | | | 3 |
| | ENGR 40 | | 5 | | STATS 60 | 5 | | | ARTSTU elective | | | 3 |
| | | | | | Writing | | | 4 | | | | |
| | *Subtotals* | *0* | *9* | *8* | *Subtotals* | *5* | *4* | *9* | *Subtotals* | *0* | *3* | *11* |
| | Total | | | 17 | Total | | | 18 | Total | | | 14 |
| *Junior* | ME115A | | 3 | | ME 115B | | 3 | | Overseas studies | | | 12 |
| | ME 203* | | 4 | | ENGR 70A | | 5 | | (waive ME115C) | | | |
| | ME 103D | | 1 | | ARTSTUDI 160 | | | 3 | | | | |
| | ENGR 102M* | | 1 | | GER | | | 3 | | | | |
| | ME80 | | 3 | | | | | | | | | |
| | GER | | | 3 | | | | | | | | |
| | *Subtotals* | *0* | *12* | *3* | *Subtotals* | *0* | *8* | *6* | *Subtotals* | *0* | *0* | *12* |
| | Total | | | 15 | Total | | | 14 | Total | | | 12 |
| *Senior* | ME 116 | | 4 | | ME 216A | | 4 | | ME 216B | | 4 | |
| | Sci. Elective | 3 | | | ME 112 | | 4 | | GER | | | 3 |
| | Sci Elective | 3 | | | GER | | | 3 | Elective | | | 3 |
| | Elective | | | 4 | Elective | | | 4 | Elective | | | 3 |
| | *Subtotals* | *6* | *4* | *4* | *Subtotals* | *0* | *8* | *7* | *Subtotals* | *0* | *4* | *9* |
| | Total | | | 14 | Total | | | 15 | Total | | | 13 |

| | |
|---|---|
| Total Math & Science Units (including 10 AP units): | 43 |
| Total Engineering Units: | 52 |
| Total Other Units: | 90 |
| **Total Units:** | 185 |

*Notes:*

* ME 203 must be taken concurrently with ENGR 102M to fulfill the "Writing in the Major" requirement.

# Product Design

*(Typical 4-Year Plan without an overseas quarter)*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other | Class | Math/ Sci. | Engr. | Other |
| *Freshman* | MATH 51 | 5 | | | MATH 52 | 5 | | | PHYSICS 43 | 4 | | |
| | ENGR 14 | | 3 | | PHYSICS 41 | 4 | | | PSYCH 1 | | | 5 |
| | IHUM | | | 4 | IHUM | | | 4 | IHUM | | | 4 |
| | | | | | Writing | | | 4 | | | | |
| | *Subtotals* | *5* | *3* | *4* | *Subtotals* | *9* | *0* | *8* | *Subtotals* | *4* | *0* | *9* |
| | Total | | | 12 | Total | | | 17 | Total | | | 13 |
| *Sophomore* | Language | | | 5 | Language | | | 5 | Language | | | 5 |
| | PHYSICS 45 | 4 | | | ME 101 | | 3 | | ME 120 | | 3 | |
| | ARTSTUDI 60 | | | 3 | ME 110A | | 1 | | PSYCH elective | | | 3 |
| | ENGR 40 | | 5 | | STATS 60 | 5 | | | ARTSTUDI elective | | | 3 |
| | | | | | Writing | | | 4 | | | | |
| | *Subtotals* | *4* | *5* | *8* | *Subtotals* | *5* | *4* | *9* | *Subtotals* | *0* | *3* | *11* |
| | Total | | | 17 | Total | | | 18 | Total | | | 14 |
| *Junior* | ME115A | | 3 | | ME 115B | | 3 | | ME115C | | 3 | |
| | ME 203* | | 4 | | ENGR 70A | | 5 | | Eng. Fund. | | 3 | |
| | ME 103D | | 1 | | ARTSTUDI 160 | | | 3 | Sci. Elective | 3 | | |
| | ENGR 102M* | | 1 | | GER | | | 3 | Elective | | | 3 |
| | ME80 | | 3 | | | | | | | | | |
| | GER | | | 3 | | | | | | | | |
| | *Subtotals* | *0* | *12* | *3* | *Subtotals* | *0* | *8* | *6* | *Subtotals* | *3* | *6* | *3* |
| | Total | | | 15 | Total | | | 14 | Total | | | 12 |
| *Senior* | ME 116 | | 4 | | ME 216A | | 4 | | ME 216B | | 4 | |
| | Sci Elective | 3 | | | ME 112 | | 4 | | GER | | | 3 |
| | Elective | | | 3 | GER | | | 3 | Elective | | | 3 |
| | GER | | | 4 | | | | | | | | |
| | *Subtotals* | *3* | *4* | *7* | *Subtotals* | *0* | *8* | *3* | *Subtotals* | *0* | *4* | *6* |
| | Total | | | 14 | Total | | | 11 | Total | | | 10 |

| | |
|---|---|
| Total Math & Science Units (including 10 AP units): | 43 |
| Total Engineering Units: | 57 |
| Total Other Units: | 77 |
| **Total Units:** | 177 |

*Notes:*

* ME 203 must be taken concurrently with ENGR 102M to fulfill the "Writing in the Major" requirement.

# INSTRUCTIONS FOR DECLARING MAJOR IN ENGINEERING: PRODUCT DESIGN (BS-PD)

Detailed instructions can be obtained from the ME Student Services Office (Building 530, Room 125)

1. Print a copy of your transcript from Axess.
2. Download and complete the program sheet from the School of Engineering web site at **`http://ughb.stanford.edu`**. If you need instructions on how to download, consult the School of Engineering Student Affairs Office in Terman 201. Please note: When completing the sheet, include courses you plan to take as well as those you have already taken.
3. Pick up a Product Design major declaration form from the Student Services Office in Building 530.
4. Identify an undergraduate program advisor from the list on the back of the major declaration form. If you prefer, the Student Services Office will assign one for you.
5. Discuss the program with your advisor and have him/her approve the program sheet AND the declaration form.
6. Return completed documents to the ME Student Services Office
7. Login to Axess and formally declare your major. **NOTE: Select "Engineering" as your major (NOT Mechanical Engineering), with a subplan in Product Design.**
8. E-mail Christine Crapps (crapps@stanford.edu) to let her know that you have declared your major so that she may approve it.

**Note: The online version of the UGHB is considered the definitive and final version of SoE requirements for each major**. Since corrections or updates may have been made after this Handbook was published in August 2009, download the online PD program sheet from **`ughb.stanford.edu`** to ensure you are using an accurate major plan.

**Stanford University ♦ School of Engineering**

# Product Design

# 2009–2010 Program Sheet

***Final version of completed and signed program sheet due to the department no later than one month prior to the last quarter of senior year.***

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

Email: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

## Mathematics and Science Requirement

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| *Mathematics (20 units minimum; see Note 1)* | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *Mathematics Unit Total (20 units minimum)* | | |

*Science (22 units minimum; see note 1)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *School of Engineering Approved Science Courses (15 units minimum; see Note 2)* | | | | | | | |
| PHYS | 41 | Mechanics (req'd | | | | 4 | |
| PHYS | 43 | Light and Heat (req'd) | | | | 4 | |
| PHYS | 45 | Electricity and Magnetism (req'd) | | | | 4 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | *SOE Science Unit Total (15 units minimum)* | | |

*Behavioral Sciences (7 units minimum)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PSYCH | 1 | Intro to Psychology (req'd) | | | | 5 | |
| PSYCH | | Psychology Elective (PSYCH 20-95) | | | | 2 to 5 | |
| | | | | | *Behavioral Science Unit Total (7 units minimum)* | | |
| | | | | | *Science Unit Total (SOE + Behavioral) (22 units minimum)* | | |
| | | | | | *Mathematics and Science Total ( 42 units minimum)* | | |

## Technology in Society Requirement (1 course required)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ME | 120 | History and Philosophy of Design (req'd) | | | | 3 or 4 | |

## NOTES

* This form is available as an Excel file at http://ughb.stanford.edu/. The printed form must be signed by the advisor and by the ME Student Services Manager. Changes must be initialed in ink.

* All courses listed on this form must be taken for a letter grade if offered by the instructor.

* Read all emails from the Office of Student Affairs; this is the SoE's only method of conveying key information to Engineering majors.

* Minimum Grade Point Average (GPA) for all courses in Engineering Fundamentals and Product Design Depth (combined) is 2.0.

* Transfer and AP credits in Math, Science, Fundamentals, & TIS must be approved by the SoE Dean's office. Transfer credits in Engineering Depth must be approved by the Advisor. Transfer credit information and petitions are available at http://ughb.stanford.edu/transfer.html.

* All courses listed on this form must be listed under only one category; no double-counting.Delete courses not taken.

( 1 ) AP units can be applied; have these approved by SoE Dean's Office before final quarter.

( 2 ) At least 15 units must be from the School of Engineering approved science list in the undergraduate handbook (Figure 3-2 and at http://ughb.stanford.edu).

## Product Design Program Sheet (continued)

**Engineering Fundamentals** (3 courses required)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENGR | 40 | Introductory Electronics (req'd) | | | | 5 | |
| ENGR | 70A | Programming Methodology (req'd) | | | | 5 | |
| | | Fundamentals Elective: See Note 3 | | | | 3-5 | |
| | | | | | *Engineering Fundamentals Total (3 courses required)* | | |

**Product Design Depth** *(51 units minimum)*

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| ENGR | 14 | Applied Mechanics (req'd) | | | | 3 | |
| ENGR | 102M | Tech/Prof Writing (req'd) WIM; see note 5 | | | | 1 | |
| ME | 80 | Strength of Materials (req'd) | | | | 4 | |
| ME | 101 | Visual Thinking (req'd) | | | | 3 | |
| ME | 103D | Engineering Drawing (req'd) | | | | 1 | |
| ME | 110A | Design Sketching (req'd) | | | | 1 | |
| ME | 112 | Mechanical Engineering Design (req'd) | | | | 4 | |
| ME | 115A | Introduction to Design Methods (req'd; see Note 4) | | | | 3 | |
| ME | 115B | Human Values in Design (req'd; see Note 4) | | | | 3 | |
| ME | 115C | Design and Business Factors (req'd; see Note 4) | | | | 3 | |
| ME | 116 | Advanced Product Design: Formgiving (req'd) | | | | 4 | |
| ME | 203 | Manufacturing Technology (req'd) WIM; see Note 5 | | | | 4 | |
| ME | 216A | Advanced Product Design: Needfinding (req'd) | | | | 4 | |
| ME | 216B | Advanced Product Design: Implementation (req'd) | | | | 4 | |
| ARTSTUDI | 60 | Basic Design (req'd) | | | | 3 | |
| ARTSTUDI | 160 | Intermediate Design (req'd) | | | | 3 | |
| ARTSTUDI | | Studio Art Course | | | | 3 | |
| | | | | | *Product Design Engineering Depth Total (51 units)* | | |

**Program Totals**

| | |
|---|---|
| *Mathematics and Science* *(42 units minimum)* | |
| *Product Design Depth* *(51 units minimum)* | |
| *Engineering (Fundamentals + Depth) Units* *(64 units minimum)* | |

**Program Approvals**

*Advisor*

Printed Name: _____ Date: _____

Signature: _____

*Departmental*

Printed Name: _____ Date: _____

Signature: _____

*School of Engineering (signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

**NOTES (continued from page 1)**

(3) Choose one more fundamental from: ENGR 10, 15, 20, 25, 30, 50, 50M, 60, 62

(4) One ME 115 class requirement waived if student takes a quarter abroad.

( 5 ) Fulfills the "Writing in the Major" requirement. ENGR102M and ME203 must be taken concurrently.

# 6. MINORS AND HONORS PROGRAMS

Many of the School's departments offer an undergraduate minor to interested students. The requirements for each of the available minors are listed on the pages that follow. To obtain more information, contact a department's Undergraduate Program representative or the Office of Student Affairs in Room 201, Terman Engineering Center.

General requirements and policies for a minor in the School of Engineering are:

1. A minor consists of a set of courses totaling not less than 18 and not more than 36 units, with a minimum of six courses of at least 3 units each.
2. The set of courses should be sufficiently coherent as to present a body of knowledge within a discipline or sub-discipline.
3. Students may not overlap (double-count) courses for completing major and minor requirements, *unless*:
    a) Overlapping courses constitute introductory skill requirements (for example, introductory math and statistics)
    b) Overlapping courses enable the student to meet School of Engineering requirements, such as introductory science, the TIS requirement, and engineering fundamentals.
4. Departmentally-based minor programs are structured at the discretion of the sponsoring department, subject only to requirements (1), (2), and (3) above.

No "General Engineering" minor is offered. University policy and procedures for declaring a minor, the Multiple-Major Minor Form, limitations on No Credit units, and so forth, may be found in the *Stanford Bulletin* or at the Student Services Center in 2nd floor Tresidder Union. Minors must be officially declared by students no later than the deadline for their application to graduate, although individual departments may set an earlier deadline. All Multiple-Major Minor Forms must be signed by the Dean's Office (Darlene Lazar in 201 Terman).

# MINOR PROGRAMS

## AERONAUTICS AND ASTRONAUTICS MINOR

The Aero/Astro minor introduces undergraduates to the key elements of modern aerospace systems. Within the minor, students may focus on aircraft, spacecraft, or disciplines relevant to both. The course requirements for the minor are listed in the following table.

**COURSES FULFILLING THE MINOR IN AERONAUTICS AND ASTRONAUTICS†**

| **Core:** | **Title** | **Units** |
|---|---|---|
| ENGR 14* | Applied Mechanics: Statics | 3 |
| ENGR 15* | Dynamics | 3 |
| ENGR 30* | Engineering Thermodynamics | 3 |
| AA 100 | Introduction to Aero/Astro | 3 |
| ME 70 | Introductory Fluids Engineering | 4 |
| ME 131A | Heat Transfer | 3-4 |
| | *Core total* | 12–25 |

| **Upper division electives:** | | |
|---|---|---|
| 2 courses from one of the elective areas below | | 6 |
| 1 course from a second elective area below | | 3 |
| | *Program total* | 21–34 |

| **Elective areas:** | | |
|---|---|---|
| Dynamics and Controls: | | |
| ENGR 105 | Feedback Control Design | 3 |
| ENGR 205 | Introduction to Control Design Techniques | 3 |
| AA 242A | Classical Dynamics | 3 |
| AA 271A | Dynamics and Control of Spacecraft/Aircraft | 3 |
| AA 279 | Space Mechanics | 3 |
| Aerospace Systems Synthesis/Design: | | |
| AA 236A,B | Spacecraft Design, Spacecraft Design Laboratory | 5, 3 |
| AA 241A,B | Introduction to Aircraft Design, Synthesis, and Analysis (not given 2007-08) | 3, 3 |
| Fluids: | | |
| AA 200A | Applied Aerodynamics | 3 |
| AA 210A | Fundamentals of Compressible Flow | 3 |
| AA 214A | Numerical Methods in Fluid Mechanics | 3 |
| AA 283 | Aircraft and Rocket Propulsion | 3 |
| ME 131B | Fluid Mechanics: Compressible Flow and Turbomachinery | 4 |
| Structures: | | |
| AA 240A | Analysis of Structures | 3 |
| AA 240B | Analysis of Structure II | 3 |
| AA 256 | Mechanics of Composites | 3 |
| Notes | * ENGR 14, 15, or 30 are waived as minor requirements if already taken as part of the major. | |
| | * Courses cannot be double-counted within a major and a minor, or within multiple minors: if any of the core classes are an integral part of the student's major or of another minor program, the Aero/Astro advisor can help select substitute courses to fulfill the Aero/Astro requirements. | |

## CHEMICAL ENGINEERING MINOR

The courses required for the Chemical Engineering minor appear in the following table.

**COURSES FULFILLING THE MINOR IN CHEMICAL ENGINEERING**

| Class | Title | Units |
|---|---|---|
| ENGR 20 | Introduction to Chemical Engineering | 3 |
| CHEMENG 100 | Chemical Process Modeling, Dynamics, and Control | 3 |
| CHEMENG 110 | Equilibrium Thermodynamics | 3 |
| CHEMENG 120A | Fluid Mechanics | 4 |
| CHEMENG 120B | Energy and Mass Transport | 4 |
| CHEMENG 140 *or*<br>CHEMENG 160 *or*<br>CHEMENG 181 | Micro & Nanoscale Fabrication Engineering<br>Polymer Science and Engineering<br>Biochemistry I | 3<br>3<br>3 |
| CHEMENG 170 | Kinetics and Reactor Design | 3 |
| CHEMENG 180 | Chemical Engineering Plant Design | 3 |
| CHEMENG 185A | Chemical Engineering Laboratory A | 4 |
| CHEM 171 | Physical Chemistry - Chemical Thermodynamics | 3 |
| | *Program total* | 33 |

## CIVIL ENGINEERING MINOR

The civil engineering minor is intended to give students an in-depth introduction to one or more areas of civil engineering. Departmental expertise and undergraduate course offerings are available in the areas of Architectural Design, Construction Engineering and Management, and Structural/Geotechnical Engineering. (Students interested in Environmental and Water Studies should refer to the Environmental Engineering minor.) The minimum prerequisite for a civil engineering minor is MATH 42 (or MATH 21); however many courses of interest require PHYSICS 41 and/or MATH 51 as prerequisites. Students should recognize that a minor in civil engineering is **not** an ABET-accredited degree program.

Since civil engineering is a very broad field, and undergraduates having widely varying backgrounds may be interested in obtaining a civil engineering minor, there is no single set of course requirements. Interested students are encouraged to propose their own set of courses within the guidelines listed on the following page; the undergraduate minor advisor must officially approve this list for the Civil and Environmental Engineering Department. Additional information on preparing a minor program, including sample programs focusing on each of the three areas of expertise listed above, is available at **`http://cee.stanford.edu/prospective/ug/minor_overview.html`**.

General guidelines and procedures:

- A civil engineering minor must contain at least 24 units of coursework not taken for the major, and must conform to the School of Engineering minor requirements published in the *Stanford Bulletin* or this Handbook.
- Complete a **Major-Minor & Multiple-Major Course Approval Form**. The form is available online at `http://registrar.stanford.edu/shared/forms.htm#Undergrads`, or, in the CEE department's student services office.
- Consult and obtain study list approval from the appropriate advisor, using the Major-Minor & Multiple-Major Course Approval form: Professor Kiremidjian (**`kiremidjian@stanford.edu`**) is the CEE undergraduate minor adviser in Structural Engineering and Construction. John Barton (**`jhbarton@stanford.edu`**), Program Director, is the CEE undergraduate minor adviser in Architectural Design. You must also obtain a signature on this form from the Dean's Office (Darlene Lazar) before it goes to the Student Services Center.
- Follow the instructions attached to the form. Prior to applying online for the minor in civil engineering, a completed and signed copy of the form must be filed with the department's office of student services in the Y2E2 Building, Rm 316.
- Apply for the CE minor on Axess. The CEE Student Services Administrator will then check the Major-Minor & Multiple-Major Course Approval Form to accept the declaration. **Minors must be officially declared and all courses completed (or in progress) no later than the deadline for a student's application to graduate.**

## COMPUTER SCIENCE MINOR

The courses necessary to fulfill the requirements for the minor in Computer Science are shown in the table below (continuing on the next page). In addition, students must complete the standard mathematics sequence through MATH 51 as a prerequisite.

**COURSES FULFILLING THE MINOR IN COMPUTER SCIENCE**

| *Introductory programming:* | | **Units** |
|---|---|---|
| CS 106B or<br>CS 106X | Programming Abstractions<br>Programming Abstractions (Accelerated) | 5<br>5 |
| *Core:* | | |
| CS 103[2] | Mathematical Foundations of Computing | 5 |
| CS107[3] | Computer Organization and Systems | 5 |
| CS109[4] | Introduction to Probability for Computer Scientists | 5 |
| | *Core total (including introductory programming)* | 20 |

*(continued on the next page)*

| **Computer Science Minor, continued** | | |
|---|---|---|
| *Electives:* | | |
| 2 courses from two different areas taken from the list below | | 6–9 |
| | *Program Total* | **26-29** |
| *Elective areas:* | | |
| Software: | | |
| CS 108 | Object-Oriented Systems Design | 4 |
| CS 110 | Principles of Computer Systems | 5 |
| Systems: | | |
| CS 140 | Operating Systems | 4 |
| CS 143 | Compilers | 4 |
| CS 144 | Introduction to Computer Networking | 4 |
| CS 145 | Introduction to Databases | 4 |
| CS 148 | Introduction to Computer Graphics and Imaging | 3 |
| Theory: | | |
| CS 154 | Automata and Complexity Theory | 4 |
| CS 157 | Logic and Automated Reasoning | 4 |
| CS 161 | Design and Analysis of Algorithms | 5 |
| Artificial Intelligence: | | |
| CS 121 or<br>CS 221 | Introduction to Artificial Intelligence<br>Artificial Intelligence: Principles and Techniques | 3<br>4 |
| Human-Computer Interaction: | | |
| CS 147 | Introduction to HCI Design | 3–4 |

Notes:

1. AP units may be used to meet the introductory programming requirement.
2. Students who have taken either CS103X or CS103A,B are considered to have satisfied the CS103 requirement.
3. The name of CS107 has changed. The previous CS107 course titled Programming Paradigms also fulfills this requirement.
4. Students who complete STAT 116, MS&E 120, or CME 106 in Winter 2008-09 or earlier may count that course as satisfying the CS109 requirement. These same courses taken in Spring 2008-09 or later cannot be used to satisfy the CS 109 requirement.

*All courses must be taken for a letter grade.
*The minimum acceptable GPA is 2.0.
*Only CS106AB/X may be double-counted towards both major and minor requirements.
*A maximum of one transfer credit course may be counted towards the minor requirements.

## ELECTRICAL ENGINEERING MINOR

There are three options for completing a minor in Electrical Engineering, as outlined below.

### COURSES FULFILLING THE MINOR IN ELECTRICAL ENGINEERING

| ***Option I*** | | **Units** |
|---|---|---|
| ENGR 40 | Introductory Electronics | 5 |
| EE 101A | Signal Processing and Linear Systems I | 4 |
| EE 101B | Signal Processing and Linear Systems II | 4 |
| Four letter-graded EE courses of level 100 or higher | | 13–21 |
| | *Program total* | 26–34 |
| *Option II* | | |
| ENGR 40 | Introductory Electronics | 5 |
| EE 102A | Circuits I | 4 |
| EE 102B | Circuits II | 4 |
| Four letter-graded EE or EE cognate courses of level 100 or higher | | 13–21 |
| | *Program total* | 28–36 |

| Electrical Engineering Minor, continued | | |
|---|---|---|
| *Option III* | | |
| ENGR 40 | Introductory Electronics | 5 |
| EE 108A | Digital Systems I | 4 |
| EE 108B | Digital Systems II | 4 |
| Four letter-graded EE or EE cognate courses of level 100 or higher | | 13–21 |
| | *Program total* | 28–36 |

## ENVIRONMENTAL ENGINEERING MINOR

The environmental engineering minor is intended to give students an in-depth introduction to one or more areas of environmental engineering. Departmental expertise and undergraduate course offerings are available in the areas of Environmental Engineering and Science, Environmental Fluid Mechanics and Hydrology, and Atmosphere/Energy Engineering. The minimum prerequisite for an environmental engineering minor is MATH 42 (or MATH 21); however, many courses of interest require PHYSICS 41 and/or MATH 51 as prerequisites. Students should recognize that a minor in environmental engineering is not an ABET-accredited degree program.

Since undergraduates having widely varying backgrounds may be interested in obtaining an environmental engineering minor, no single set of course requirements will be appropriate for all students. Instead, interested students are encouraged to propose their own set of courses within the guidelines listed below; this list must be officially approved by the undergraduate minor advisor for the Civil and Environmental Engineering (CEE) Department. Additional information, including sample programs focusing on the three different areas of expertise listed above, is available at **`http://cee.stanford.edu/prospective/ug/minorEnvE.html`**.

General guidelines and procedures for the minor in Environmental Engineering:

- An environmental engineering minor must contain at least 24 units of coursework not taken for the major, and must conform to the School of Engineering (SoE) minor requirements published in the *Stanford Bulletin* or in this Handbook.
- A **Major-Minor & Multiple-Major Course Approval Form must be completed;** available at **http://registrar.stanford.edu/shared/forms/htm#Undergrads** or in the department's student services office.
- Prof. Lynn Hildemann, email: **hildemann@stanford.edu**, is the advisor for minors in Environmental Engineering. Students must consult with her in developing their minor program and must obtain her approval of their study list using the Major-Minor & Multiple-Major Course Approval form. **You must also obtain a signature on this form from the Dean's Office** (Darlene Lazar) before it goes to the Student Services Office.

- Follow the instructions attached to the form. Prior to applying for the minor in Environmental Engineering online, a completed and signed copy of the form must be filed with the CEE department's office of student services in Rm 316, Y2E2 Building.
- Apply for the EnvE minor on Axess. The CEE Student Services Administrator will then check the **Major-Minor & Multiple-Major Course Approval Form** to accept the declaration. **Minors must be officially declared and all courses completed (or in progress) no later than the deadline for a student's application to graduate.**

## MANAGEMENT SCIENCE AND ENGINEERING MINOR

The following courses fulfill the requirements for the minor in Management Science and Engineering. In addition, students must complete MATH 51 or CME 100 as a prerequisite.

**COURSES FULFILLING THE MINOR IN MANAGEMENT SCIENCE AND ENGINEERING**

| **Core:** | | **Units** |
|---|---|---|
| ENGR 60 | Engineering Economy | 3 |
| MS&E 111 | Introduction to Optimization | 4 |
| MS&E 120 | Probabilistic Analysis | 5 |
| MS&E 121 | Introduction to Stochastic Modeling | 4 |
| MS&E 130 *or*<br>MS&E 134 | Information Systems and Networks *or*<br>Organizations and Information Systems | 3<br>4 |
| MS&E 142 or<br>MS&E 260 | Investment Science *or*<br>Analysis of Production and Operating Systems | 3<br>4 |
| MS&E 180 | Organizations: Theory and Management | 4 |
| | *Core total* | 26-28 |
| *Electives:* | | |
| Any one 100 or 200 level MS&E course. | | 3-4 |
| | *Program total* | 29-32 |

## MATERIALS SCIENCE AND ENGINEERING MINOR

A minor in the Department of Materials Science and Engineering allows interested students to explore the role of materials in modern technology and to gain understanding of the fundamental processes that govern materials behavior. The courses listed in the following table fulfill the requirements. All courses for the minor requirements must be taken for a letter grade if offered by the instructor.

**COURSES FULFILLING THE MINOR IN MATERIALS SCIENCE AND ENGINEERING**

| **Core*: Choose one of the following:*** | | **Units** |
|---|---|---|
| ENGR 50 | Introduction to Materials Science, Nantechnology Emphasis | 4 |
| ENGR 50M | Introduction to Materials Science, Biomaterials Emphasis | 4 |
| | *Core total* | 4 |

*(continued on the next page)*

| Materials Science and Engineering Minor, continued | | |
|---|---|---|
| *Electives:* | | |
| Any 6 courses taken from the list below | | 24 |
| | *Program total* | 28 |
| *Approved elective courses:* | | |
| MATSCI 151 | Microstructure and Mechanical Properties | 4 |
| MATSCI 152 | Electronic Materials Engineering | 4 |
| MATSCI 153 | Nanostructure and Characterization | 4 |
| MATSCI 154 | Solid State Thermodynamics | 4 |
| MATSCI 155 | Nanomaterials Synthesis | 4 |
| MATSCI 156 | Solar Cells, Fuel Cells, and Batteries: Materials for the Energy Solution | 4 |
| MATSCI 157 | Quantum Mechanics of Nanoscale Materials | 4 |
| MATSCI 160 | Nanomaterials Laboratory | 4 |
| MATSCI 161 | Nanocharacterization Laboratory | 4 |
| MATSCI 162 | X-Ray Diffraction Laboratory | 4 |
| MATSCI 163 | Mechanical Behavior Laboratory | 4 |
| MATSCI 164 | Electronic and Photonic Materials and Devices Laboratory | 4 |
| MATSCI 190 | Organic and Biological Materials | 4 |
| MATSCI 192 | Solid State Thermodynamics | 4 |
| MATSCI 193 | Materials Chemistry | 4 |
| MATSCI 194 | Thermodynamics and Phase Equilibria | 4 |
| MATSCI 195 | Waves and Diffraction in Solids | 4 |
| MATSCI 196 | Imperfections in Crystalline Solids | 4 |
| MATSCI 197 | Rate Processes in Materials | 4 |
| MATSCI 198 | Mechanical Properties of Materials | 4 |
| MATSCI 199 | Electronic and Optical Properties of Solids | 4 |

## MECHANICAL ENGINEERING MINOR

There are three options for students interested in a minor in Mechanical Engineering: A general minor that exposes students to the breadth of the field, and two specialized minors—Thermosciences and Mechanical Design—that allow students to pursue a particular area in more depth. The requirements for each of these minors are listed below.

### General Minor in Mechanical Engineering

This minor aims to expose students to the breadth of Mechanical Engineering in terms of topics and of analytic and design activities. Students interested in this minor must take the following courses as prerequisites: MATH 41, MATH 42, PHYSICS 41.

| Core | | Units |
|---|---|---|
| ENGR 14* | Applied Mechanics:Statics | 3 |
| ENGR 15* | Dynamics | 3 |
| ENGR 30* | Engineering of Thermodynamics | 3 |
| ME 70 | Introductory Fluids Engineering | 4 |
| ME 101 | Visual Thinking | 3 |
| *Plus any two of the following electives:* | | |
| ME 80 | Strength of Materials | 4 |
| ME 131A | Heat Transfer | 4 |
| ME 161 | Dynamic Systems | 4 |

| | | |
|---|---|---|
| ME 203 | Manufacturing and Design | 4 |
| | **Program Total** | **24** |

### Thermosciences Minor in Mechanical Engineering

Students interested in this minor must take the following courses as prerequisites: MATH 41, MATH 42, MATH 51 (or CME 100), PHYSICS 41.

| **Core:** | | **Units** |
|---|---|---|
| ENGR 14* | Applied Mechanics: Statics | 3 |
| ENGR 30* | Thermodynamics | 3 |
| ME 70 | Introductory Fluids Engineering | 4 |
| ME 131A | Heat Transfer | 4 |
| ME 131B | Fluid Mechanics | 3 |
| ME 140 | Advanced Thermal Systems | 5 |
| | **Program Total** | **22** |

### Mechanical Design Minor in Mechanical Engineering

This minor aims to expose students to design activities, supported by analysis. Students interested in this minor must take the following courses as prerequisites: MATH 41, MATH 42, PHYSICS 41.

| **Core** | | **Units** |
|---|---|---|
| ENGR 14* | Applied Mechanics: Statics | 3 |
| ENGR 15* | Dynamics | 3 |
| ME 80 | Strength of Materials | 4 |
| ME 101 | Visual Thinking | 3 |
| ME 112 | Mechanical Systems Design | 4 |
| ME 203 | Manufacturing and Design | 4 |
| *Plus one of the following:* | | |
| ME 113 | Mechanical Engineering Design | 4 |
| ME 210 | Introduction to Mechatronics | 4 |
| ME 220 | Introduction to Sensors | 3 |
| | **Program Total** | **24-25** |

*For all of the above minor programs: If ENGR14, 15, or 30 will be taken for the major requirements, other courses may be substituted for these minor requirements via petition. The total number of required units remains the same as listed in the above guidelines.

# HONORS PROGRAMS

The departmental honors programs are designed to allow undergraduates with strong academic records and enthusiasm for independent research to engage in a significant project leading to a degree with departmental honors. This option is particularly valuable for students who intend to pursue a Ph.D. after college because it provides research experience that helps prepare a student for doctoral-level work. Typically, these programs are competitive in terms of their admission and also require that the student find a faculty member to supervise the work. Honors programs currently exist only in Chemical Engineering, Civil Engineering, Computer Science, Electrical Engineering, Environmental Engineering, Mechanical Engineering, and Science, Technology and Society, although the School is encouraging other departments to establish honors programs as well. These programs are described in the remainder of this section.

## CHEMICAL ENGINEERING

This program offers an opportunity for undergraduate majors to undertake research at an advanced level with a faculty mentor, graduate students, and other undergraduates. This three-quarter sequential program involves (1) research study in an area proposed to and agreed to by a Department of Chemical Engineering faculty adviser and/or sponsor, (2) concurrent enrollment in the undergraduate honors seminar, (3) completion of a faculty-approved thesis, and (4) participation in the Chemical Engineering Honors Symposium held annually during Spring Quarter. The last requirement may also be fulfilled through an alternative, public, oral presentation with the approval of the department chair. Work should begin at least four quarters prior to graduation.

Chemical engineering majors who wish to be considered for the honors program should see departmental student services by the beginning of Winter Quarter of their junior year for more information about the application process, for a research proposal template and for other assistance. An application includes a proposal describing the research project, endorsement by a chemical engineering faculty sponsor, and a transcript of courses taken at Stanford. A faculty review committee will select the successful candidates. To qualify for recommendation for the degree of Bachelor of Science in Chemical Engineering with Honors, degree students should:

1. Maintain an overall GPA of 3.5 or higher as calculated on the unofficial transcript.

2. Complete at least three quarters of research with a minimum of 9 units of CHEMENG 190H for a letter grade. All quarters must focus on the same topic. Maintain the same faculty advisor and faculty reader throughout, if feasible.
3. Enroll in CHEMENG 191H concurrently with each enrollment in 190H
4. Participate in the Chemical Engineering Honors Symposium held during Spring Quarter with a poster and oral presentation of thesis work or, at the faculty's discretion, in a comparable public event.
5. Submit final thesis drafts simultaneously to both the advisor and the reader (and if appropriate to the Chemical Engineering faculty sponsor) no later than April 16 (or the end of the second week of the quarter in which the BSH is to be conferred).
6. Complete all work and thesis revisions and obtain indicated faculty approvals on the Certificate of Final Reading of Thesis form by the end of the third week of May (or the second month of the graduation quarter).
7. Submit to Chemical Engineering Student Services five final copies of the honors thesis as approved by the appropriate faculty. Include in each an original, completed faulty signature sheet immediately following g the title page. The 2009-10 deadline is May 10, 2010, (or the Monday at the beginning of the second week of the second month of the graduation quarter).
8. Submit one copy of the honors thesis to the Dean's Office in 201 Terman once it is approved by the department (no later than two weeks before the end of your final quarter.)

All requirements for the honors program are in addition to the normal undergraduate program requirements.

## CIVIL ENGINEERING

Highly qualified engineering students can receive a B.S. with Honors in Civil Engineering by undertaking a more intensive course of study that includes an in-depth research project. To apply, you must find a faculty member in the CEE department who is willing to act as supervisor for your undergraduate honors thesis; the two of you must agree upon a topic for the thesis project.

In the fourth quarter before graduation (typically, spring quarter of junior year), you must submit to the CEE Student Services office for approval a written proposal describing the research to be undertaken. At the time of submittal you must have a GPA of at least 3.3 for coursework taken at Stanford, and this GPA must be maintained until graduation. You must complete a written thesis of high quality, obtaining input from the School of Engineering Writing Program via ENGR 202S

or its equivalent. Up to 10 units of CEE 199H may be taken to support the research efforts. The ENGR 202S and CEE 199H units are beyond the normal undergraduate program requirements. The completed thesis must be submitted to the thesis advisor for review by the Monday after the change of grading basis for your graduation quarter (May 12, 2010 for students graduating in the spring). The advisor must approve and sign off on your written thesis. In addition to a written thesis, you are strongly encouraged to present your research results in a seminar. Two copies of the signed thesis must be provided to the CEE Student Services office by day after the course withdrawal deadline for your graduation quarter (May 26, 2010, for students graduating in the spring).

## COMPUTER SCIENCE

Selected computer science undergraduates whose academic records and personal initiative indicate that they have the necessary skills to undertake high-quality research in computer science may apply to the honors program. Applicants must be majoring in Computer Science, must have a GPA of at least 3.6 in courses that count toward the major, and must achieve senior standing (135 or more units) by the end of the academic year in which they apply. Coterminal MS students are eligible to apply as long as they have not already received their undergraduate degrees. Beyond these requirements, students who apply for the honors program must also find a faculty member who agrees to serve as the thesis advisor for the project. Thesis advisors must be members of Stanford's Academic Council.

Students who meet the eligibility requirements and wish to be considered for the honors program must submit a written application to the Computer Science undergraduate program office by May 1 of the year preceding the honors work. The application must include a letter describing the research project, a letter of endorsement from the faculty sponsor, and a transcript of courses taken at Stanford. Each year, a faculty review committee will select the successful candidates for honors from the pool of qualified applicants.

In order to receive departmental honors, students admitted to the honors program must do the following, in addition to satisfying the standard requirements for the undergraduate degree:

1. Complete at least 9 units of CS191 or 191W under the direction of their project sponsor.
2. Attend a weekly honors seminar in winter quarter.
3. Complete an honors thesis deemed acceptable by a committee consisting of the thesis advisor and at east one additional faculty member.

4. Present the thesis at a public colloquium sponsored by the department.
5. Maintain the 3.6 GPA required for admission to the honors program.

## ELECTRICAL ENGINEERING

The Electrical Engineering Department offers a program leading to a Bachelor of Science in Electrical Engineering with Honors. This program offers a unique opportunity for qualified undergraduate majors to conduct independent study and research at an advanced level with a faculty mentor, graduate students, and fellow undergraduates. To qualify, students must complete following requirements:

1. Submit an application, including the thesis proposal, by autumn quarter of senior year signed by the thesis advisor and second reader (one must be a member of the Electrical Engineering faculty).
2. Maintain a grade point average of at least 3.5 in Electrical Engineering courses.
3. Take at least 10 units of EE 191. These units must be letter graded.
4. Submit two final copies of the honors thesis approved by your advisor and second reader.
5. Attend the Electrical Engineering Honors Symposium at the end of Spring quarter and give a poster or oral presentation.

## ENVIRONMENTAL ENGINEERING

Highly qualified students in an engineering major can receive a BS with Honors in Environmental Engineering by undertaking a more intensive course of study that includes an in-depth research project. To apply, you must find a faculty member in the CEE department who is willing to act as supervisor for your undergraduate honors thesis and the two of you must agree upon a topic for the thesis project.

In the fourth quarter before graduation (typically, spring quarter of junior year), you must submit to the CEE Student Services office for approval a written proposal describing the research to be undertaken. At the time of submittal you must have a GPA of at least 3.3 for coursework taken at Stanford, and this GPA must be maintained until graduation. You must complete a written thesis of high quality, obtaining input from the School of Engineering Writing Program via ENGR 202S or its equivalent. Up to 10 units of CEE 199H may be taken to support the research efforts. The

ENGR 202S and CEE 199H units are beyond the normal undergraduate program requirements. The completed thesis must be submitted to the thesis advisor for review by the Monday after the change of grading basis for your graduation quarter (May 12, 2010 for students graduating in the spring). The advisor must approve and sign off on your written thesis. In addition to a written thesis, you are strongly encouraged to present your research results in a seminar. Two copies of the signed thesis must be provided to the CEE Student Services office by day after the course withdrawal deadline for your graduation quarter (May 26, 2010, for students graduating in the spring).

## MECHANICAL ENGINEERING

The Department of Mechanical Engineering offers a program leading to a Bachelor of Science in Mechanical Engineering with Honors. This program provides a unique opportunity for qualified mechanical engineering majors to conduct independent study and research at an advanced level with a faculty mentor.

Honors Criteria:

- GPA of 3.5 or higher in the major
- Arrangement with an ME faculty member who agrees to serve as the thesis advisor. The advisor must be a member of the academic council.
- Application Deadline:
  No later than the second week of the autumn quarter of the senior year.

Application:

- One page written statement describing the research topic and signed advisor form (see ME Student Services for form)
- Unofficial Stanford transcript (from Axess)
- Signature of thesis advisor
- Submit all of the above to the Student Services Office, Building 530, room125

Applications are subject to the review and final approval by the Undergraduate Curriculum Committee. Applicants and thesis advisors will receive written notification when a decision has been made.

In order to receive departmental honors:

- Declare the honors program in Axess

- Maintain the 3.5 GPA required for admissions to the honors program
- Under direction of the thesis advisor, complete at least 9 units of ME191H (Honors Thesis) during the senior year
- Submit a completed thesis draft to the advisor by April 1
- Present the thesis synopsis at the Mechanical Engineering Poster Session held in April
- Further revisions and a final endorsement by the advisor are to be completed by May 15, when two bound copies are to be submitted to the Mechanical Engineering Services Office

## SCIENCE, TECHNOLOGY, AND SOCIETY

Undergraduate engineering majors in all fields are encouraged to consider complementing their technical studies by enrolling in the STS Honors Program (the Science, Technology, and Society Program is a unit of the School of Humanities and Sciences). Earning "Honors in Science, Technology, and Society" requires successful completion of STS 101/E 130 (or STS 101Q), three other STS courses (one for each of three perspectives—ethical, historical, and social scientific–on STS phenomena), and either STS 190 (Junior Honors Seminar) or the STS Honors College the two weeks just before autumn quarter. It also requires a grade of B or better on an original senior honors thesis whose topic involves science or technology in society, and a GPA of 3.4 in the abovementioned four courses.

In recent years, the STS Program has made substantial grants to undergraduate engineering majors enabling them travel to countries such as India, Kenya, Thailand, and South Africa to conduct their honors thesis research. For details on the STS Honors Program, see the STS section of the 2009-10 *Stanford Bulletin*, contact the STS Office (723-2565), or e-mail STS Program Director Professor Robert McGinn (**mcginn@stanford.edu**), or STS Honors Program Director, Dr. Rebecca Slayton (**rslayton@stanford.edu**). A number of past STS honors theses written by engineering students are on file in the STS Office and are available for inspection on request. STS honors theses written by engineering majors include a study of the role of the Internet in the process of social change in Iran, the design of software for tele-diagnosis of health problems in rural India, the technological and economic development of Dubai, and the role of India's Institutes of Technology in Regional Economic Development.

For additional detail on the STS Honors Program, go to **http://sts.stanford.edu/honors.html** and click on the Information and Application Form.

# 7. OTHER DEGREE PROGRAMS

In addition to the Bachelor of Science degree, the School of Engineering offers a variety of additional degree options.

## ALTERNATIVE BACHELOR'S DEGREES

### Bachelor of Arts and Sciences

The Bachelor of Arts and Sciences (B.A.S.) is a baccalaureate degree available to those students who complete the requirements for a major leading to the B.S. degree and for a major leading to the A.B. degree, with no overlapping courses allowed. It is particularly appropriate for engineering students with a strong interest in the humanities and social sciences and allows a student to take full advantage of Stanford's eminence in the liberal arts. Note that this degree requires a minimum of 180 units as contrasted with a Dual A.B. and B.S. Degree Program, which requires 225 units. For further information see the *Stanford Bulletin.*

### Multiple Bachelor of Science Majors

It is possible to receive a single B.S. degree with designations in two separate majors. The second major may or may not be in engineering. For example, students completing separate depth requirements for two different engineering majors may receive a degree designating both majors, with no overlapping courses in depth requirements. Alternatively, a **Secondary Major** is one degree with a note on your transcript that requirements for a second major were completed. For further information see the *Stanford Bulletin.*

## COTERMINAL DEGREE PROGRAMS

Students may work simultaneously toward a bachelor's and a master's degree. The degrees may be granted simultaneously or at the conclusion of different quarters, though the bachelor's degree cannot be awarded after the master's degree has been granted. The two degrees do not have to be from the same department; for example, a B.S. in Mechanical Engineering and a M.S. in Aeronautics and Astronautics is possible.

The University minimum requirements for the coterminal bachelor's/master's program are 180 units for the bachelor's degree plus 45 (or higher departmental requirement, as determined by each graduate department) *unduplicated* units for the master's degree. A student may apply for the coterminal B.S. and M.S. program after completing 120 units toward graduation and no later than the end of their eleventh quarter. Students should apply directly to the department in which they wish to receive the M.S. degree. Most departments require the Graduate Records Examination (GRE); applications can be obtained at Undergraduate Advising and Research in Sweet Hall. After all forms have been completed, they must be submitted, along with an up-to-date transcript, to the department in which the student wishes to obtain the M.S. degree. It is recommended that an applicant check with the proposed graduate department to learn the optimal timing for submitting an application.

**FIGURE 7-1. DEPARTMENTAL INFORMATION FOR COTERM PROGRAMS**

| Dept/Program | Application Deadlines | Contact | Informational Website |
|---|---|---|---|
| Aeronautics & Astronautics | 4th Friday of each quarter | Jay Subramanian Jayanthi@stanford.edu | aa.stanford.edu |
| Bioengineering | Dec 1 | Olgalydia Urbano ourbano@stanford.edu | bioengineering.stanford.edu |
| Chemical Engineering | 10/21/09 for Win 09-10<br>01/27/10 for Spr 09-10<br>04/28/10 for Aut 10-11 | Jeanne Cosby | Cheme.stanford.edu |
| Civil and Environmental Engineering | By beginning of Winter quarter | Sandra Wetzel | Cee.stanford.edu |
| Computational & Mathematical Engineering | 10/13/09 for Wtr 09-10<br>1/19/10 for Spr 09-10<br>1/12/10 for Aut 10-11 | Indira Choudhury | icme@stanford.edu |
| Computer Science | 10/27/09 for Wtr 09-10<br>1/5/10 for Spr 09-10<br>12/8/09 - early Aut 10-11<br>4/20/10 - late Aut 10-11 | Kathleen. DiTommaso | cs.stanford.edu |
| Electrical Engineering | Rolling; see web site | Debbie Bryan | ee-admissions.stanford.edu/coterm/ or in the EE Graduate Handbook http://ee.stanford.edu/gradhandbook/ |
| Engineering: General | | Sally Gressens | See *Stanford Bulletin, SoE, MS in ENGR* |
| Biomechanical Engineering | See ME | Patrick Ferguson 4-7660 | meinquiry@stanford.edu |
| Management Science & Engineering | Aut: 10/27/09<br>Win: 1/5/10 | Juanita Winkleman<br>Lori Cottle | http://www.stanford.edu/dept/MSandE |
| Materials Science | 4th Friday of each quarter | Fi Verplanke | http://mse.stanford.edu verplanke@stanford.edu |
| Mechanical Engineering | 3 deadlines; see website | Patrick Ferguson 4-7660 | meinquiry@stanford.edu |

# 8. SPECIAL PROGRAMS AND ORGANIZATIONS

## ENGINEERING DIVERSITY PROGRAMS (EDP)

The School of Engineering believes strongly in encouraging all students to succeed in engineering. Indeed, one of the great strengths of any educational system lies in having a student body that is both highly qualified and diverse in terms of culture, class, race, ethnicity, gender, background, work and life experiences, skills, and interests. Because of its strong belief in the value of diversity, the School especially encourages women, African Americans, Mexican Americans, Native Americans, Puerto Ricans and other Latinos, as well as others whose backgrounds and experience provide additional dimensions that enhance learning and equity, to utilize the Engineering Diversity Program services and resources.

To underscore its dual commitment to excellence and the value of diversity, the School of Engineering provides a wide range of resources and services through the Engineering Diversity Programs (EDP), which are available to all Stanford students:

- Academic and general advising for undergraduate and graduate students, which includes academic skills development, creating four-year undergraduate plans, Ph.D. academic and professional development support, identifying summer internships, and creating self-directed study groups.
- Accelerated Calculus for Engineers (ACE) introductory mathematics series for additional credit units and added rigor.
- Outreach to and recruitment of graduate EDP students.
- Fellowships, teaching and research assistantships for Ph.D. EDP students and selected
- Support and sponsorship of Society of Women Engineers (SWE), Society of Black Engineers and Scientists (SBSE), American Indian Science and Engineering Society (AISES), and Stanford Society of Chicano/Latino Scientists and Engineers (SSCLES).
- Stanford Summer Engineering Academy (SSEA), a one-month residential program for entering freshmen that allows them to explore various engineering and science fields. Taught by faculty, students are involved in hands-on and minds-on learning.
- Recruiting students for corporate EDP scholarships.
- Tutoring is offered in collaboration with the Center for Teaching and Learning. See the SoE website **`http://soe.stanford.edu/edp/programs/tutorial.html`** for more information.

- Engineering and Science Opportunity Job Fair, and diversity job and internship search support, which supplements that offered by the Career Development Center.
- Graduate Environmental Support Seminar, Graduate Seminar on Teaching and Advising Methods, Graduate EDP Orientation, and Graduate Diversity Admit Weekend.
- Graduate Peer Advisor Program, which matches interested undergraduate students with graduate students, faculty, alumni, deans, and corporate representatives in specific engineering fields.

## TECHNICAL COMMUNICATIONS PROGRAM

The Technical Communications Program offers a variety of courses and tutorial services designed to help engineering students improve their writing and speaking skills and to prepare them to communicate effectively when they become professionals.

Each quarter the program offers several elective courses in technical/professional writing and public speaking/presentation development. These courses are specially designed for engineering students and stress regular individual tutorial instruction.

- **ENGR 102E—Technical/Professional Writing for Electrical Engineers** (1 unit). The process of writing technical/professional documents in EE. Lectures and individual tutorials. Corequisite EE 108A. Fulfills Writing in the Major for Electrical Engineering. Autumn, Winter.
- **ENGR 102M—Technical/Professional Writing for Mechanical Engineers** (1 unit). The process of writing technical/professional documents in ME. Lectures and individual tutorials. Corequisite ME 203. Fulfills Writing in the Major for Mechanical Engineering. Autumn, Winter
- **ENGR 202W—Technical Writing** (3 units). How to write clear, concise, and well ordered technical prose. Drafting strategies and principles of editing for structure and style. Applications to a variety of genres in engineering and science. Graduate level; undergraduates admitted with consent of instructor. Autumn, Winter, Spring.
- **ENGR 202S—Writing: Special Projects** (1 unit). Writing tutorial for students working on non-course related materials including theses, journal articles, and conference papers. Weekly individual meetings. May be repeated for credit. Autumn, Winter, Spring.
- **ENGR 103—Public Speaking** (3 units). Introduces students to the full range of speaking activities, from impromptu talks to carefully rehearsed formal presentations. This practical course helps students develop confidence in their speaking ability through weekly practice in class, rehearsals in individual tutorials, and videotaped feedback. Autumn, Winter, Spring.

The Technical Communications Program also provides **non-credit writing and speech tutorials**. Students can meet with a writing tutor who will help them draft or revise documents, concentrating not on technical content, but on organization, style, and mechanics. Students can meet with a speech tutor who will help them plan presentations, design visual aids, and improve delivery. NOTE: These non-credit tutorials are not an editing service and are intended for short-term assistance. For extended tutorial support, students should register for one of the formal courses.

For further information on TCP see **http://soe.stanford.edu/tcp/**

# STANFORD TECHNOLOGY VENTURES PROGRAM

The Stanford Technology Ventures Program (STVP) is the entrepreneurship center within the Stanford University School of Engineering, hosted by the department of Management Science and Engineering. STVP's mission is to build a world-class center dedicated to accelerating high technology entrepreneurship research and education for engineers and scientists worldwide. STVP's believes that engineers and scientists need entrepreneurial skills to be successful at all levels within organizations, and prepares students for leadership positions in industry, universities, and society. STVP consists of courses, conferences, online resources, and scholarly research on high technology entrepreneurship. More information can be found at the program's web site at **http://stvp.stanford.edu**.

### Mayfield Fellows Program

The Mayfield Fellows Program (MFP) is a key component of the Stanford Technology Ventures Program. MFP provides juniors, seniors and co-terminal masters students in engineering and the sciences with a nine-month work/study program focusing on entrepreneurship. This includes all three courses in the "Management of Technology Ventures" series (ENGR140A, ENGR140B, and ENGR140C). These courses use a multidisciplinary approach to teaching entrepreneurship, including small seminar-style classes, a paid summer internship at a start-up company, and off-site meetings with leaders in the entrepreneurial community. In addition, each student is matched with three mentors including their summer employer, a venture capitalist, and a MFP alumnus.

New Mayfield fellows are announced in March and the program begins in April, running through December of each year (spring, summer, and autumn quarters). Completed applications are due by February 1. A dozen students are admitted each year. Additional information is available at the program's web site at **http://mfp.stanford.edu**.

# STANFORD CENTER FOR PROFESSIONAL DEVELOPMENT

The Stanford Center for Professional Development (SCPD) makes it possible for working professionals worldwide to become a part of the spirit of innovation and openness at Stanford University. Master of Science degrees, graduate and professional certificates, individual courses, workshops, and seminars are delivered online, on campus, and at the work site. (Conferral of a Bachelor's degree is required for admission to these programs.) Additional information is available at **scpd.stanford.edu** or by calling 650.725.3000..

### The Honors Cooperative Program

The Honors Cooperative Program (HCP) enables students who are employed full-time in SCPD-member companies to pursue graduate degree study on a part-time basis through the Stanford Center for Professional Development. HCP students are admitted to graduate degree programs through the regular Stanford graduate admissions process, receive the same course materials, assignments, and examinations, and are held to the same academic standards as on-campus students. Call 650-725-3016 for more information.

# ENGINEERS AND OVERSEAS STUDIES

> *"The (study abroad) perspective has been, for me, the most interesting, life-changing, and valuable effect of studying abroad. It is also something that cannot be easily achieved without studying abroad—the way that the abroad experience immerses you in a rich and realistic life, though temporary, provides you with an experience that cannot be achieved later as a traveler." Paris Alum*

For many years the School of Engineering and the Bing Overseas Studies Program (BOSP) have worked together to provide outstanding opportunities for engineering majors to study, work, and experience life in other countries. Careers in engineering frequently have an international component—whether through working as a consultant in another culture, transferring for a period of time to another country, or establishing an enterprise and developing contacts in other areas of the world. Achieving cultural literacy in another country provokes reflection on the differences and similarities among societies and prepares students to work in an international context.

With careful planning, most engineering students can fit study at one of Stanford's overseas centers into their academic plans. BOSP encourages students to talk with their advisors early on, as early as freshman year, about planning for one or more quarters abroad. By starting early, students can strategically plan for required engineering courses and language acquisition and then be able to study and work abroad while making progress toward their Stanford degrees. Several

programs require minimal language study prior to enrollment. Most programs include courses that satisfy two or more University General Education Requirements (GERs) so prospective engineering majors can plan to fulfill one or two GERs abroad. In addition, one or more engineering fundamentals courses are offered as tutored video courses by some overseas programs; courses fulfilling the Technology in Society requirement may be offered at some locations; and, for many engineering majors, participation in the Kyoto-SCTI program itself fulfills the TIS requirement.

The Associate Dean for Student Affairs in Engineering as well as advisors in Undergraduate Advising and Research, and staff and Student Advisors in the Bing Overseas Studies Program can help students understand how to integrate coursework taken overseas into their overall academic planning.

Information about Stanford's programs, including courses offered, is available on the Web at **`http://bosp.stanford.edu/`**. Students are also encouraged to stop by the BOSP office on the ground floor of Sweet Hall. The following program information highlights opportunities that might be of special interest to engineers.

### AUSTRALIA

> *For me, one of the greatest parts of my study abroad experience was the opportunity to interact with brilliant, interesting, and fun professors and graduate students from another university. If I had known how awesome the people would be in Australia, I would have been even more sold on the program than I was already.*
>
> –BOSP Australia Alum

During Autumn Quarter, the BOSP Australia program sends students along roughly two-thirds of the eastern coastline emphasizing topics related to Australian coastal studies. This program has been established in collaboration with the Centre for Marine Studies at the University of Queensland. Up to 48 students are enrolled in four required academic modules: Coral Reef Ecosystems, Coastal Zone Management, Coastal Forest Ecosystems, and Australian Studies. Civil and Environmental Engineering has approved credit for the first three of these four courses. In addition, students complete Targeted Research Projects, under the supervision of University of Queensland instructors, on selected topics. This opportunity to do hands-on research will greatly enhance students' research skills and their appreciation of issues Australia faces as it deals with ecotourism and protection of the Great Barrier Reef.

### BEIJING

BOSP's program in Beijing, China is hosted by Peking University (PKU) during Autumn and Spring quarters. The program offers a variety of courses in the humanities and social sciences,

including many that satisfy GERs. The classes in Beijing are taught by Peking University faculty, as well as by Stanford faculty-in-residence. Occasionally, a Stanford engineering professor will teach in Beijing and offer one or more engineering–oriented courses. Classes are taught in English by PKU professors, many of whom hold graduate degrees from US institutions. Although courses are taught primarily in English, students in the Beijing program are required to have some proficiency in Chinese. The minimum requirement for enrollment in Autumn Quarter is one year of college-level Mandarin (CHINLANG 3) and for Spring Quarter is two quarters of college-level Mandarin (CHINLANG 2).

### BERLIN

> *My internship experience really complemented what I'd learned in my engineering classes. In fact, I felt that I received two educations for the price of one. I did a long internship, and it was worth it. Doing a long internship means you can learn more, show more effort, and the company gets a better feel for you. They might even hire you back. I'm a very obvious example of staying longer. I'm back in Germany now working for the same company as a permanent employee.*
>
> —BOSP Berlin Alum

The Berlin Center is open for study in Autumn, Winter, and Spring quarters. Students who study in Berlin for one or more quarters and have completed one year of German language (GERLANG 3) are eligible to participate in a full-time Krupp Internship in any succeeding quarter(s). Since 1982 the Stanford Program in Berlin, with support from the Krupp Foundation (Alfried Krupp von Bohlen und Halbach-Stiftung: http://www.krupp-stiftung.de), has offered paid internships all over Germany to engineering students and others. Internships are available in virtually all fields of engineering. The onsite Internship Coordinator works to place students in internships closely related to their academic and career interests and their technical and language skills. Internship placements are in private companies and public institutions all over Germany, not only in Berlin. The program guarantees 1000 Euros for a full working month, which covers all living expenses. Internships last from three to six months.

Students without previous German language experience can enroll in beginning intensive German in Berlin in Autumn or Winter quarter, or they can take a minimum of one quarter of German prior to arrival in Spring Quarter. The equivalent of three quarters of German is required before beginning a Krupp Internshipthis is the minimum; some hosts might require a higher level of proficiency. Internships tend to be more rewarding for those engineering students – advanced junior, senior, and co-term – who have already taken a number of engineering courses; product design students must have a portfolio of workproofs. Past internship hosts have included: BMW, 3M Germany, Siemans, Volkswagen, Yahoo! Deutschland, and Fraunhofer Institutes for Mechanical Engineers and computer scientists; Bayer, Sanofi-Aventis Deutschland GmbH, Max-Delbrück Center for Molecular Medicine, and Max-Planck-Institutes for Chemical Engineers; LuraTech, Sennheiser, and Siemens for Electrical Engineers; Hochtief, Corporation for

Sustainable Building Technology (GFÖB), Berlin Senat Department for Urban Development, and Fraunhofer Institutes for Civil Engineers; and Brandenburg Economic Development Board Potsdam, Greiner Ingenieurberatung, Robert Bosch, and VCM Venture Capital Management for Management Science & Engineering students. After returning to campus students can work with the Department of German Studies to reflect on their internship experiences in writing and earn academic credit for doing so. See http://bosp.stanford.edu/berlin/index.html and http://www.stanford.fu-berlin.de/ for program details and internship profiles

In some quarters, a Stanford engineering professor will teach at the Berlin Center. During these quarters, one or more engineering-oriented courses are taught in addition to the regular course offerings in German history, culture and economics. ENGR 40 and ENGR 50 are offered as tutored video courses every quarter.

## FLORENCE

> *It was the most integrated academic experience I've ever had; I truly felt like I was learning every moment of the day. My classes, almost all about modern Italy, dovetailed with each other, but also dealt with issues I was confronting every day in the newspapers, with my Italian "family," with Italian friends and in movies and music.*
>
> —BOSP Florence Alum

Home to great innovators such as Galileo, Leonardo da Vinci, and Brunelleschi, the city of Florence provides unique intellectual and visual resources for students studying a variety of subjects ranging from Renaissance History and Art to Contemporary Italian and European Studies. The program is structured to help integrate students as fully as possible into Italian culture through homestays, language partners, and volunteer work during the Autumn, Winter, and Spring quarters. A minimum of one year of Italian (ITALLANG 3) is required; a second year is recommended for participation in courses at the University of Florence. ENGR 50 is offered all three quarters. Students studying in Florence for two consecutive quarters can elect to participate in an academic internship during the second study quarter. Product Design students have found Florence an ideal location of study due to its past and present artistic and architectural riches. Occasionally, the Stanford faculty-in-residence will be from engineering and offer one or more engineering–oriented course.

## KYOTO — STANFORD CENTER FOR TECHNOLOGY AND INNOVATION (SCTI)

> *My mentor was the only female engineer and she was terrific. She is still a source of inspiration to me, and we have kept in contact since. I learned more about Japanese companies by being there than you can ever learn in books . . . during everyday experiences like the morning group meeting to the relatively rare like the group "off–site" sleepover party at a hot spring spa.*
>
> —Kyoto-SCTI Alum

Kyoto-SCTI introduces students to the organization of the scientific and advanced industrial sectors of contemporary Japan through a quarter of study followed by an optional, paid internship. The program is designed for students with intellectual interests in the production, management, and politics of advanced economic and technological systems, including engineering majors in all fields of study whose career prospects will be enhanced by knowledge of Japan. During Spring quarter, the academic program focuses on the ways in which culture, institutions, and technology issues are organized in modern Japan. An electronic version of EE 108B is offered with the support of an on-site graduate student from Electrical Engineering, and ENGR 40 is offered as a tutored video course. In some years, a member of the Stanford engineering faculty is resident at SCTI in the spring.

Minimum language requirements for SCTI differ depending on whether a student chooses to complete the optional summer internship and whether an internship is technical or non-technical. Students not intending to complete an internship or those interested in a technical internship must complete two quarters of five-unit JLCC (JAPANLNG 8B). Students proposing internships in non-technical fields are required to take five quarters of five-unit JLCC (JAPANLNG 18B). Beyond the minimum requirements, students will greatly benefit from as much language preparation as they are able to incorporate into their schedule. Returned students and alumni encourage all participants to gain as much language background as possible before entering the academic program and the internship.

The Internship Coordinator in Kyoto works to place all students in paid internships closely related to their academic and career interests. Student interns are expected to participate in the internship in Japan from late June to early September. Past internship placements have included internships with ATR, Fuji Soft, Hitachi, Horiba, IBM, Kawasaki, KBMJ, Kyoto University, NEC, NTT, Obayashi, Panasonic, Sharp, and others.

## OXFORD

> *My academic work at Oxford reached a level of intensity that was difficult to attain at Stanford because the one on one tutorials forced me to focus my research interest into a coherent investigation of a single question. I have never been so excited to do research in my life because Oxford gave me a brilliant and energetic teacher that met with me individually for two to three hours per week. It was the first time that I ever felt like I had a part in the learning process because the classes were driven solely by my input and interest.*
>
> —BOSP Oxford Alum

The Stanford program in Oxford is offered in Autumn, Winter, and Spring quarters, and each student takes a tutorial as a regular part of the program. As the characteristic pedagogical method

for undergraduates at Oxford, the tutorial is a highly personalized, demanding, and rewarding form of instruction that involves weekly meetings between a student (or, occasionally, two students) and a member of the Oxford academic community. Tutorials on selected topics in Engineering, including architecture, are sometimes possible. The BOSP office in Sweet Hall has binders with past tutorial logs which students can review to see the range and specifics of past tutorials. Occasionally, a visiting Stanford engineering professor will teach one or more engineering–oriented courses in addition to the regular course offerings in British literature, history, and economics.

## PARIS

> *Studying in Paris was incredible and I think impossible to completely understand unless experienced. Not only was having classes in French in a French university setting interesting, but it seemed like the entire city acted like a classroom. All academic, artistic, social, and cultural experiences are part of the program.*
>
> —BOSP Paris Alum

The Bing Overseas Studies Program, the School of Engineering, and the Department of French and Italian are working together to provide opportunities for engineering students studying in Paris. The Stanford Program in Paris is located in the Institut Supérieur d'Électronique de Paris (ISEP). ENGR 40 is offered as a tutored video course in autumn and spring and ENGR 50 in all three quarters. Students in these courses meet weekly for tutoring with a member of the ISEP or another engineering school faculty member. One year of college-level French (FRENLANG 3) is required and students with two years of college-level French will have access to additional engineering courses taught in French. Internship arrangements are continuously being expanded in France. One of the newest internship offerings involves participation in an Electronic Engineering Lab during the Winter, Spring, or Summer (excluding August) quarters. To be eligible for this internship, students are expected to have some background in electronics or microelectronics. These new research internships are financed by French companies or hospitals and are excellent ways to pursue research in your field in Paris while getting to know French and international researchers at the ISEP, your host institution. They include research in the fields of image processing, robotics connection, radio digitalization, and object tracking. A second network of internships is based on students' specific interests and requests and can accommodate the diverse interests of engineering students. These all require students spend two quarters in Paris, either fall and winter or winter and spring. The first quarter is devoted to gauging students' interests and preparing for the experience, the second, to the internships themselves.

## STANFORD UNIVERSITY/ÉCOLE CENTRALE PARIS JUNIOR YEAR ABROAD PROGRAM

Although not formally part of the Overseas Studies Program, Stanford undergraduates in Mechanical Engineering and Electrical Engineering can receive credit for study abroad at École Centrale Paris. École Centrale Paris is one of the best known science and engineering schools in France and Europe. Stanford students are enrolled in engineering program classes with French and International students. Instruction is mostly in French.

Requirements for the program:

- Basic knowledge of French (1 year college level). Spending the summer prior to the study at École in language program in France is an option.
- Excellent academic background.

What the Stanford/ECP Program Offers:

- One year of study during the junior year at École Centrale Paris with credit transfer from ECP to Stanford.
- Immersion in French culture.

Information about the program can be found at **http://www.ecp.fr/study-program/stanford**. Further information about the program for students in Mechanical Engineering can be obtained at `http://me.stanford.edu` or from Professor Mark Cappelli, Bldg. 520-520J. Further information about the program for students in Electrical Engineering can be obtained from Professor Brad Osgood, Packard 271.

## OTHER BOSP PROGRAMS AND RESOURCES

In addition to the programs mentioned above, the Bing Overseas Studies Program also offers an Autumn quarter program in Moscow, Russia and full-year programs in Madrid, Spain and Santiago, Chile. In 2009-10 a new program will open in Cape Town, South Africa for Winter and Spring quarters. Keep in mind that in any quarter of study, Stanford Engineering faculty members may be faculty-in-residence at one of the BOSP programs, thus providing expanded opportunities for engineering students.

For those students who are looking for an overseas opportunity during summer, BOSP now offers a full-time internship program in Asia for qualified students. Currently offered in the People's Republic of China, Hong Kong, Japan, Mongolia, the Republic of Korea, Singapore, and Taiwan, this internship program provides students the opportunity to increase their knowledge and

understanding of local language and culture, while gaining practical, international work experience in their given field.

For students interested in information on non-Stanford programs, the BOSP offices now house a library of information on overseas study opportunities with other institutions and organizations. A staff member can advise you regarding the processes involved when studying in a non-Stanford program and applying for transfer credit.

A more complete and up-to-date description of BOSP opportunities and the range of academic options offered overseas may be found at: http://bosp.stanford.edu.

For information on scholarships for study and research abroad or overseas internships and short-term work, see the "Summer Employment and Career Planning" section later in this handbook.

# RESEARCH EXPERIENCE FOR UNDERGRADUATES

Engaging in independent research under the direction of a faculty member can be one of the most exciting and rewarding experiences of your undergraduate career. The Research Experience for Undergraduates (REU) program is designed to give undergraduates the chance to work with faculty and their research groups on advanced research projects. The program runs ten weeks, from June (beginning shortly after commencement) through August. The program is coordinated jointly by the Office of the Vice Provost for Undergraduate Education, the Office of Student Affairs in the School of Engineering, and the individual engineering departments.

Students who are accepted into the program will receive a summer stipend. On-campus housing and a meal plan may also be provided through the Summer Research College (SRC) but must be applied for separately. Whether well into your major or still testing the waters, all engineering students are strongly encouraged to consider taking advantage of what the REU program can offer. To find out more about the opportunities and how to apply, contact the Director of Student Services in your major department. The application deadline is typically in early April.

# STUDENT ENGINEERING SOCIETIES

## TAU BETA PI

Tau Beta Pi is the only engineering honor society that represents the entire engineering profession. It is the nation's second oldest honor society and was founded at Lehigh University in

1885 to recognize students of exemplary character and distinguished scholarship. There are now active collegiate chapters at 232 US colleges and universities, active alumni chapters in 16 districts across the United States, and a total initiated membership of 508,878.

The California Gamma chapter of Tau Beta Pi at Stanford offers valuable engineering resources. Tau Beta Pi provides peer tutoring services across the engineering disciplines to build understanding and interest in science, mathematics, and engineering. Tau Beta Pi also runs a variety of service and social projects for the undergraduate engineering student community. Members of Tau Beta Pi are involved in selecting the recipient of the Stanford Tau Beta Pi Award for Excellence in Undergraduate Teaching. Please refer to **tbp.stanford.edu** for the most updated information and schedule.

To be officially elected as a member of Tau Beta Pi, you must be a declared engineering major and have placed within the top one-eighth of your class as a junior or the top one-fifth of your class as a senior. Invitations are sent to elected students twice a year, once in the fall and once in the spring. Invited candidates must fulfill the candidacy requirements of the California Gamma Chapter through participation in service and fellowship activities. While it is considered an honor to be elected into Tau Beta Pi, one does not need to be an official member to participate in the activities organized by the society. For more information, please visit our website at **http://tbp.stanford.edu** or e-mail the chapter president, Hao Zou, at **zou_hao@gsb.stanford.edu.**

### INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

The Stanford Institute of Electrical and Electronics Engineers (IEEE, pronounced "eye-triple-E") is the CS- and EE-department-backed academic, professional and networking society for Computer Science and Electrical Engineering students. IEEE is a professional association of over 350,000 engineers in 150 countries focused on developing technical standards, affecting technology policy, promoting career development, and creating communities of networked technical professionals. At Stanford, the organization provides access to peers, more advanced students, professors, and industry engineers to foster a more complete engineering education experience in and out of the classroom. Stanford IEEE sponsors programming and electronic design competitions, community service, mentorship, research, scholarship grants, as well as ECJ, Stanford's first technical student research journal. Please visit the IEEE website at **http://ieee.stanford.edu** for more information.

## BASES

BASES (Business Association of Stanford Engineering Students) is the primary extra-curricular vehicle for students who are interested in technology and entrepreneurship. BASES has evolved to include undergraduate and graduate students, along with faculty members from all schools at

Stanford, including Engineering, Business, Law, Medicine, and the Humanities and Sciences. It hosts a collection of programs on campus, including two annual business plan competitions with prizes up to $100K (the E-Challenge and Social E-Challenge), a weekly lecture series called Entrepreneurial Thought Leaders Seminar with talks by technology and business leaders, start-up job fairs, and various community initiatives. For more information about BASES, visit their website at **http://bases.stanford.edu**.

### STANFORD UNDERGRADUATE RESEARCH JOURNAL

In September of 2001, the Stanford Undergraduate Research Journal (SURJ) was created as a forum for undergraduates to share their research with the entire Stanford community. Today, SURJ is an established force on campus promoting intellectual curiosity and multi-disciplinary literacy. With an annual publication that accepts around 10% of original research submissions through the peer-review process, SURJ is Stanford's first and only academic journal that features all disciplines, including Natural Sciences & Engineering, Humanities, and Social Sciences. Interested authors should join **surj-infoline@lists.stanford.edu** and have an original research manuscript ready by Winter Quarter. Staff and editor positions are also available if you wish to participate in the peer-review process as part of the Editorial Board, help develop the financial platform for sustaining a major publication, or join the design team that creates the look and feel of the Journal. For more information about how to join or contribute research to SURJ, and to view past editions of the Journal, please visit our website at **http://www.stanford.edu/group/journal/.**

### PRODUCT DESIGN STUDENT ASSOCIATION (PDSA)

The PDSA's purpose is to serve the undergraduate Product Design students by fulfilling two missions: 1) Provide a variety of helpful resources such as mentorship; office hours (upper-classmen answering questions regarding coursework, scheduling classes, etc.); a website with online resources, student postings; and internship/job opportunities; and 2) Help build a network between students/alumni/ faculty and businesses. To achieve this goal, we will put on community-building events that serve to bring the PD community together as well as to educate the greater Stanford population about Product Design. Visit **http://www.stanfordpdsa.org** to learn more**.**

# 9. SUMMER EMPLOYMENT AND CAREER PLANNING

Stanford's School of Engineering is fortunate to be part of a major university with strengths in the humanities and sciences as well as engineering. Our curriculum has been designed to encourage engineering students to take maximum advantage of Stanford's liberal arts by requiring a practical minimum of technical courses in the engineering major. This broader education does not handicap Stanford's engineering students once in the profession, because they are well trained in fundamentals and have broad skills required for leadership. However, one way to extend one's engineering training is through summer work experience. The School recommends that each student have a summer work experience or technical internship before graduation. Generally this can be arranged through the Career Development Center (CDC) if planning is started in the Fall Quarter. Some overseas work experiences are also available through the Overseas Resource Center of Bechtel International Center or through internships linked with the Overseas Studies Program in Berlin.

## CAREER DEVELOPMENT CENTER

Career counselors at the Career Development Center (CDC) assist undergraduate and graduate engineering students in exploring their passions, understanding their unique talents, and developing a successful career search strategy. Step one is to register with the CDC by establishing a Cardinal Careers account at https://stanford-csm.symplicity.com/students. Your account will give you:

- Access to the jobs database for full-time, part-time, internship and on-campus (including federal work study) opportunities
- Opportunity to:
  a) Set up job search agents which will work for you to deliver jobs of interest
  b) Include your resume in an e-resume book
  c) Get activated for our on-campus interview program, Cardinal Recruiting
  d) Sign up to receive CDC CONNECT, our e-newsletter, and other targeted career information

The following page has a listing of other key CDC resources/programs that you will find helpful:

- **Cardinal Recruiting:** Your opportunity to interview with companies on-campus. For more information about the types of companies that participate, how to register, and the relevant policies and procedures, please check out the CDC Cardinal Recruiting web page at **http://cdc.stanford.edu/recruiting.**
- **Career Fairs:** The CDC hosts a number of career fairs throughout the year. The first fair of the year will be held on Tuesday, October 10, 2006. This is typically the largest career fair of the academic year. For more information, go to **http://cdc.stanford.edu/recruiting/job_fairs.html.**
- **Resume Writing, Interviewing, and Job Hunting Strategies:** The CDC supports all aspects of the job search process. We have handouts, web pages, workshops, an extensive career resource library, and career counselors available to assist you with your job search. Information about our resources and services is at **http://cdc.stanford.edu/services/**.
- **Professional Assistance:** Meet with a Career Counselor to discuss your career-search strategy. Call 725-1789 to schedule an appointment.
- **Calendar of Events:** For a comprehensive schedule of the CDC's programs and activities, go to **http://cdc.stanford.edu/calendar**.
- **Reference File Service:** Opening a reference file is a convenient way of having your letters of reference forwarded directly to prospective employers and/or graduate admissions offices. You must be a senior within three quarters of graduation, a graduate student, or an alum to establish a file. However, freshmen, sophomores, and juniors may store letters in the Records Department to be used later. Go to **http://cdc.stanford.edu/services/rfs.html.**

# OVERSEAS RESOURCE CENTER

The Overseas Resource Center (ORC), located on the second floor of the Bechtel International Center, provides information and advising on international opportunities to students and community members. There are numerous opportunities for technical students who wish to pursue overseas study, research, or work opportunities. Visit the ORC or consult our website at **http://www.stanford.edu/dept/icenter/orc** to find out what's available.

**Scholarships for Study and Research Abroad**.

- The ORC is Stanford's advising center for all international scholarship opportunities. Information on several hundred scholarships – from travel grants to single/multi-year, fully-funded study and research opportunities – can be found in the ORC

  **Rhodes, Marshall, and Fulbright**: It is a common misconception that these scholarships are geared towards students in the humanities. Engineering students are strongly encouraged to look into these opportunities.

**Churchill Scholarships**: This award provides full financial support for one year of graduate work in engineering, mathematics, or the sciences at Churchill College, Cambridge University.

**German Academic Exchange (DAAD) Awards**: There are many opportunities for

**Whitaker Program for Biomedical** graduate and undergraduate engineering students to study in Germany. Many of these awards do not require any prior knowledge of German. **Engineers**: This program provides funding for young graduates to conduct research abroad in the field of biomedical engineering.

**KAUST Discovery Scholarship Program**: The program provides full financial support toward a graduate degree at the King Abdullah University of Science and Technology in Saudi Arabia.

For a full list of awards, please visit the ORC website at **http://www.stanford.edu/dept/icenter/orc/**.

- **Work Abroad**
  Information on short-term work, internships, and volunteer and teaching abroad opportunities for technical and non-technical students. Many resources can be found on the ORC website; listed here are three of the most popular work abroad programs for Stanford students.

  **IAESTE Training Program**
  The International Association for the Exchange of Students for Technical Experience (IAESTE) is an exchange program that provides opportunities for on-the-job practical training for students in engineering, architecture, agriculture, mathematics, computer science, and natural and physical sciences in 70 member countries. Participants must have completed their sophomore year. Trainees are paid a maintenance allowance adequate to cover living costs while in training. Fluency in the language is required for some countries. For more information, please visit the IAESTE website at **http://www.iaeste.org**.

**COUNCIL ON INTERNATIONAL EDUCATIONAL EXCHANGE (CIEE)**
CIEE coordinates programs in Ireland, Germany, France, Australia, New Zealand, Costa Rica and Canada that allow U.S. students to obtain a work visa. If you are interested in arranging an internship or work experience in any of the above countries, please go to **http://www.councilexchanges.org/work/index.htm**.

**BUNAC**
Coordinates work programs in Britain and Australia. Please see the BUNAC website at **http://www.ciee.org**.

**Travel Services**

ORC travel services include passport photos (color only) and International Student Identity cards. General travel information, visa/passport requirements, and U.S. State Department Travel Advisories and Reports are also available.

For information on Stanford Overseas Studies academic programs, see the Overseas Studies section in "Special Programs and Organizations" earlier in this handbook.

## FUNDAMENTALS OF ENGINEERING EXAM

Many engineers, especially those in Civil, Environmental, and Mechanical Engineering, will find it an important step in their careers to become Registered Professional Engineers in the state in which they intend to practice. The first step in becoming registered is to take and pass the Fundamentals of Engineering (FE) examination (formally the Engineering-In-Training, or EIT, exam). All engineering students should consider taking the FE exam, whether or not they currently envision becoming licensed engineers. The exam is broadly based, takes eight hours, and covers basic topics such as calculus, physics, chemistry, statics, thermodynamics, circuits, and so forth. It is much easier to pass the exam while these basic subjects are still relatively fresh in your mind, and hence it is highly recommended that the exam be taken toward the end of the senior year or shortly thereafter. For more information, visit **http://www.pels.ca.gov/.**

| Exam | Date | Postmark Deadline |
|---|---|---|
| EIT/FE | October 24, 2009 (Saturday)<br>April 17, 2010 (Saturday)<br>October 30, 2010 (Saturday) | August 24, 2009 (Monday)<br>January 29, 2010 (Friday)<br>To be determined |
| Special Civil: | October 24, 2009 (Saturday) | July 20, 2009 (Monday) |
| | April 17, 2010 (Saturday)<br>October 30, 2010 (Saturday) | January 4, 2010 (Monday)<br>To be determined |
| ChE/Civil/EE/ME: | October 23, 2009 (Friday) | July 20, 2009 (Monday) |
| | April 16, 2010 (Friday)<br>October 29, 2010 (Friday) | January 4, 2010 (Monday)<br>To be determined |

# 10. FORMS

This section contains useful forms. Copies of these forms may also be downloaded from the Handbook web site, **`http://ughb.stanford.edu`**.

- **School of Engineering: Petition for Program Deviation**: Use this form to deviate from set requirements in Math, Science, TIS, or Fundamentals
- **Departmental Petition for Program Deviation**: Use this form to deviate from set requirements in Depth (core) courses
- **School of Engineering Petition for Transfer Credit**: Use this form to transfer credit for Math, Science, TIS, or Fundamentals courses
- **Departmental Petition for Transfer Credit**: Use this form to transfer credit for Depth (core) courses
- **Blank Four-Year Plan Sheet**: For planning an individually designed major in Engineering
- **Blank Program Sheet**: For your IDMEN major plan

**DO NOT USE THIS FORM FOR TRANSFER CREDIT**

# School of Engineering*
# PETITION
# PROGRAM DEVIATION

☐ UNDECLARED
☐ ENTERED_____
☐ EM NOTIFICATION_____

***This form is to deviate from set requirements in Math, Science, TIS, or Fundamentals**

This form can also be found as a pdf file on the web at: http://ughb.stanford.edu.

1. Fill out this petition form, clearly explaining why you feel this alteration is justified – provide details about how the course fulfills the intent of the requirement and why you cannot fulfill the requirement with an approved course.
2. Attach your completed and current Program Sheet
3. Attach a copy of your unofficial SU transcript, available on Axess
4. Obtain signatures of approval from your department and advisor, including your advisor's rationale for acceptance
5. Bring your petition to Darlene Lazar in the Office of Student Affairs in Terman 201. It will be referred to the proper committees and final action will be communicated to the student via email.

All petitions must be submitted in the quarter PRIOR TO your anticipated final quarter at Stanford – Winter quarter for those of you expecting to graduate in June – in order to allow time to adjust your schedule in case your petition is denied

*Please write legibly – Thanks!*

ID #: _____

Name: _____ Email: _____

Signature: _____ Phone: _____

Date: _____ Expected Major: _____ Expected Date of Graduation: _____

---

Enter statement of request here. *Do not add an attachment or go over one page.*

---

Dept Student Services Contact Signature:_____ Date:_____

Advisor's Detailed Comments (Mandatory):

☐ Denied ☐ Granted Rationale:

Advisor (Print):_____ Signature:_____ Date:_____

| | | |
|---|---|---|
| Dean's Office: Action By OSA | ☐ Need further documentation: | |
| | ☐ Denied | |
| | ☐ Granted | Signature: Date: |

**DO NOT USE THIS FORM FOR TRANSFER CREDIT**

# Department/Program* PETITION PROGRAM DEVIATION

**DO NOT USE THIS FORM FOR PETITIONS TO THE SCHOOL OF ENGINEERING**

***This form is to deviate from set requirements in your major Depth (core) program**

This form can also be found as a pdf file on the web at: **http://ughb.stanford.edu**.

1. Fill out this petition form, clearly explaining why you feel this alteration is justified – provide details about how the course fulfills the intent of the requirement and why you cannot fulfill the requirement with an approved course.
2. Attach your completed and current Program Sheet
3. Attach a copy of your unofficial (from Axess) SU transcript
4. Obtain signature of approval from your advisor, including his/her rationale for acceptance
5. Take your documents to your departmental student services administrator.

All petitions must be submitted in the quarter PRIOR TO your anticipated final quarter at Stanford – Winter quarter for those of you expecting to graduate in June –in order to allow time to adjust your schedule in case your petition is denied.

*Please write legibly – Thanks!*

ID #: _____

Name: _____ Address: _____

Signature: _____ Phone: _____ Email: _____

Date: _____ Expected Major: _____ Expected Date of Graduation: _____

Enter statement of request here. *Do not add an attachment*.

**Advisor's Concurrence or Opinion**

Comments:

Advisor (Print): _____ Signature: _____ Date: _____

Action: ☐ Postponed
☐ Denied
☐ Granted Signature: _____ Date: _____

**TRANSCRIPT:**

☐ **AWAITING**

☐ **DATE REC'D:** _____

☐ **Entered in Database**

# School of Engineering*
# PETITION
# TRANSFER CREDIT

☐ **PRE-APPROVAL**

☐ **UNDECLARED**

☐ **SUMMER SESSION GRANT APPLICANT**

*Use this form to transfer credit for Math, Science, TIS, and Fundamentals courses
→Transfer credit must first be accepted by the University before you may petition to use it for Engineering requirements. For policies, forms, and procedures, see **http://www.stanford.edu/dept/registrar/academic/transfer.html**.

1. Complete this form, outlining your request and which Stanford course is considered equivalent. This form can also be found as a pdf file on the web at: **http://ughb.stanford.edu**.
2. Attach your completed (ink only), up-to-date *original* Program Sheet. The transfer course should be listed on your program sheet first by its equivalent Stanford course number and title, followed by the course number at the other school, followed by a check mark in the Transfer column.
3. Attach a catalog description of the course(s) from the other institution.
4. Attach a copy of your unofficial (from Axess) Stanford transcript
5. Take petition documents to Darlene Lazar in 201 Terman
6. Ask staff at the Student Services Center, http://www.stanford.edu/group/studentservicescenter/ or 2nd floor Tresidder Union,to forward a copy of your transfer transcript to Darlene Lazar once you have completed the course. Upon approval of your request, the Dean's Office will notify you via email. Original documents will be forwarded to your department and placed in your academic file.

*Revised 8/2009*

SUID #: _____

Name: _____ Email: _____

Signature: _____ Phone: _____

Date: _____ Expected Major: _____ Expected Date of Graduation: _____

---

Name of Transfer Institution(s): _____ Date: _____

| *Department, number, and title of transfer course(s):* | *Dept, number, and title of Stanford course(s):* |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |

Why did you take, or why would you like to take, these courses at another institution? (Please be brief: your explanation must fit into this space)

---

Action: ☐ Denied

☐ Pre-Approval Granted Signature: _____ Date: _____

☐ Final Granted Signature: _____ Date: _____

USE SOE TRANSFER FORM TO TRANSFER MATH, SCIENCE TIS OR FUNDAMENTALS

# Departmental/Program* PETITION TRANSFER CREDIT

☐ PRE-APPROVAL

***Use this form to transfer credit for Depth (core) courses for your major**
**→Transfer credit must first be accepted by the University before you may petition to use it for Engineering requirements.** For SU Registrar policies, forms, and procedures, see **http://www.stanford.edu/dept/registrar/academic/transfer.html**.

1 Complete this form, outlining your request and which Stanford course is considered equivalent. This form can also be found as a pdf file on the web at**: http://ughb.stanford.edu**.
2 Attach your completed (ink only), up-to-date *original* Program Sheet. The transfer course should be listed on your program sheet first by its equivalent Stanford course number and title, followed by the course number at the other school, followed by a check mark in the Transfer column.
3 Attach a catalog description of the course(s) from the other institution.
4 Attach a copy of your unofficial (from Axess) Stanford transcript
5 Take petition documents to your department's student services office
6 Ask staff at the Student Services Center, http://www.stanford.edu/group/studentservicescenter/ or 2nd floor Tresidder Union, to forward a copy of your transfer transcript to your department once you have completed the course.

Your advisor or your program's student services office will inform you of the outcome of your petition.

ID #: _____

Name: _____ Address: _____

Signature: _____ Phone: _____ Email: _____

Date: _____ Expected Major: _____ Expected Date of Graduation: _____

---

Name of Transfer Institution(s): _____

| *Department, number, and title of transfer course(s):* | *Dept, number, and title of Stanford course(s):* |
|---|---|
| | |
| | |
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| | |

Why did you take, or why would you like to take, these courses at another institution?

---

Action: ☐ Denied

☐ Pre-Approval Granted Signature: _____ Date: _____

☐ Final Granted Signature: _____ Date: _____

# Individually Designed Major in Engineering (IDMEN)

*4-Year Plan*

| | *Fall* | | | | *Winter* | | | | *Spring* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Class** | **Math/ Sci.** | **Engr.** | **Other** | **Class** | **Math/ Sci.** | **Engr.** | **Other** | **Class** | **Math/ Sci.** | **Engr.** | **Other** |
| *Freshman* | | | | | | | | | | | | |
| | *Subtotals* | *0* | *0* | *0* | *Subtotals* | *0* | *0* | *0* | *Subtotals* | *0* | *0* | *0* |
| | **Total** | | | **0** | **Total** | | | **0** | **Total** | | | **0** |
| *Sophomore* | | | | | | | | | | | | |
| | *Subtotals* | *0* | *0* | *0* | *Subtotals* | *0* | *0* | *0* | *Subtotals* | *0* | *0* | *0* |
| | **Total** | | | **0** | **Total** | | | **0** | **Total** | | | **0** |
| *Junior* | | | | | | | | | | | | |
| | *Subtotals* | *0* | *0* | *0* | *Subtotals* | *0* | *0* | *0* | *Subtotals* | *0* | *0* | *0* |
| | **Total** | | | **0** | **Total** | | | **0** | **Total** | | | **0** |
| *Senior* | | | | | | | | | | | | |
| | *Subtotals* | *0* | *0* | *0* | *Subtotals* | *0* | *0* | *0* | *Subtotals* | *0* | *0* | *0* |
| | **Total** | | | **0** | **Total** | | | **0** | **Total** | | | **0** |

| | |
|---|---|
| Total Math & Science Units: | 0 |
| Total Engineering Units: | 0 |
| Total Other Units: | 0 |
| **Total Units:** | **0** |

**Stanford University ♦ School of Engineering**

# Individually Designed Major in Engineering

Title: _____

## 2009–2010 Program Sheet

***Follow all requirements as stated for the year of the program sheet used.***

Name: _____ SU ID: _____

E-mail: _____ Local Phone: _____

Date: _____ Date B.S. expected: _____

| Dept | Course | Title | Transfer/AP Approval | | | Units | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |

**Mathematics** *(21 units minimum required; see UGHB Fig. 3-1 for approved courses)*

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| | | | | | *Mathematics Total* | | |

**Science** *(17 units minimum required; see UGHB Fig. 3-2 for approved courses)*

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|---|---|---|---|---|---|---|---|
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| | | | | | | | |
| | | | | | *Science Total* | | |

**Technology in Society** *(1 course required; see UGHB Fig. 3-3 for approved list)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**GENERAL NOTES**

1) The following materials must accompany this Program Sheet: Written proposal, 4-Year Plan, letter of support from Primary Advisor, and an unofficial Stanford transcript.
2) This form is available as an Excel file at ughb.stanford.edu. The printed form must be signed by the advisor and, if required, by the departmental representative. Changes must be initialed in ink.
3) All courses listed on this form must be taken for a letter grade if offered by the instructor. Minimum Grade Point Average (GPA) for all courses in Engineering Fundamentals and Engineering Depth (combined) is a 2.0.
4) All transfer and AP credits must be approved by the SoE Dean's office. Transfer credits in Engineering Depth must be approved by the Primary Advisor.
5) Program must include a course approved to fullfill the "Writing in the Major" requirement.

*program sheet continues on page 2*

## Individually Designed Major cont.

**Engineering Fundamentals** *(3 courses required)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | *Engineering Fundamentals Total (3 courses required)* | |

**Engineering Depth** *(31 units minimum)*

| Dept | Course | Title | Transfer/AP Approval | | | Unit | Grade |
|---|---|---|---|---|---|---|---|
| | | | ✓ if Transfer | Initials | Date | | |
| | | | | | | | |
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| | | | | | | | |
| | | | | | | *Engineering Depth Total* | |

**Additional Courses** *(as necessary to bring program totals to at least 90 but not more than 107 units)*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | *Engineering Courses (Funds + Depth) Total (40 minimum)* | |
| | | | | | | *Totals from previous page* | |
| | | | | | | *Program Totals* | |

Primary Advisor

Printed Name: _____ Date: _____

Signature: _____

Secondary Advisor

Printed Name: _____ Date: _____

Signature: _____

School of Engineering Approval *(signature not required prior to graduation)*

Printed Name: _____ Date: _____

Signature: _____

# 11. INFORMATION FOR ADVISORS

Advising within the School of Engineering varies somewhat depending upon the category of student involved. Engineering advisors are typically assisting graduate students, undergraduates who have declared their major, and undeclared undergraduates who have indicated a preliminary academic interest in engineering. This Handbook deals only with undergraduates.

Advising of undergraduates can occur on many levels. Most of the questions that advisees will bring to you relate to specific requirements for an engineering degree at Stanford. This *Handbook for Undergraduate Engineering Programs* is meant to serve both you and your advisees as the source of most of the answers to such questions. Further clarifications on curricula can be obtained from the Office of Student Affairs in Terman 201, 723-5984.

There is, of course, no manual to turn to for the most valuable information that you will be able to impart to your advisees, which is based on your knowledge, wisdom, and personal experiences. The individual counseling of your students on matters of personal concern to them is probably the most valuable function that you will perform.

At times, you may feel the need to refer the student to any of a variety of support services offered by the School and University, including: Undergraduate Advising and Research (UAR), the Center for Teaching and Learning (CTL), Engineering Diversity Programs (Terman 201), the Career Development Center (CDC), Counseling and Psychological Services (CAPS), Vaden Health Center, the Bechtel International Center, the University Ombudsperson, and the Dean of Students. Undergraduate Advising and Research also provides resources and general information at **`http://undergrad.stanford.edu/`**

Advisors are strongly encouraged to make themselves available on a regular basis to their advisees, but in particular it is essential that each advisor schedule a liberal number of office hours during registration periods. During these registration periods, students frequently need to be able to stop by to obtain necessary signatures and advice. Your indulgence in these sometimes-unscheduled visits is greatly appreciated by the students as they go about their rush of activities.

To advise pre-major students, Undergraduate Advising and Research (UAR) assigns each new freshman a **Pre-Major Advisor** and an **Academic Director**. Pre-Major Advisors are Stanford faculty and administrators who volunteer to mentor 1-8 undergraduates from the time they arrive to Stanford as freshmen until the time they declare their major (typically during the sophomore year). In a departure from previous years, in 2009 UAR asks only that Pre-Major Advisors do what they already do best as scholars, teachers, and/or higher education administrators: inspire

students to embrace the next four years of their life with the full depth of their curiosity. Pre-Major Advisors are not expected to advise in the specifics of majors that lie well outside of their own expertise, but are instead encouraged to refer students to their Academic Director when such situations arise.

The **Academic Director** serves as UAR's representative in each residence that houses freshmen and sophomores. To accomplish such far-reaching support, nearly all Academic Directors serve multiple residences, with an office located in a residence that is geographically proximate to the residences they serve. Each Academic Director can advise on Stanford's undergraduate curriculum, research and public serve opportunities, academic rules and regulations, and other campus resources. Academic Directors are available five days per week to discuss logistics, course selection, majors, units, overseas studies, transfer credit, and academic standing with undergraduate students.

UAR also has advisors who work specifically with student athletes, particularly regarding the strict NCAA compliance guidelines to which all student athletes must adhere. UAR Advisors in Sweet Hall provide general advising for all class years and special advising for pre-professional planning such as the health professions (*e.g.*, medicine) and law.

Major Advising in Engineering: For advisees who declare your department as their major, one of your principal administrative responsibilities is the approval of their Program Sheet. This document is usually submitted twice, once when they declare and again during their senior year as they prepare to graduate. You must certify that their course work meets the degree requirements established by your own department and by the School of Engineering. As mentioned in this Handbook, deviations within the category of Engineering Depth must be approved by a student's advisor – including approval of courses transferred from another institution. Your approval of such variances is indicated by initialing and dating the entry on the Program Sheet.

# ADVISING UNDERGRADUATE ENGINEERING STUDENTS

## WHEN STUDENT DECLARES A MAJOR

- Review Program Sheet (PS), ensuring it includes required courses and units as stated in UGHB PS samples (given in Chapter 5, *Program Descriptions and Requirements for Engineering Majors;* a student may use any Program Sheet from date of entry at Stanford)
- Inform student of how and when to use the Petition process (to deviate from Depth or SoE requirements; to transfer course credit for units taken outside of Stanford – see UGHB, Chapter 4 for details)
- ABET-accredited majors: Make sure that the advisee is aware of having to meet the required 68 units of Engineering Science and Engineering Design by the end of their undergraduate career (UGHB, Chapter 3). In some cases, additional courses beyond the required courses may be needed to meet the minimum requirement.
- Advisors may invite their advisees (in groups of three or more) to lunch as often as once a quarter (obtain reimbursement via the Advisee Meal Program)
- Advise student that they must come back for a final review of their PS and to obtain an advisor (and in some cases departmental) signature two quarters before they expect to graduate.

## TO PREPARE STUDENT FOR GRADUATION

Review Program Sheet, looking for the following:

- Check that all required Depth courses have been taken OR will be taken Senior year OR the student has deviation/transfer petitions approved by the advisor/department in their file
- Check that minimum unit totals required by the department, as stated on their chosen Program Sheet, have been met for Math, Science, TIS, WIM, Fundamentals, and Depth.
- If you have a Math/Sci/Fund/TIS class that you require for your major, please check progress toward completion since **students rarely come into OSA to check their progress unless specifically petitioning to transfer credit or deviate**. Example: An ME student should be told s/he has not fulfilled their TIS requirement for ME unless the STS or other course they have chosen is one approved specifically for ME majors (see Chapter 3, Fig. 3-3). This select list is specific to the ME major and should be drawn to the attention of the student by the department.
- Check that an approved Writing in the Major (WIM) course has been/will be completed (see Program Sheet footnotes for appropriate course[s])
- ABET-accredited majors: Make sure that the advisee will meet the required 68 units of Engineering Science and Engineering Design units by the end of their undergraduate career (this total is different than the course unit (Depth) total; see UGHB, Chapter 3 or footnotes on the Program Sheets)
- ***Please DO NOT sign a Program Sheet without ensuring that all Depth and ABET requirements have or will be met by the student's final quarter.***

# SCHOOL OF ENGINEERING ADVISEE MEAL PROGRAM

The Advisee Meal Program has been cancelled due to budget cuts.