

# School of Engineering & Applied Science

## Mission Statement

The mission of the School of Engineering & Applied Science (SEAS) at Washington University is to serve society as a center for learning in engineering, science and technology. It is our duty to disseminate and create knowledge through teaching, research, publications and the transfer of important ideas and research into the development of new products and technologies. We strive to provide an environment that nurtures critical thinking and the education of innovators and leaders for the future.

## Undergraduate Degree Programs

The School of Engineering & Applied Science offers four-year, full-time programs of instruction leading to various Bachelor of Science degrees. Bachelor of Science degrees are available in the fields of biomedical engineering, chemical engineering, computer science, computer engineering, electrical engineering, mechanical engineering, and systems science and engineering.

If a student is interested in an academic program broadly based on the engineering sciences, the School of Engineering & Applied Science offers the Bachelor of Science (BS) Major in Applied Science degree with several options including chemical engineering, electrical engineering, mechanical engineering, and systems science & engineering. These degree options provide more flexibility for students who do not intend to become licensed engineers and want to select their course work according to their personal educational objectives. For example, some students use this flexibility to gain technical background and training while pursuing or preparing for professional training in medicine, business or law. However, although the flexibility exists to do so, it is not necessary to combine an Applied Science degree program with another major or degree. Students can also use this added flexibility to achieve a well-rounded undergraduate education by selecting courses from across the university while pursuing a degree in the School of Engineering & Applied Science.

## BS in Engineering (Individually Designed Major)

The requirements to be admitted to an IDM are more stringent than those for our other engineering degree programs, and the IDM will not be available to students when they first enter Washington University (so it will not be listed on the admissions application as an option).

Students applying for an IDM should:

- have already completed at least one semester at Washington University.
- apply before the beginning of the junior year.
- have at least a 3.5 cumulative GPA at Washington University and be maintaining good standing in the School of Engineering.
- find an Engineering faculty member who will agree to serve as that student's IDM adviser. The student and adviser will design a plan of study, which lists the courses that must be successfully completed to earn the IDM. That plan must include at least 42 engineering units of credit.
- satisfy all other general engineering degree requirements (<http://bulletin.wustl.edu/undergrad/engineering/requirements>).
- present (with the help of their adviser) the plan to a standing engineering committee (normally, the Engineering Undergraduate Studies Committee), which will then assess the proposed plan and will approve or deny the request.

## Combined Majors and/or Multiple Degrees

### Multiple Majors in Engineering

All undergraduate divisions at Washington University allow students to pursue majors and degrees in more than one division. The following options are available:

**Second Degrees.** A student in any undergraduate division of the university may be allowed by another division to pursue a second bachelor's degree. For this, the student must satisfactorily complete all of the degree requirements for *both* degrees in order to earn two diplomas. These requirements may include a "residency" requirement. For engineering majors, this residency requirement is stated on the Engineering Degree Requirements (<http://bulletin.wustl.edu/undergrad/engineering/requirements>) page. In addition, the College of Arts & Sciences requires any student earning an AB degree and a bachelor's degree from another division to earn a minimum of 150 total units. If the additional residency and units requirement for a second degree are incompatible with a student's plan, then the student should consider a second major as a more convenient and equally viable alternative.

**Second Majors.** A student pursuing a bachelor's degree in engineering may also pursue second majors offered by other undergraduate divisions. There are four second majors offered by the School of Engineering & Applied Science: computer science, electrical engineering science, financial engineering and systems science. In addition, there are second majors offered by the College of Arts & Sciences and the School of Business. Students may declare a second major online via WebSTAC (<https://acadinfo.wustl.edu/WebSTAC.asp>) up until the time they have filed an Intent to Graduate. Upon completion of the

requirements, the student's transcript will show an engineering degree and all earned second majors. Only one diploma is granted; no reference to the second major is noted on the diploma.

**Minors.** Undergraduate students are allowed to pursue minors offered by any undergraduate division of the university. A minor usually requires five to six courses. The minor program's home division sets the requirements for admission and completion of the minor program. Students may declare a minor online via WebSTAC (<https://acadinfo.wustl.edu/WebSTAC.asp>) up until the time they have filed an Intent to Graduate. An engineering student who completes all of the requirements will have the award of the minor noted on the official transcript; no reference of the minor is noted on the diploma.

**Residency Rule for Engineering Minors:** No more than 6 units of credit transferred from another institution (outside Washington University) can be used to meet the requirements of any minor offered by the School of Engineering & Applied Science. The remaining units (up to the amount required for the minor) must be applicable units from Washington University. The review committee that oversees a minor has the authority to establish a more stringent residency rule.

## Process Control Systems

The Department of Energy, Environmental & Chemical Engineering and the Department of Electrical & Systems Engineering jointly sponsor a double-degree program in process control systems. Undergraduate degrees are earned in both Chemical Engineering and in Systems Science & Engineering.

The emphasis in this course of study is on the science and technology of process automation with a solid traditional foundation in the two major disciplines. Graduates of the program can contribute, through automation, to improved product quality, reduced manufacturing costs, greater capital productivity, and improved safety and environmental quality.

## Bachelor's/Master's Program in Engineering

This program provides students who enter Washington University as undergraduates in day-school programs the opportunity to earn School of Engineering & Applied Science (SEAS) master's degrees which includes Sever Institute master's degrees. Interested students are encouraged to discuss the program with faculty advisers by the end of their junior year in order to best develop a plan for their master's study.

Students must meet the admission requirements and application deadlines stipulated by SEAS and the department of interest. A minimum 3.0 GPA is required for admission, but some programs may have higher GPA requirements. Each SEAS department has the option to participate as well as to decide which master's programs to offer students. Students must be admitted to a

degree program in Engineering at least one semester prior to their anticipated graduation semester.

Scholarship support may be available to students during their master's year of study. Full-time student status is typically required to be eligible for scholarship support. For more information regarding scholarships and financial aid in the final master's year of study, please visit the Bachelor's/Master's Program (<https://engineering.wustl.edu/prospective-students/graduate-admissions/Pages/bs-ms.aspx>) website.

### Engineering Undergraduates

The Bachelor's/Master's Program for current School of Engineering & Applied Science (SEAS) undergraduate students normally takes one additional year to complete and requires participants to complete at least 150 total units. When approved by the department, up to 6 units of the 150 total units can be used to satisfy requirements for both degrees. However, at least 150 units must still be completed, and all stipulated degree requirements for all programs must be satisfied.

To satisfy residency for both degrees, all participants must complete a minimum of 84 applicable Washington University units, which includes a combination of at least 60 in-residence units counted for the SEAS undergraduate degree and at least 30 in-residence units counted for the SEAS master's degree, with up to 6 units used to satisfy requirements for both degrees if approved by the department.

The cumulative GPA used to determine undergraduate final Latin honors will include all undergraduate and graduate course work completed up until the time Latin honors are officially determined in May of each year. This means that master's courses will also be included in the calculations if a student defers earning the BS degree until the master's degree is also earned.

### Non-Engineering Undergraduates

Students from other undergraduate divisions at Washington University are also eligible to participate in the Bachelor's/Master's Program. These students must complete their undergraduate degrees before they are designated as being primary School of Engineering & Applied Science (SEAS) master's students. Admitted students might take longer than one year to complete the requirements for a master's degree. Part-time graduate enrollment might be possible with prior permission, but students will be required to maintain Satisfactory Academic Progress (SAP) standards connected to financial aid in order to maintain scholarship and financial aid support. Scholarship support can be applied to "E" courses taken at Washington University during the summer if those courses count toward fulfilling the requirements of the master's degree. Scholarship support used during a summer session will count as one of the total semesters of scholarship support available to the student.

A reasonable number of required prerequisite courses as defined by the department may be taken while admitted to the master's

program, but these courses will not be counted toward the SEAS master's degree if they are courses not normally counted toward its requirement. Prerequisite courses will count in the student's GPA when determining probation/suspension eligibility and SAP standards. Poor performance (earning less than B- grades) in these courses can be grounds for removal from the program by the department.

A minimum of 24 units of residency counted for the Engineering master's degree is required for all students. When approved by the department, up to 6 units can be used to satisfy requirements for both the non-Engineering undergraduate degree and the Engineering master's degree.

### Other Bachelor's/Master's Programs

These programs allow engineering undergraduates to earn master's degrees outside of the School of Engineering & Applied Science. Students in these 3/2 programs will pay the standard full-time undergraduate tuition rate for the fourth year, except for the MBA program which charges a premium above the undergraduate tuition rate. Students will receive financial aid for the fourth year based upon their eligibility for undergraduate financial aid awards, including Pell grants.

There is no commitment for undergraduate financial aid beyond the fourth year of study; students in 3/2 programs may apply to the professional programs for graduate student financial aid for study in the professional program beyond the fourth year.

This policy applies to the current 3/2 programs involving bachelor's/master's programs in Engineering, Social Work and Business and to any future Washington University 3/2 programs.

### BS/MBA Program

The School of Engineering & Applied Science and the Olin Business School offer a five-year program leading to the Bachelor of Science engineering degree and the Master of Business Administration degree. The purpose of the program is to provide students with the opportunity to develop an educational background particularly in demand by industry.

Students should apply to this joint program by April 1 of their junior year. They must complete the application for admission to the Olin Business School, available through the business school. There is no GPA requirement, but students must take the Graduate Management Admission Test (GMAT). Registration materials for the test may be obtained through the business school. Applicants are judged on undergraduate performance, GMAT scores, summer and/or co-op work experience, recommendations and personal interviews.

The BS/MBA student's fourth-year curriculum is composed largely of business courses. The fifth-year curriculum is divided almost evenly between business and engineering courses. Because merging of the two curricula results in very tight scheduling, it is possible that course overloads may be necessary to complete both programs in 10 semesters. Students

are strongly urged to meet with their advisers to plan the remaining years of the program.

### Dual Degree Program

The School of Engineering & Applied Science offers a Dual Degree Program with numerous other liberal arts (<http://engineering.wustl.edu/prospective-students/dual-degree/Pages/affiliated-schools.aspx>) colleges and universities. Qualified students earn both a non-engineering baccalaureate from the first school and a Washington University bachelor's degree in engineering by attending the affiliated institution for three or four years, then completing the program with two years of concentrated engineering study at Washington University.

If students are enrolled at an affiliated institution, they may apply for admission to dual degree study under this program, provided they are recommended by an official representative of their college or university and will receive or have received the non-engineering baccalaureate. For more information, please visit the Dual Degree Program website (<http://engineering.wustl.edu/DualDegreeProgram.aspx>).

### Engineering Undergraduate Degree (Undergraduate 2-Year Option)

Students enter as undergraduate students and complete a liberal arts degree (from their current school) and an engineering undergraduate degree (from Washington University). Participants are undergraduate students who commonly follow a 3/2 or a 4/2 schedule, entering Washington University after their junior or senior year. Please note that all students earning an undergraduate engineering degree are required to complete a minimum of 60 course units taken at Washington University.

### Engineering Undergraduate & Graduate Degrees (Graduate 3-Year Option)

Students enter as graduate students and complete both a liberal arts degree (from their current school) and then an engineering undergraduate degree and engineering master's degree in three years at Washington University. The engineering master's degree and undergraduate degree can be in different areas. Participants commonly follow a 3/3 or 4/3 schedule, entering Washington University after their junior or senior year. Please note that all students earning both an undergraduate and graduate degree are required to complete a minimum of 84 course units at Washington University. The GRE is not required for admission.

### Study Abroad and International Experiences

Students in the School of Engineering & Applied Science (SEAS) can study abroad in a number of countries and participate in several global experiences to help broaden their educational

experience. These opportunities will help students become global citizens better able to address current issues.

For information about these programs, please visit the SEAS website (<https://engineering.wustl.edu/current-students/outside-classroom/Pages/study-abroad.aspx>).

## Cooperative Education and Internships

The Engineering Cooperative (Co-op) Program is coordinated through the Career Center. It offers students a unique opportunity to gain in-depth engineering experience prior to graduation. Co-op students learn about a field of engineering by working alongside practicing engineers on extensive projects of the sort that are typically undertaken by entry-level engineers. This type of experience gives students a chance to preview a career path and employment options, gain career clarification, improve communication and team project skills, and enhance marketability with future employers. The cooperative education experience is typically completed over the course of a semester and a summer term.

In addition, the Career Center provides resources for students searching for summer internships and/or part-time fall or spring internships with local companies while enrolled in courses.

For more information on co-ops and internships, please visit the Career Center website (<http://careercenter.wustl.edu>) or call 314-935-5930.

## Pre-Medical Education

The School of Engineering & Applied Science makes available, as options within its undergraduate degree programs, curricula that prepare students for entry into medical, dental or veterinary school while they pursue the undergraduate degree.

These curricula were formulated in recognition of the increasing importance in medicine of the methods and subject matter of the basic engineering sciences. The student who successfully completes one of the curricula will be well prepared for the study of medicine and will have, in addition, a solid background in engineering. Moreover, the student who decides not to go on to medical school will have an exceptionally wide selection of options, including not only those commonly open to the graduate in engineering, but also those of graduate study in biomedical engineering. In accordance with the recommendations of the school's Pre-Medicine Committee, all curricula include, in addition to the normal degree requirements, the following courses:

**Biology:** Biol 2960, Biol 2970

**General Chemistry:** two semesters with lab

**Organic Chemistry:** two semesters with lab

**Psychology:** Psych 100B

**Sociology:** SOC 2510

Many medical schools have other assorted prerequisites, which can be found in the AMCAS Instruction Manual. Students may download the manual from the Association of American Medical Colleges (AAMC) website (<http://www.aamc.org>).

If students are interested in attending medical or dental school, they must consult and register with the Pre-Medicine Committee before the end of their sophomore year. Engineering students should contact the pre-medical adviser in Engineering Student Services (<https://engineering.wustl.edu/current-students/student-services/Pages/premedicine.aspx>), Lopata Hall, Room 303.

There is extensive detailed information concerning the Medical College Admission Test, the choice of advanced biology or chemistry courses, and the choice of medical school that should be discussed prior to the beginning of the junior year. Students requesting letters of recommendation from the Pre-Medicine Committee must do so in writing by the end of the fall semester of the senior year. The Pre-Medicine Committee reserves the right not to write letters for students deemed not qualified.

## Engineering Summer School

The School of Engineering & Applied Science offers a variety of engineering courses each summer. Class times are varied to accommodate both traditional daytime students and those with full- or part-time employment. The Engineering Summer School calendar comprises one full eight-week evening session as well as several accelerated sessions of shorter duration.

If students are interested in enrolling in an engineering summer course, they can obtain further information in Lopata Hall, Room 303, 314-935-6100.

## Student Services

### Engineering Student Services

Engineering Student Services, located in Lopata Hall, Room 303, has three main areas: Admissions, Advising Support, and Registrar. Our admissions officers work closely with the university Admissions Office to provide current and useful information to students and parents who are learning about our university, our community, and the opportunities available in the School of Engineering & Applied Science. The advising staff has a comprehensive knowledge of all campus resources and can help with such items as tutoring, international studies, assistance with the registration process, and general advising. The registrar handles class scheduling, transfer and AP credit, course registration, graduation eligibility, and other student records-related processes. Engineering Student Services (<https://engineering.wustl.edu/current-students/student-services/Pages/default.aspx>) serves all students, faculty and staff. For an appointment, call 314-935-6100.

## Engineering Communication Center

The Engineering Communication Center offers all engineering students, faculty and postdocs free help with their engineering communication needs. The faculty who staff the center work with individuals to define audiences and purposes, develop and organize ideas, create effective graphics and page design, and sharpen self-editing skills. Help is offered for résumés and employment correspondence, proposals, formal reports, lab reports, graduate program application statements, and presentations. For an appointment, call 314-935-4902 or email [ecc@seas.wustl.edu](mailto:ecc@seas.wustl.edu).

## The Career Center

The Career Center helps engineering students prepare for a lifetime of career management by offering innovative approaches to help prepare them for a successful co-op, internship and job search. The Career Center offers a variety of services and resources for Engineering undergraduate and graduate students.

Whether students are looking for a summer internship, a co-op or a full-time job, the center is here to help. The Career Center offers a breadth of resources, including CareerLink: an online job, co-op and internship database; the Engineering Mentoring Program; ENGroups: Engineering Careers Interest Groups; special events; skill-building workshops; career fairs and on-campus interviews; and résumé referrals for job opportunities.

The Career Center offers one-on-one career guidance to students at any stage of their career-planning process. Students are encouraged to meet with a career adviser early in their academic career and at least once each year to build a relationship. To schedule an advising appointment, please contact 314-935-5930 or email [careers@wustl.edu](mailto:careers@wustl.edu) or visit the website (<http://careercenter.wustl.edu>).

## Course Descriptions

For administrative purposes, the School of Engineering & Applied Science is subdivided into five academic departments: Biomedical Engineering (E62); Computer Science & Engineering (E81); Electrical & Systems Engineering (E35); Energy, Environmental & Chemical Engineering (E44); and Mechanical Engineering & Materials Science (E37). Each department may offer courses leading to one or more bachelor's, master's or doctoral degrees.

The courses of instruction are numbered according to the following system:

- 100 to 199 are primarily for first-year students.
- 200 to 299 are primarily for sophomores.
- 300 to 399 are primarily for juniors.
- 400 to 499 are primarily for juniors and seniors, although certain courses may carry graduate credit.
- 500 or above are offered to graduate students and to juniors and seniors who have met all stated requirements. If there

are no stated requirements, juniors and seniors should obtain permission of the instructor.

One unit of credit is given for each hour of lecture, and one unit for each two and one-half hours of laboratory. Each course description shows the course's credit. A table of all engineering courses (PDF) ([https://engineering.wustl.edu/current-students/student-services/Documents/Engineering\\_Course\\_Attributes\\_Feb%2028\\_2017.pdf](https://engineering.wustl.edu/current-students/student-services/Documents/Engineering_Course_Attributes_Feb%2028_2017.pdf)) and, for each course, the division of its topics units (PDF) is available and frequently updated on the school's website.

## First-Year Program

This First-Year Program is offered as a starting point for beginning students and their advisers when planning each student's individual course schedule.

A typical first-year course load totals 14 to 16 units for each semester, and it is not wise to enroll for more than 16 units during the first semester. It may be that a load of less than 14 units is desirable. Students should enroll in the following courses:

**Calculus:** Beginning engineering students with previous calculus course work usually begin with Math 132 Calculus II. Students with a strong mathematics background may be ready for Math 233 Calculus III or even Math 217 Differential Equations.

**Physics and/or Chemistry:** If biomedical engineering or chemical engineering is a likely major, chemistry and physics should be completed during the first year; for other majors, physics is the recommended choice.

**Other Courses:** Most first-year engineering students also enroll in one or more humanities/social sciences courses, engineering courses at the 100 level, and perhaps a computer science course. If students have a major or are strongly leaning toward a major, they should follow the recommendations for that major.

**English Proficiency:** The English proficiency requirement must be completed as soon as possible. Refer to the Engineering Degree Requirements (<http://bulletin.wustl.edu/undergrad/engineering/requirements>) for further details on this requirement.

## Suggested Courses for First Semester

| Courses                               | Units |
|---------------------------------------|-------|
| Mathematics (Math 132)                | 3     |
| Physics (Physics 117A or Physics 197) | 4     |
| Chemistry (Chem 111A and Chem 151)    | 5     |
| Humanities/social sciences elective   | 3     |
| Engineering course(s)                 | 3-6   |

\*Required for Biomedical Engineering, Chemical Engineering and Pre-Medicine students

## Suggested Courses for Second Semester

| Courses                               | Units |
|---------------------------------------|-------|
| Mathematics (next course)             | 3     |
| Physics (Physics 118A or Physics 198) | 4     |
| Chemistry (Chem 112A and Chem 152)**  | 5     |
| Humanities/social sciences elective   | 3     |
| Engineering course(s)                 | 3-6   |

\*\*Required for Biomedical Engineering, Chemical Engineering and Pre-Medicine students

## Recommended Courses

The following list recommends course sequences for each engineering major.

**Biomedical Engineering:** BME 140, first semester; Biol 2960, second semester.

**Chemical Engineering:** EECE 101

**Computer Engineering:** CSE 131, first semester; CSE 132, second semester.

**Computer Science:** CSE 131–CSE 132, first and second semester; CSE 240, second semester.

**Electrical Engineering:** CSE 131 and ESE 103, first semester; ESE 260, second semester.

**Mechanical Engineering:** MEMS 202, first semester.

**Systems Science and Engineering:** CSE 131, first semester; Math 309, first or second semester; ESE 205 Introduction to Engineering Design, second semester.

**Contact:** Engineering Student Services

**Phone:** 314-935-6100

**Website:** <http://engineering.wustl.edu>