

ENGINEERING

<http://www.miami.edu/engineering>

Mission

The College of Engineering transforms lives by: creating new knowledge, re-creating knowledge for education, translating knowledge for commercialization, and applying knowledge to serve the community.

The objective of the College of Engineering is to serve society by offering high-quality educational programs in the professional areas that it covers, and by performing research and community service, with high professional standards. The College is dedicated to educating engineers to deal with the major issues of society over the next generation - enhancing competitiveness, advancing health care, coming into harmony with the environment, utilizing technology for humankind's benefit, and supporting a sophisticated infrastructure. The goal of the faculty is to prepare students to be employed effectively in manufacturing, consulting, construction, information technology, service industries, and those related to the medical industry and health care, in roles involving planning, design and implementation at all levels of decision making. Students are broadly prepared in technical, leadership, and management skills. Student development accrues both inside and outside the classroom, with input from faculty, employers, alumni, and other students. They are made acutely aware of environmental and international perspectives. Professional competence in the traditional sense is complemented by a broad capability to function in society. The College places great emphasis on providing students with a learning experience which will enable them to develop productive careers while creating engineering solutions to problems of our society. Learning is centered around real life experiences, which involve an understanding of science, mathematics, social values, and aesthetics, to produce economical solutions to physical problems which society encounters. Protection and enhancement of the environment is stressed at all levels, and emphasis is placed on the creative application of knowledge which will improve the quality of life.

Department and Programs

The College of Engineering has six departments -

- Biomedical Engineering,
- Chemical, Environmental, and Materials Engineering
- Civil and Architectural Engineering,
- Electrical and Computer Engineering,
- Industrial and Systems Engineering, and
- Mechanical and Aerospace Engineering

offering curricula leading to Bachelor of Science degrees in the following fields:

- Aerospace Engineering,
- Architectural Engineering,
- Biomedical Engineering,
- Civil Engineering,
- Computer Engineering,
- Electrical Engineering,
- Engineering Science,
- Environmental Engineering,
- Industrial Engineering,
- Innovation, Technology and Design,
- Mechanical Engineering, and
- Software Engineering.

Interdisciplinary areas of study, areas of specialization within departments, and study in different areas are available through options, concentrations and dual degree programs.

Accreditation

The programs in Aerospace Engineering, Architectural Engineering, Biomedical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Environmental Engineering, Industrial Engineering, and Mechanical Engineering are accredited by the

Engineering Accreditation Commission of ABET, <http://www.abet.org>
415 North Charles Street
Baltimore, MD 21201

telephone: 410-347-7700

The programs in Engineering Science, Innovation, Technology and Design, and Software Engineering are not accredited.

The College offers graduate programs leading to degrees both in the traditional and interdisciplinary areas of study. Programs leading to the M.S. degree may include specialization in the following areas of study: Architectural Engineering, Biomedical Engineering, Civil Engineering, Electrical and Computer Engineering, Engineering Management, Environmental Engineering, Industrial Engineering, Mechanical Engineering, Medical Informatics, Structural Engineering, and Thermal and Fluid Sciences. .

Engineering Laboratories

The College of Engineering maintains a variety of well-equipped laboratories adequate for undergraduate instruction and providing for graduate and sponsored research.

Computer Laboratory

- Clarke Computational Laboratory
- Computer Graphics Laboratory

Biomedical Engineering Laboratories

- Biomedical Imaging Laboratory
- Scanning Electron Microscope Laboratory
- Ophthalmic Optics and Imaging Laboratory
- Orthopedic Biomechanics Laboratory
- Mechanobiology Laboratory
- Biomaterials Laboratory
- Biomedical Atomic Force Microscopy Laboratory
- Islet Immunoengineering Lab
- Neural Stem & Tissue Engineered Microenvironments Lab
- Physiomimetic Microsystems Laboratory
- Neurosensory Laboratory
- Neural Interfaces Lab
- Sensory Electrophysiology Laboratory
- Conscious Audition and Scene Analysis Lab
- Cell and Tissue Engineering Laboratory (instructional)
- Measurements Laboratory (instructional)

Chemical, Environmental and Materials Engineering Laboratories

- Environmental Engineering Laboratory

Civil and Architectural Engineering Laboratories

- Geotechnical Engineering Laboratory
- Mechanics of Solids and Materials Laboratory
- Structures and Materials Laboratory
- Sustainable Building Systems Laboratory

Electrical and Computer Engineering Laboratories

- Electronics Laboratory
- Wireless Communications Laboratory
- Digital Signal Processing Laboratory
- Electrical Machinery Laboratory
- Digital Design Laboratory
- Microprocessor Laboratory
- Photonics and Micro-Devices Laboratory
- Distributed Decision Environments Laboratory
- Underwater Imaging Laboratory
- Networks Laboratory
- Embedded Systems Laboratory

- Computer Vision and Image Processing Laboratory
- Information Technology Laboratory
- Multimedia Laboratory
- Digital Audio and Speech Processing Laboratory
- Optics and Fiber Communications Laboratory
- ECE Computer Laboratory
- Nanophotonics and Devices Laboratory
- MEMS and VLSI Laboratory

Industrial and Systems Engineering Laboratories

- Computer Integrated Manufacturing Laboratory
- Industrial Hygiene Laboratory
- Biomechanics and Gait Laboratory
- Human Factors and Aging Research Laboratory
- Productivity Research Laboratory
- Work Design Laboratory
- Work Physiology Laboratory
- Systems and Operations Research Laboratory
- Industrial Ventilation Laboratory
- Robotics Laboratory

Mechanical and Aerospace Engineering Laboratories

- Advanced Additive Manufacturing Laboratory
- Aerospace Materials Simulation Laboratory
- Aerodynamics and Computational Fluid Dynamics Laboratory
- Aerosol and Air Sensing Group
- Fuel Cells Laboratory
- Thermo-Fluid Mechanics Laboratory
- Integrated Nano-Bio-Systems Laboratory
- Internal Combustion Laboratory
- Materials Laboratory
- Measurements Laboratory
- Micromechanics of Extreme Materials Laboratory
- Tissue Biomechanics Laboratory
- Wind Tunnel Laboratory

Academic Policies

Admission

Admission to the College of Engineering is covered under the section on Admission to the University in the General Information section of this Bulletin. Algebra, trigonometry, analytic geometry, chemistry, computer literacy, and physics are high school subjects that are appropriate for students planning on entering the College.

The academic work of each transfer student will be evaluated on an individual basis, and the student will be enrolled in the College at an appropriate level.

Requirements for Graduation

The College believes that emphasis should be placed on the student's ultimate level of attainment in selected subject areas. For those students whose preparation is advanced beyond that of the average secondary school graduate, the University provides proficiency examinations and schedules the students for more advanced work. Graduation for these students may be accelerated. For those students whose secondary school preparation has not provided an adequate background, the University offers preparatory courses. Graduation for these students may be delayed accordingly.

The student's program of study is selected jointly with an adviser, with special attention to the individual student's needs. Flexibility is ordinarily possible within the framework of sound education in the essential fundamentals and within the development of depth in selected fields of design and analysis. An examination of a typical curriculum given under the various department sections of this Bulletin shows that there is a strong common

core of studies. Therefore, students uncertain of their ultimate field of specialization retain a high degree of mobility to enable them to transfer from one curriculum to another.

Each student must demonstrate upon admission an adequate preparation in the necessary skills of reading, writing, and mathematics. Placement test scores will indicate which, if any, supplementary courses must be taken the first semester. Although these courses are recorded for University credit hour, the student must take the full curriculum, as listed, in addition to these courses. Students not prepared in these areas are advised to make every effort to correct deficiencies before the first semester.

Completion of any of the prescribed curricula, except Engineering Science, with an overall grade point average of at least 2.0 (C) in all course work, to include all accepted work from other institution(s), is the basic requirement for graduation in the College. An average of C also must be attained in all work attempted at the University of Miami and the professional studies. The Engineering Science curriculum, because of its special purpose, has a higher requirement, i.e., a grade point average of 3.0 (B).

The requirements for graduation as specified by each Department and Program reflect the general education requirements of the University of Miami and the requirements of the appropriate accrediting agencies. The curricula contain required courses and elective courses. No course required for graduation may be taken under the credit-no credit (Credit-Only) option.

Students are expected to make satisfactory progress toward graduation by meeting the criteria established above. Whenever a student fails to demonstrate positive academic progress, he/she may be placed on academic probation or dismissed by the College of Engineering Scholastic Standards and Advising (SSA) Committee.

General Educational Requirements

Written Communication Skills

Effective writing skills advance ideas efficiently and persuasively, so the expectation is that students become adept at using writing as an effective communication tool. Students fulfill this requirement by satisfactorily completing WRS 105 together with WRS 107, or the equivalent. Appropriate Advanced Placement (AP) or International Baccalaureate (IB) scores in English composition may be used to satisfy this requirement.

Students will be able to:

- • Demonstrate effective written communication skills in relation to specific rhetorical tasks.
- • Construct original, well-reasoned arguments using a range of materials.
- • Integrate and synthesize appropriate and relevant primary and secondary sources in their writing.

EFFECTIVE FALL 2017, NEW STUDENTS WITHOUT PRIOR COLLEGE CREDIT IN WRITTEN COMMUNICATION SKILLS WILL BE PLACED AS FOLLOWS:

- WRS 103: ACT English score below 18 or SAT Evidence-Based Reading and Writing or Critical Reading score below 430, or TOEFL iBT Writing score below 18.
- WRS 105: ACT English score 18 or above or SAT Evidence-Based Reading and Writing or Critical Reading score 430 or above, or TOEFL iBT Writing score 18 or above
- WRS 107: ACT English score 32 or above or SAT Evidence-Based Reading and Writing or Critical Reading score 700 or above

Written Communication Skills General Education Requirements must be completed prior to attaining junior year classification.

Advanced Writing and Communications Skills

Engineering students satisfy the University's Advanced Writing and Communication Skills requirement by completing a set of classroom courses, laboratory courses and/or design courses where they learn effective oral, graphical and technical writing skills. These requirements are specified under each department.

Quantitative Skills

All students in the College of Engineering meet the quantitative skills proficiency requirement by completing MTH 151 or equivalent.

Areas of Knowledge

Students at the College of Engineering fulfill the Areas of Knowledge requirement by completing three *cognates*, one from each of the three areas of the university curriculum:

- Arts & Humanities;
- People & Society; and
- Science, Technology, Engineering & Mathematics.

For students in the College of Engineering, their engineering major will count as a cognate in Science, Technology, Engineering & Mathematics. These students have to complete a cognate in People & Society and Arts & Humanities.

A cognate is a group of at least three courses for at least nine credit hours, related in a topical, thematic, interdisciplinary, sequential, or other fashion, so that completion of a cognate provides coherent depth of knowledge. Each cognate has course options that allow students to complete the cognate in a manner that meets their interests, while staying within the coherent focus of the cognate. While students are required to take three cognates to

fulfill the Areas of Knowledge requirement, there is no limit to the number of additional cognates students may complete. All cognates completed by students are listed on the students' transcripts, thus certifying their depth of knowledge in those areas.

The university offers a large number and range of cognates. All approved cognates are visible in a cognate search engine (at www.miami.edu/cognates/) that allows students to search for cognates based on cognate features, cognate courses, and keywords. Each cognate is administered by a department or program that is designated as the Responsible Academic Unit (RAU) for the cognate. Inquiries regarding a cognate should be directed to the cognate's RAU.

Individualized Cognates

Students may create an individualized cognate to fulfill an Area of Knowledge requirement. All of the courses used in an individualized cognate must have the Area of Knowledge attribute in CaneLink for the requirement that they are being used to fulfill, even if they are transfer credits. If a course has been approved to be utilized in an individualized cognate, an Area of Knowledge attribute will be listed in CaneLink. No exceptions will be accepted. A searchable list of courses eligible to be used in individualized cognates is available at this link (<https://ua.miami.edu/indiv-cognate-courses.html>).

The student's official records are maintained by the Office of Enrollment Services. It is the student's obligation to take the initiative to assure that all requirements are being met in conformity with his/her own graduation plans.

Degree Programs

Dual Majors

Dual majors are offered for engineering students with strong interest in related fields of study such as Physics or Mathematics. In order to obtain a dual major in one of these areas, the student will have to obtain, in parallel, a degree in one of the engineering programs, plus additional course work approved by the dual majors department. Further information on this dual major program may be obtained from the Dean's Office of the College.

Minors

Minors are offered by the College of Engineering. The departments of:

- Chemical, Environmental and Materials Engineering
- Civil and Architectural Engineering,
- Electrical and Computer Engineering,
- Industrial Engineering, and
- Mechanical Engineering

offer minors with various areas of specialization. Details of each area of concentration and its requirements may be found under each departmental listing.

Engineering students can earn a minor offered by any other College/School within the University of Miami, including the College of Engineering.

In cases where the major degree requirements satisfy some of the requirements for the minor, at least six credit hours beyond the major degree requirements must be taken in the minor subject area to earn a minor. Minors in Engineering require a minimum GPA of 2.0 in the courses required for the minor.

Departmental Honors Program

A student in the College of Engineering may graduate with Departmental Honors noted upon his/her diploma and transcript upon fulfillment of the following requirements:

1. Completion of at least 18 credit hours of course work in honors courses and/or in courses at the 500 level, including 6 credit hours in independent study, senior thesis, or designated advanced or special honors courses specified by the department, with grades of at least B in these 6 credit hours.
2. Attainment of at least a 3.4 overall grade point average. Transfer students must also attain at least a 3.4 grade point average in all work taken at the University of Miami.
3. Attainment of at least a 3.5 average in the departmental major courses.
4. A written request from the student to the departmental faculty during his/her semester of expected graduation stating the desire to graduate with Departmental Honors, and specifying those courses taken in compliance with section (A) above.

Certificate Programs in Engineering

In cooperation with the University's School of Continuing Studies, the College of Engineering offers practicing engineers advanced or specialized training without having to meet the stringent entrance requirements of the Graduate School. Persons holding Bachelor's degrees, registered as Professional Engineers, or possessing equivalent qualifications can be granted Certificates of Proficiency by the University after completing fifteen credit hours of course work in a specified field of engineering. Study programs are arranged on an individual basis by each student and his/her advisor. Detailed information on Certificate Programs can be requested from the Office of the Dean of Engineering.

The Internship Cooperative Program

The Cooperative Program takes its name from the close cooperation that exists between the College and participating employers. This arrangement attempts to insure that each student's academic and work experience will integrate and contribute significantly to his/her overall growth and professional development. Interviews and screening by both the employer and Cooperative Program personnel attempt to match the needs of the employer carefully with the interests and capability of the student.

Advantages to the Student

1. Offers on-the-job experience to supplement the academic degree program.
2. Offers potential long term career employment with the Cooperative Program employer.
3. The experience obtained makes the student, upon graduation, potentially much more valuable to any future employer. Upon completion of an appropriate amount and level of experience, graduation in the Cooperative Program may be recognized by a special seal on the student's diploma.
4. Helps the student to verify whether or not his/her career or specialty choice is correct.
5. Tends to increase motivation and to make academic studies more meaningful.
6. Earnings from Cooperative Program employment can cover a significant portion of the student's college expenses.
7. Certain work experience may shorten the experience requirements, after graduation, for eligibility for professional registration.
8. Helps to develop the students understanding of human relations and the lifelong need of learning to balance appropriately the demands on ones time of multiple duties such as studying, employment, daily necessities, family obligations, etc.

Advantages to the Employer

1. Offers an opportunity to recruit and screen potential employees in the fields of engineering.
2. The Cooperative Program maintains an up-to-date roster of available undergraduate and graduate students, many with previous experience. This roster offers employers means of obtaining employees to meet fluctuating work loads, on relatively short notice.
3. Students in the Cooperative Program can provide good company public relations with their classmates.
4. Participation in a Cooperative Program serves the profession by providing opportunities for many capable and well deserving young persons to attend a University, who otherwise might lack the financial ability or motivation to attend.

Types of Cooperative Program Arrangements

Continuous Work-Study

An arrangement involving a combination of part-time employment (15 or more hours per week) and a credit hour academic load which is appropriately reduced from the normal full-time load to balance the employment duties. Full-time employment may be undertaken during the summer period. Two students may be used during the year to share the hours of a full-time position (20 hours each student). In some instances, an individual student will hold a full-time position and carry a light academic load in evening and/or early morning classes.

Alternating Work-Study

An arrangement involving two students alternating full-time employment and full-time study. Students alternate positions of work and study at the end of each semester (including the summer), and thereby provide the equivalent employee time of a full-time position year-round.

Student Eligibility for the Program

University of Miami students enrolled in the College of Engineering are eligible to enter the Cooperative Program. Initial entry into the Program is limited to superior students. Normally, work assignments are not given until the equivalent of one or two semesters of full-time academic work is completed. Currently, most students in the Program are under continuous work-study arrangements.

Study Abroad Programs

The College of Engineering encourages its students to take advantage of one of the University of Miami's numerous study abroad options in Latin America, Europe, Asia, Australia and the Middle East, especially through partners in the Global Engineering Education Exchange (GE3). Of particular interest to Engineering students are the following: internships (unpaid and paid) in Spain, England, France, Argentina, Colombia, Chile, and Australia in which professional work experience is carried out abroad; course work at Engineering schools abroad for a semester or an academic year; summer programs in intensive Language instruction, Humanities and Social Sciences abroad. The cost of attending these programs is equivalent to University of Miami tuition and fees. Almost all University of Miami financial aid is granted. With prior approval and detailed curriculum advice, courses taken abroad will apply towards graduation.

The Management of Technology Supplemental Program

The objective of this program is to educate engineers in how to exploit their technological knowledge. This is a vital, but often neglected, link in achieving competitiveness in the global marketplace. The basic premise motivating this approach is the recognition that in today's world, technology is the backbone of the business enterprise system and that wealth can only be created through production of goods and services. This program will

educate engineers in a multitude of subjects bridging the gap between product technology, production technology and the marketplace, which is the ultimate customer of engineering contributions.

The program consists of four courses:

1. Quality in Design of Products and Production Systems
2. Entrepreneurship for Engineers
3. Production Systems Design
4. Management of Technology.

A project is required at the end of the program, but is threaded throughout the program starting with the first course. Upon completion of the program, the student will receive a special certificate of completion. This program is available to all qualified students in all departments of the College of Engineering.

Admission to the Program

Admission to this supplemental program will be by application submitted by the candidate or by nomination by an advisor or department chair. All applications will be reviewed by a standing committee. Students must meet the prerequisite of each course before enrolling in it.

Requirements for the Certificate

The program is an add-on to existing curriculum. Students must complete all courses designated in order to qualify for the certificate. A notation will be made on the student's transcript recognizing their completion of the special program. No designation will be made on the diploma.

Course Sequence

Courses are recommended to be taken in the sequence indicated above.

Team Work

Students will be encouraged to work on projects in teams. Multidisciplinary teams will also be encouraged.

The College is primarily housed in the J. Neville McArthur Building. Completed in 1959 and renovated in 1984, this attractive building is the gift of the late J. Neville McArthur, who was a member of the Board of Trustees and a prominent citizen and dairyman. The Engineering Addition is also a gift of the McArthur family. Students in the College of Engineering come from all parts of the United States and from many nations throughout the world, comprising one of the most diverse and cosmopolitan engineering student bodies in the country.

Combined BS/MS Program

The College offers a five-year Bachelor of Science and Master of Science BS/MS degree program in Architectural Engineering, Biomedical Engineering, Civil Engineering, Computer Engineering, Electrical Engineering, Environmental Engineering, Industrial Engineering, and Mechanical Engineering. This program is specifically designed for those students who want to pursue their graduate study as they are completing their undergraduate study. Both degrees are awarded at the completion of required coursework for both the BS and MS degrees. The special conditions and processes for the five-year BS/MS Program are as follows:

Requirements

You must be an undergraduate student in the College of Engineering (CoE). The Admission Committee will carefully review academic credentials for admission into our M.S. program. Students should discuss the program and possibility of entering with an academic adviser. Completed applications are due prior to the beginning of your junior year.

Application Process

Interested CoE students must complete the application process during their "junior" year. Applicants will need to provide all the required documentation outlined on the on-line graduate application including 3 recommenders, a UM transcript sent directly from the UM Office of the Registrar. An admission decision will not be made until all required application materials have been received and processed for review by the Admission Committee.

Financial Implications

Many financial aid programs, including those offered by the University and the federal and state governments are restricted to coursework required to complete an undergraduate degree. For further information contact the University of Miami Financial Aid Office.

Once admitted into BS-MS program

In your senior year when you have a full time undergraduate status, you may take a maximum of twelve (12) graduate credit hours (a maximum of six (6) credit hours per semester) with approval of your academic advisor. In order to register for these classes, you must complete and submit the UM Graduate School "Application for Undergraduate to Take Graduate Course" special form.

During your last one or two semesters, when you are taking graduate course work only, register as a graduate student.

A student wishing to withdraw from the BS/MS Program without the MS degree must complete all the requirements for the BS degree.

To qualify for the MS degree, the student must meet all the pertinent Graduate School requirements, including a minimum of 3.0 GPA in the credit hours applied toward the MS degree.

The student is awarded both the BS and MS degrees at the end of the fifth year when all degree requirements are satisfied.

The Doctor of Philosophy Degree is currently offered in the area of:

- Biomedical Engineering
- Chemical, Environmental and Materials Engineering
- Civil Engineering
- Electrical and Computer Engineering
- Industrial Engineering
- Mechanical Engineering

The Ph.D. programs in Interdepartmental Graduate Studies permit, with approval of the Graduate Council, highly qualified students to pursue a privileged individualized program which cuts across disciplinary lines.

The Bulletin of the Graduate School (<http://bulletin.miami.edu/graduate-academic-programs/engineering/>) presents more detailed information on these graduate programs.

Foote Fellows in CoE

The Foote Fellows Honors Program recognizes the most educationally accomplished incoming students at the University of Miami. Foote Fellows have distinguished themselves both in and out of the classroom at their previous schools, are self-motivated, and think independently. Admission to the Foote Fellows Honors Program is by invitation.

Foote Fellows in the College of Engineering are exempt from the Cognates Program of General Education requirements within the curricular framework of their major. Within the curricular framework of their majors, Foote Fellows enjoy unmatched freedom and flexibility to explore a multitude of educational resources. Many Foote Fellows leverage this opportunity to take additional majors and/or minors and to study abroad.

At each of the nine undergraduate schools at the University of Miami, a dedicated adviser helps Foote Fellows chart their academic path and attain access to distinctive learning opportunities at the University, such as special school-based seminars, faculty-mentored research, networking opportunities, and off-campus internships.

Foote Fellows also will be invited to join advanced, interdisciplinary Foote Fellow seminars taught by leading faculty members from across the University. An example is Books That Matter, a rigorous seminar in non-fiction reading that is offered in sessions for first-year and for upper-class students. Further, Foote Fellows receive focused advising on post-baccalaureate distinguished fellowships and awards.

The Foote Fellows Honors Program reflects the educational vision of former University of Miami President Edward T. Foote, who retired in 2000 after serving the University for twenty years.