Concentrations and Minors

Concentration in Engineering Leadership

E-Lead Program

The Opus College of Engineering offers a people-focused, technical leadership program, E-Lead, for its undergraduates. This three-year program is designed to:

• Develop engineers able to address 21st-century global challenges
• Prepare individuals to lead, not only through innovation and technical expertise, but also through their ability to motivate, engage and guide people and organizations who represent the full range of diversity across the human spectrum
• Educate and develop the leadership and character of outstanding engineering students, who will be able to lead technical teams in solving global problems

To participate, students must apply and be accepted to the program in their sophomore year. Students who complete all of the required elements of the E-Lead Program earn 9 credits and have a concentration in Engineering Leadership noted on their transcript.

Program elements include:

• Three one-credit E-Lead Studios, offered each year
• Participation in an industry internship, co-op, research internship or major service project
• Shadowing industry leaders
• Attending national leadership institute
• Creation of Personal Leadership Development Portfolio
• Completion of a senior capstone leadership project

Throughout the three-year program, E-Lead students are encouraged to: practice leadership through work or service, regularly read leadership books and articles, communicate with mentor(s), and attend a national professional conference.

Required Courses:

<table>
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<tr>
<th>Professional Development Course</th>
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<tr>
<td>GEEN 2952</td>
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<td>Professional Development for Engineers</td>
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<tr>
<th>Seminar Courses</th>
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<tr>
<td>GEEN 2961</td>
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<tr>
<td>E-Lead 1: Foundations of Leadership and Individual Development</td>
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<tr>
<td>GEEN 3961</td>
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<td>E-Lead 2: Leading Others</td>
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<td>GEEN 4961</td>
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<td>E-Lead 3: Leading Technology and Innovation</td>
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<th>Experiential Courses</th>
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<tr>
<td>GEEN 3959</td>
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<tr>
<td>E-Lead Experience: Explorations in Engineering Leadership Practice</td>
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<td>GEEN 3990</td>
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<tr>
<td>E-Lead Experience: Professional Engineering Leadership Experience</td>
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<td>GEEN 4998</td>
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<td>E-Lead Experience: Capstone Project</td>
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Total Credit Hours: 9

Concentration in Global Engineering

The profession of engineering is becoming increasingly global, including geographically distributed design teams, multinational companies and operations, global customer bases and markets, regional and international standards, culturally influenced approaches to research and development and a world-view of the environment. As a result, there is a need for students to develop a global perspective of their technical field and profession.

The goal of this program is to provide an integrated opportunity for students to experience engineering from a global perspective throughout their studies and provide formal recognition of these accomplishments via the completion of a concentration as noted on their transcript.

All engineering undergraduates in good standing are eligible to participate in this program. Students who wish to pursue this concentration should work closely with their academic adviser beginning in their freshman year to effectively integrate their interests and these experiences with their engineering degree requirements.

This concentration requires completion of a minimum of 13 credits including:
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Culture/Second language - One of the following:
- HIST 1301 Survey of Latin America
- HIST 1401 Africa
- SPAN 3002 Spoken Spanish

Study Abroad Experience:
- MARQ 1005 Cross-Cultural Issues in Study Abroad
- MARQ 3005 Bridging the Local and Global: Unpacking your Study Abroad Experience

Full-time Study abroad placeholder course (GEEN 9052)

International Engineering Project:
- GEEN 4995 Independent Study in General Engineering

And one of the following:
- BIEN 4998 Senior Design Project
- COEN 4998 Senior Design Project
- CEEN 4998 Senior Design Project
- ELEN 4998 Senior Design Project
- MEEN 4998 Senior Design Project

International engineering co-op/internship experience or international engineering service or research project - One of the following:
- GEEN 4993 Co-Op Work Period 4
- GEEN 4994 and Co-Op Grading Period 4

or
- GEEN 4995 Independent Study in General Engineering

Minor in Engineering Ethics and Values

The goal of this program is to involve engineering students in an elective program which will help them to: (a) understand the impact of Christian, Catholic and Jesuit values on engineering ethics, (b) recognize current engineering ethical issues and (c) strengthen their moral resolve to act courageously on these issues once they enter the engineering profession.

The minor in engineering ethics and values requirements include:

Required Courses
- PHIL 1001 Foundations in Philosophy
- PHIL 2310 Theory of Ethics
- THEO 1001 Foundations in Theology: Finding God in all Things

Four ENEV colloquia
- ENEV 1952 Ethics and Values Colloquium 1
- ENEV 2952 Ethics and Values Colloquium 2
- ENEV 3952 Ethics and Values Colloquium 3
- ENEV 4952 Ethics and Values Colloquium 4

Three of the following courses:
- BIEN 4931 Topics in Biomedical Engineering (selected sections only) a
- ENEV 4995 Independent Study b
- MANA 3002 Business and Its Environment
- PHIL 3350 Philosophy of the Environment
- PHIL 4320 Contemporary Ethical Problems
- PHIL 4330 Business Ethics
- PHIL 4335 Biomedical Ethics
- SOCI 3520 Health Care Systems
- SOCI 5400 Social Inequality
- SOWJ 1001 Introduction to Social Welfare and Justice
- THEO 2400 Christian Discipleship
- THEO 4430 Religion and Science
- THEO 4440 Foundations of Ecological Ethics
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THEO 4450
Medical Ethics

<table>
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<th>Total Credit Hours</th>
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a Specific topics in Ethics only. College approval is required.
b Study in the area of Engineering Ethics and Values only. College approval is required.

For more information, contact the Engineering Academic Advising Center (http://www.marquette.edu/engineering/academic-advising-center).

Non-Engineering Minors

Engineering students may choose to pursue minors that are outside the Opus College of Engineering. In general, if any other major or minor program is desired, students should consult the appropriate area in the Undergraduate Bulletin for guidelines and requirements. The following section provides information for non-engineering minors that are often pursued by engineering students.

Students wishing to achieve a minor in biological sciences, business administration, computer science, mathematics or physics should consult with the Engineering Academic Advising Center to discuss the requirements of these minors. Careful planning with an academic adviser can minimize the number of additional hours beyond the normal graduation requirements.

Biological Sciences Minor

The Biological Science (BSCI) minor may be of interest to biomedical engineering students. Students may obtain a minor in biological science by completing the course requirements listed in the biological science section of this bulletin with a grade of C or better. The Klingler College of Arts and Sciences Major and Minor Overlap policy (http://bulletin.marquette.edu/undergrad/helenwayklinglercollegeofartsandsciences/academicregulations/#majorsandminors) requires 9 unique credits, that is credits not used to satisfy requirements for a different major/minor, in order to earn a minor. Students should consult with the Engineering Academic Advising Center regarding degree and minor requirements.

Business Administration Minor

A Business Administration (BUAD) minor may be of interest to students of any engineering discipline. Students may obtain a minor in business administration by completing the course requirements listed in the business administration section of this bulletin with a grade of C or better. Curriculum substitutions may be requested for the following as appropriate.

- CEEN 1210 Introduction to Computing, Analysis, Design and Communication, GEEN 1210 Engineering Discovery 2 or BIEN 1120 Introduction to Computing for Biomedical Engineers can substitute for the BUAD 1060 Business Applications: Basic Business Analytic Tools requirement.
- MEEN 3426 Engineering Statistics or MATH 4720 Statistical Methods can substitute for BUAD 1560 Introduction to Statistics and Business Analytics.
- Electrical or Computer engineering students may utilize either MANA 3001 Behavior and Organization or MARK 3001 Introduction to Marketing as an EE Technical elective, or COEN Technical elective with careful selection of breadth and depth course selection.

Computer Science Minor

Students in Electrical or Computer Engineering may obtain a minor in computer science by completing the course requirements with a grade of C or better. The following is a list of requirements and curriculum substitutions allowed.

- COSC 1010 Introduction to Software Development--EECE 1610 Introduction to Computer Programming (3cr) and EECE 2030 Digital Electronics (1 of 3cr) count for COSC 1010 Introduction to Software Development (4cr).
- COSC 1020 Object-Oriented Software Design--EECE 2710 Introduction to Computer Hardware and Software (3cr) and COEN 4710 Computer Hardware (1 of 3cr) count for COSC 1020 Object-Oriented Software Design (4cr).
- COSC 2200 Hardware Systems--EECE 2030 Digital Electronics (2 of 3cr) and COEN 4710 Computer Hardware (1 of 3cr) count for COSC 2200 Hardware Systems (3cr).
- COSC 2100 Data Structures and MATH 2100 Discrete Mathematics must be completed.
- Complete 9 unique credit hours of upper-division COSC elective course work.

The Klingler College of Arts and Sciences Major and Minor Overlap policy (http://bulletin.marquette.edu/undergrad/helenwayklinglercollegeofartsandsciences/academicregulations/#majorsandminors) requires 9 unique credits, that is credits not used to satisfy requirements for a different major/minor, in order to earn a minor. Students should consult with the Engineering Academic Advising Center regarding degree and minor requirements.

Mathematics Minor

Students enrolled in the Opus College of Engineering may obtain a minor in mathematics by completing the course requirements listed in the mathematics section of this bulletin with a grade of C or better. It is important to note that MATH 1450 Calculus 1, MATH 1451 Calculus 2, MATH 2450 Calculus 3, and MATH 2451 Differential Equations count towards the mathematics minor. However, MATH 1455 Calculus 2 for Biomedical and Civil Engineers and MATH 2455 Differential Equations for Biomedical and Civil Engineers do not satisfy minor requirements. The Klingler College of Arts
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and Sciences Major and Minor Overlap policy (http://bulletin.marquette.edu/undergrad/helenwayklinglercollegeofartsandsciences/academicregulations/#majorsandminors) requires 9 unique credits, that is credits not used to satisfy requirements for a different major/minor, in order to earn a minor. Students should consult with the Engineering Academic Advising Center regarding degree and minor requirements.

Physics Minor

Students enrolled in the Opus College of Engineering may obtain a minor in physics by completing the course requirements listed in the physics section of this bulletin with a grade of C or better.

Students who take ELEN 3110 Electromagnetic Fields 1 or ELEN 3120 Electromagnetic Fields 2 may not take PHYS 4031 Electricity and Magnetism 1 or PHYS 4032 Electricity and Magnetism 2 to satisfy the physics minor requirements; both ELEN 3110 Electromagnetic Fields 1 or ELEN 3120 Electromagnetic Fields 2 count toward the upper-division PHYS course requirements. The Klingler College of Arts and Sciences Major and Minor Overlap policy (http://bulletin.marquette.edu/undergrad/helenwayklinglercollegeofartsandsciences/academicregulations/#majorsandminors) requires 9 unique credits, that is credits not used to satisfy requirements for a different major/minor, in order to earn a minor. Students should consult with the Engineering Academic Advising Center regarding degree and minor requirements.

ROTC Requirements for Engineering

Students are required to complete the requirements of their program as listed in the ROTC sections (http://bulletin.marquette.edu/undergrad/helenwayklinglercollegeofartsandsciences/reserveofficers_trainingcorps) of this bulletin. ROTC students are encouraged to schedule a meeting at the Engineering Academic Advising Center early in the first semester of their freshman year to prepare a course plan as required by their ROTC program.

AIR FORCE (AFROTC) - Minor in Air Force Aerospace Studies

All AFROTC students must complete all required courses as outlined in the bulletin for their specific engineering major as well as the courses required by the AFROTC program. Students in the AFROTC program may declare a minor in Air Force Aerospace Studies (AFAS).

ARMY (AROTC) - Minor in Military Science and Leadership

All AROTC students must complete all required courses as outlined in the bulletin for their specific engineering major as well as the courses required by the AROTC program. Students in the AROTC program may declare a minor in Military Science and Leadership (MISL).

NAVAL (NROTC) - Minor in Naval Science

All NROTC students must complete all required courses outlined in the bulletin for their specific engineering major as well as the courses required by the NROTC program. Students in the NROTC program may declare a minor in Naval Science (NASC). Students may be enrolled in either the Navy or Marine Option.

NASC 1022 Sea Power and Maritime Affairs

NASC 2185 Leadership and Management

NASC 3142 Naval Ship Systems 1 and NASC 3162 Naval Ship Systems 2 may count as engineering technical electives with approval. In the event a student elects to withdraw from the NROTC program, NASC 3142 Naval Ship Systems 1 and NASC 3162 Naval Ship Systems 2 will not qualify as technical electives in an engineering program. Electrical and Computer Engineering majors must satisfy breadth and depth elective requirements before NASC 3142 Naval Ship Systems 1 or NASC 3162 Naval Ship Systems 2 may be used as a technical elective.