Computer Engineering, BCO

The computer engineering major provides a solid foundation in electrical engineering fundamentals, as well as a comprehensive study of computer software and hardware systems. Through an ample elective program, students can customize their studies to their individual interests, emphasizing hardware engineering, software engineering or intelligent systems.

DEGREE REQUIREMENTS

All engineering students must successfully complete the curriculum prescribed in the Undergraduate Bulletin by the college at the time they are admitted or readmitted as degree candidates. This includes the requirements of the minimum number of degree hours earned, all required courses and an approved elective program, a C (2.000) average in all Marquette credits applied toward the degree, and a C (2.000) average in all Opus College of Engineering courses. Note: The BS in Biomedical Engineering requires a minimum 2.500 GPA in all Marquette work. The Engineering Leadership concentration requires a minimum 2.800 in all Marquette work. The BS in Biomedical Engineering requires a minimum 2.500 GPA in all Opus College of Engineering courses. The BS in Biomedical Engineering requires a minimum 2.500 GPA in all biomedical engineering major courses. A minimum of 60 credits must be taken at Marquette University. The final 30 credits must be taken at Marquette University or in an approved study abroad program unless given prior approval from the Office of the Provost. The 32 credit hours of upper division course work must be taken at Marquette University. At least 15 credit hours of course work in the major must be completed at Marquette University.

The following conditions apply under special circumstances:

1. If all degree credit is earned in continuous study in engineering at Marquette, the fulfillment of all degree requirements is normally straightforward. Students making an inter-college curriculum change have credits earned in a previous curriculum allocated to the new curriculum by the Office of Academic Affairs through consultations with the appropriate department chair or their designate.
2. Students who have interrupted their enrollment from the university are normally obliged to follow the curriculum in effect at the time of readmission or more directly they must complete the courses prescribed by their department at the time of readmission. Normally, this is defined in concert with the Director of Student Studies and Records in consultation with department chair or their designate. Policies and regulations that are in effect at the time of return apply to all students, regardless of the term of initial enrollment.
3. Transfer students coming into engineering degree programs have their previous credits evaluated and applied toward the specific engineering degree they are pursuing, at the time of admission.
4. Students may elect to repeat courses at Marquette using the Course Repeat (https://bulletin.marquette.edu/policies/repeated-courses/) policy. The repeated course grade is used in the computation of the GPA. The first grade is removed from the GPA. The original grade remains on the student’s record. Students must complete and submit a Request to Repeat an Undergraduate Course form. Note: For Opus College of Engineering students, the Course Repeat cannot be used more than five times throughout their career.
5. Credit/No Credit (CR/NC), Satisfactory/Unsatisfactory (S/U) grades do not affect the student’s GPAs, only degree hours earned. The same rule applies to credit added through Advanced Placement programs, Credit by Examination and CLEP exams.
6. Any variation from standard degree requirements must be accompanied by approved Curriculum Substitution and/or Allowance Request forms, which are available on the Engineering Academic Advising Center (http://www.marquette.edu/engineering/academic-advising-center/) website.

College GRADUATION REQUIREMENT

A degree of Bachelor of Science in Biomedical Engineering, Bachelor of Science in Civil Engineering, Bachelor of Science in Construction Engineering, Bachelor of Science in Computer Engineering, Bachelor of Science in Electrical Engineering or Bachelor of Science in Mechanical Engineering may be conferred on students who successfully complete the curriculum prescribed for the degree, and who have satisfied the following requirements:

1. The Opus College of Engineering graduates students three times each year (May, August, and December).
2. Students who plan to graduate must apply for a degree through the submission of an Application for Graduation no later than the deadline posted in the Academic Calendar (http://www.marquette.edu/calendar/).
3. Graduation requirements include:
   - It is the responsibility of students to know and fulfill all university and college requirements. Note: In addition, students are required to adhere to the following college graduation requirements.
     - Minimum of 128-134 earned credit hours, depending on the major chosen.
     - Minimum 2.000 GPA in all Marquette work. The BS in Biomedical Engineering requires a minimum 2.500 GPA in all Marquette work. The Engineering Leadership concentration requires a minimum 2.800 GPA in all Marquette work.
     - Minimum 2.000 GPA in all Opus College of Engineering courses. The BS in Biomedical Engineering requires a minimum 2.500 GPA in all Opus College of Engineering courses.
     - The BS in Biomedical Engineering requires a minimum 2.500 GPA in all biomedical engineering major courses.
     - Completion of all required courses and an approved elective program.
4. Students are cautioned to enter their last term with a clear understanding that they are satisfying all degree requirements. Students should view their Academic Advisement (AA) Graduation Checklist in CheckMarq. If any requirements appear as - Not Satisfied, the Engineering Academic Advising Center (http://www.marquette.edu/engineering/academic-advising-center/) may be consulted to resolve any concerns.

5. All curricular modifications must be accompanied by approved Curriculum Substitution and/or Allowance Request forms, which are available through the Engineering Academic Advising Center (http://www.marquette.edu/engineering/academic-advising-center/) website.

6. All degree requirements must be completed on schedule and according to deadlines established in the Academic Calendar. Incomplete grades and late exams delay graduation for at least one term.

7. A final check of students' degree requirements is made by the students' departments and the director of Student Studies and Records during the last term and students are notified if they fail to meet any requirements. However, this may be too late to adjust the term course load.

8. In addition, the Opus College of Engineering adheres to the University Commencement Policy (https://bulletin.marquette.edu/policies/commencement/).

**University Graduation Requirement**

**Undergraduate Graduation Policy**

Students are required to graduate at the end of the term in which all degree requirements are completed. Degree requirements are those requirements, including university, college and all other requirements necessary to earn a minimum of one undergraduate degree and any declared degrees/majors/minors/concentrations. That is, additional degrees/majors/minors/concentrations may be earned; however, they must be completed in the same term as the first degree/primary major is completed. Except in the case of readmission, undergraduate students must meet the graduation requirements which are stated in the Undergraduate Bulletin issued for the year in which they entered Marquette. Substitutions or waivers for specific courses required for degree completion may occur, as determined by the college and/or the Marquette Core Curriculum committee.

Students who have interrupted their enrollment from the university, are normally obliged to follow the degree/major/minor/concentration requirements in effect at the time of readmission. Policies that are in effect at the time of the return, apply to all students, regardless of the term of initial enrollment. Students are responsible for keeping themselves informed of the requirements which apply in their particular cases. Students have faculty advisers available who assist in planning and implementing their plan of studies; however, it is ultimately each student’s responsibility to know and fulfill the requirements for graduation specified for the selected plan. This should be done not only by utilization of specific advisers, but also with Academic Advisement, the university’s online degree audit tool on CheckMarq provided to all undergraduates. With Academic Advisement, students track their degree progress until graduation. It is the responsibility of students to immediately bring any discrepancies found in Academic Advisement to the attention of their college.

A candidate for a baccalaureate degree must meet the following graduation requirements:

1. In all undergraduate colleges and programs, a minimum of 120 credits earned and a cumulative grade point average of 2.000 is required for a Marquette undergraduate degree.

2. Credits required to be completed in residence at Marquette:
   a. A minimum of 45 total credits must be completed at Marquette. Up to 15 of the 45 credits may be completed through an approved study abroad program.
   b. A minimum of 32 upper-division credits must be completed at Marquette. This may include upper-division credits from an approved study abroad program.
   c. The final 30 credits needed to complete a Marquette undergraduate degree must be completed at Marquette, unless those credits are earned in an approved study abroad program, or are earned as part of a written/contractual agreement with another institution, in which Marquette students participate during the final year of their degree program.
   d. A minimum of one-half of credits in the major, minor, and concentration not attached to a major must be completed at Marquette.

3. Students must attend all courses, lectures, or any other exercises that are required, even though, in some cases such activities receive no recognition in terms of credit hours.

4. Students’ records must be cleared of all grades that are not permanent, i.e., grades of I, IC, IE and NG.

5. Students must file the online application for a degree by the deadline published in the Academic Calendar (https://www.marquette.edu/central/registrar/calendars-exams-schedules.php); however, because students are required to graduate at the end of the term in which all university, degree requirements are complete, the university reserves the right to graduate a student without a graduation application on file. If the university exercises this option, there is no guarantee students will be able to participate in Commencement.

6. Commencement is held in May, after the spring term. Participation in Commencement does not mean students are graduated. See the Commencement Policy (https://bulletin.marquette.edu/policies/commencement/) in this section for further details.

7. Exceptions to this Graduation Requirements policy must be approved by the Office of the Provost, except:
   - the course and bulletin year exceptions listed in the 'Graduation Requirements' section above (as approved by the college)
   - number 3 above (as approved by the college)
   - the dean’s office in the college where the student’s program resides may exempt up to 6 of the final 30 credits from being completed in residence (number 2c above)

For additional college requirements, consult the Degree Requirements listed for each undergraduate program in this bulletin.
Special Note for 2023-2024: Students who attended Cardinal Stritch University in a bachelor's degree program during the 2022-2023 year and directly transfer to a bachelor's degree program at Marquette University in Fall 2023 or Spring 2024 with fewer than 45 credits remaining in their Marquette program are exempted from the standard Marquette residency requirement (items 2-6 listed above). In lieu of the standard residency requirement, exempted students must complete all remaining credits for their undergraduate degree at Marquette. Exempted students are expected to remain continuously enrolled (fall and spring terms) at Marquette until the completion of their bachelor's degree.

Graduation Latin Honors
The grade point average is used to compute graduation Latin honors. The computation is made by dividing the total number of grade points earned at Marquette University by the total number of grade point hours earned. The official Marquette GPA of all students is calculated by the student information system and this GPA is not rounded up or down for any reason. To graduate with Latin honors, candidates must be pursuing their first bachelor's degree, earned at least 60 grade point hours and 60 degree hours at Marquette University, normally as a junior and senior. First bachelor's degree is defined as the first bachelor's degree earned from any institution. When students earn a concurrent additional bachelor's degree (i.e., finish in the same term as the first bachelor's degree), the additional degree is also eligible for Graduation Latin Honors, if the first bachelor's degree qualifies.

Graduates whose grade point average is 3.500, graduate with cum laude (Latin for 'with honor'); graduates whose grade point average is 3.700, graduate with magna cum laude (Latin for 'with great honor'); and graduates whose grade point average is 3.900, graduate with summa cum laude (Latin for 'with highest honor'). Graduation Latin honors are recorded on diplomas, noted in the published lists of graduates at Commencement and recorded on students' transcript.

Graduation Record
The academic record of students is frozen once the degree is posted and may not be altered thereafter, unless required to do so by law and/or a documented university error is discovered after the degree is posted. This includes, but is not limited to: all relevant grade point averages, grades, additional information relating to the degree(s), major(s), minor(s), concentration(s), Latin Honors and academic censure.

Marquette Core Curriculum (MCC) - 30 Credits

Foundation Tier - 15 Credits

<table>
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<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
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</thead>
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<td>ENGL 1001</td>
<td>Foundations in Rhetoric</td>
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<td>or HOPR 1955H</td>
<td>Core Honors First-Year Seminar</td>
<td></td>
</tr>
<tr>
<td>PHIL 1001</td>
<td>Foundations in Philosophy</td>
<td></td>
</tr>
<tr>
<td>or PHIL 1001H</td>
<td>Honors Foundations in Philosophy</td>
<td></td>
</tr>
<tr>
<td>THEO 1001</td>
<td>Foundations in Theology: Finding God in all Things</td>
<td></td>
</tr>
<tr>
<td>or THEO 1001H</td>
<td>Honors Foundations in Theology: Finding God in all Things</td>
<td></td>
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<tr>
<td>CORE 1929</td>
<td>Foundations in Methods of Inquiry</td>
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<td>or CORE 1929H</td>
<td>Honors Foundations in Methods of Inquiry</td>
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</tbody>
</table>

Engaging Social Systems and Values 1 (ESSV1) Course Options
Some faculty-led study abroad courses have also been approved for ESSV1, consult the MCC website (https://www.marquette.edu/core-curriculum/mcc-study-abroad.php) for a complete list.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>ANTH 1001</td>
<td>Being Human</td>
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<tr>
<td>EDUC 1001</td>
<td>Child and Adolescent Development and Learning</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 2020</td>
<td>Texts, Social Systems and Values</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 2030</td>
<td>Global Literatures</td>
<td>3</td>
</tr>
<tr>
<td>HEAL 1025</td>
<td>Culture and Health ¹</td>
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<tr>
<td>HIST 1101</td>
<td>Introduction to American History</td>
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<tr>
<td>HIST 1601</td>
<td>Difference and Democracy</td>
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<tr>
<td>HIST 1701</td>
<td>Engaging the World</td>
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<tr>
<td>HOPR 2956H</td>
<td>Honors Engaging Social Systems and Values 1: Engaging the City</td>
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<tr>
<td>INGS 1001</td>
<td>Introduction to Gender and Sexualities Studies</td>
<td>3</td>
</tr>
<tr>
<td>SOCI 1001</td>
<td>Principles of Sociology</td>
<td>3</td>
</tr>
<tr>
<td>SOWJ 1001</td>
<td>Introduction to Social Welfare and Justice</td>
<td>3</td>
</tr>
</tbody>
</table>
Discovery Tier - 12 Credits

Students must complete four Discovery Tier courses, all from the same Discovery Theme. These four courses must include one course from each of the three content areas (Humanities, Natural Science and Mathematics, and Social Science), and one elective (an additional course from any of the three content areas). A maximum of two courses in the Discovery Tier can be applied toward a primary major. Additional dual counting may be allowed towards college-level requirements.

Students declare their Discovery Theme using the Discovery Tier Declaration Form (https://www.marquette.edu/central/registrar/how-do-i-declare-change-mcc-discovery-tier-theme.php) in CheckMarq.

For students who participate in a full-time (12 credits or more) Marquette-approved study abroad program, one study abroad course (minimum 2.5 transfer credits awarded) may fulfill the elective requirement of the Discovery Tier. Any additional MCC requirements may be fulfilled only when the approved transfer equivalent is an exact match to a specific MCC course.

Discovery Themes

The five discovery theme options are listed below. See additional information and course listings (https://bulletin.marquette.edu/resources-opportunities/marquette-core-curriculum/#discoverythemestext).

- Basic Needs and Justice
- Cognition, Memory and Intelligence
- Crossing Boundaries: The Movement of People, Goods and Ideas
- Expanding Our Horizons
- Individuals and Communities

Culminating Course - 3 Credits

<table>
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<tr>
<td>CORE 4929</td>
<td>The Service of Faith and Promotion of Justice</td>
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<tr>
<td>or CORE 4929H</td>
<td>Honors Service of Faith and Promotion of Justice</td>
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</tbody>
</table>

ENGAGING SOCIAL SYSTEMS AND VALUES 2 (ESSV2) - ONE COURSE or Experience Required

Students must complete a course or approved experience that is designated “ESSV2.” This requirement can be completed via one of the four Discovery Tier courses or through other degree requirements.

Some faculty-led study abroad courses have also been approved for ESSV2, consult the MCC website (https://www.marquette.edu/core-curriculum/mcc-study-abroad.php) for a complete list.

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<td>ADPR 4750</td>
<td>Strategic Communication in a Culturally Diverse Marketplace</td>
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<td>ADVE 3986</td>
<td>Internship in Advertising</td>
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<td>ANTH 3100</td>
<td>Urban Anthropology</td>
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<td>ANTH 3986</td>
<td>Internship in Anthropology</td>
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<td>ANTH 4986</td>
<td>Advanced Internship in Anthropology</td>
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<td>ARBC 3200</td>
<td>Culture and Civilization of the Middle East (WRIT)</td>
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<td>ARBC 3220</td>
<td>Arab and Muslim Women in the United States (WRIT)</td>
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<td>ARSC 4953</td>
<td>Seminar In Urban Social Issues</td>
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<tr>
<td>BISC 3929</td>
<td>Reflective Analysis of Global Dental Brigade</td>
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<td>BISC 4460</td>
<td>Practical Cases in Medicine</td>
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<td>BULA 4001</td>
<td>Business Law for Accounting</td>
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<td>CCOM 4986</td>
<td>Corporate Communication Internship</td>
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<td>CHNS 3215</td>
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<td>Interpersonal Communication</td>
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<td>CNEN 3860</td>
<td>Construction Materials and Methods</td>
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<td>CRLS 2540</td>
<td>Surveillance, Law and Society</td>
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<td>CRLS 3150</td>
<td>Reentry and Life After Incarceration</td>
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<td>Policy and Practice for Children Impacted by Incarceration</td>
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<td>Internship and Seminar in Criminology and Law Studies</td>
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<td>ENGL 2001</td>
<td>Ways of Knowing (WRIT)</td>
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<td>Sociolinguistics</td>
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<td>ENGL 3249</td>
<td>Creativity and Community</td>
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<td>ENGL 3250</td>
<td>Life-Writing, Creativity and Community (WRIT)</td>
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<td>ENGL 3261</td>
<td>Poetry and Community (WRIT)</td>
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<td>ENGL 3780</td>
<td>Water Is Life: Indigenous Art and Activism in Changing Climates (WRIT)</td>
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<td>The Rhetoric of Martin Luther King, Jr. and Malcolm X (WRIT)</td>
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<td>The Rhetoric of Black Protest (WRIT)</td>
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<td>Writing Center Theory, Practice and Research (WRIT)</td>
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<td>Native American / Indigenous Literatures (WRIT)</td>
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<td>German Reunification: The Collision of Two Worlds</td>
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<td>Latinx Civil Rights Movements</td>
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<td>HIST 4135</td>
<td>African-American History</td>
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<td>HIST 4140</td>
<td>American Urban History</td>
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<td>Comparative Homefronts during the Second World War</td>
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<td>Introduction to Peace Studies</td>
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<td>Cultures and Foodways</td>
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<td>Linguistic Diversity and Social Justice</td>
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<td>Diversity in Organizations</td>
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<td>PHIL 3502</td>
<td>Narrating Freedom: Gender, Race and Mass Incarceration</td>
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PSYC 3201  Introductory Social Psychology  3
PSYC 3420  Health Psychology  3
PURE 3986  Internship in Public Relations  0-3
SOCI 3700  Social Movements, Protest and Change  3
SOCI 3986  Internship and Seminar in Sociology  3
SOCI 4986  Advanced Internship and Seminar in Sociology  3
SOWJ 3170  Policy and Practice for Children Impacted by Incarceration  3
SOWJ 3400  Advocacy and Social Change: Theory and Practice  3
SOWJ 3986  Internship in Social Welfare and Justice  3
SOWJ 4700  Global Aid and Humanitarianism  3
SOWJ 4986  Advanced Internship in Social Welfare and Justice  3
SPAN 3001  Advanced Communication in Spanish  3
SPAN 4150  Spanish in the United States  3
THAR 3620  Multicultural Playwrights  3
THAR 4986  Internship in Theatre Arts  0-3
THEO 2500  Theologies of Nonviolence  1  3
THEO 3250  Contemplation and Action  3
THEO 3350  Christian-Muslim Dialogue  3
THEO 3600  Theology Engaging Culture  3
THEO 4270  The Many Faces of U.S. Catholicism  3
THEO 4400  Christian Faith and Justice  1  3

 Honors (H) designation of same course number also fulfills MCC requirement.

**WRITING INTENSIVE COURSES (WRIT) - ONE COURSE REQUIRED**

Students must complete a course that is designated "WRIT." This requirement can be completed via one of their four Discovery Tier courses or through other degree requirements.

Some faculty-led study abroad courses have also been approved, consult the MCC website (https://www.marquette.edu/core-curriculum/mcc-study-abroad.php) for a complete list.

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Honors (H) designation of same course number also fulfills MCC requirements.

With PHTH 7974 Clinical Education Experience 1

With PHTH 7505 Patient/Client Management 3

**Grade Minimums & Additional Information**

- A grade of C or better is required in Honors MCC courses. A passing grade is required in non-Honors MCC courses.
- Review the Marquette Core Curriculum (https://bulletin.marquette.edu/resources-opportunities/marquette-core-curriculum/) section of the bulletin for additional information, including transfer student requirements and Discovery Theme details.

**Computer Engineering Major**

The Department of Electrical and Computer Engineering offers a curriculum leading to a bachelor of science degree in computer engineering. The computer engineering curriculum provides a solid foundation in computer software and hardware systems together with a solid background in electrical engineering. Through an ample elective program, students can customize their studies to their individual interests, emphasizing hardware engineering, software engineering or intelligent systems.

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Senior

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Total Credit Hours: 129

1. The four courses in the Discovery Tier (DSCV) of the MCC must be completed in the same theme and include the following content areas: Humanities (HUM), Social Science (SSC), Natural Science and Mathematics (NSM) and one elective (ELE), which is an additional course from any of the three content areas. A maximum of two courses in the Discovery Tier can apply towards a primary major.

2. Students must also complete the Writing Intensive (WRIT) and Engaging Social System and Values 2 (ESSV2) requirements of the MCC. These requirements can be fulfilled through designated courses in the Discovery Tier or other degree requirements.

3. At least five of the seven electives must be from the COEN areas of concentration. The remaining electives can be in any technical area. Of the five electives, one must be in the Hardware Engineering area, one must be in the Software Engineering area, and one must be in the Intelligent Systems area. Of the seven electives, three must be in one of the following areas: Hardware Engineering, Software Engineering, or Intelligent Systems. A course listed in two concentration areas may be counted toward only one elective requirement.

Areas of Concentration within Computer Engineering

The Computer Engineering curriculum has seven electives designated as COEN/TECH electives. At least five of these electives must be courses from the COEN areas of concentration. The remaining electives can be in any technical area. The student, in consultation with his or her adviser, must design the elective program to meet both a breadth requirement and a depth requirement. To meet the breadth requirement, one COEN elective must be in the Hardware area, a second COEN elective must be in the Software area and a third COEN elective must be in the Intelligent Systems area. To meet the depth requirement, a total of three electives must be in one of the following three areas: Hardware, Software and Intelligent Systems. These areas of concentration and the courses in each area are described below.

Hardware

Hardware includes the study of computer architectures, computer chip technology, peripheral devices, signal processing, interface design and the like. The following COEN elective courses are available in the Hardware area:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breadth or Depth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COEN 4730</td>
<td>Computer Architecture</td>
<td>3</td>
</tr>
<tr>
<td>EECE 4740</td>
<td>Advanced VHDL and FPGA Design</td>
<td>3</td>
</tr>
<tr>
<td>COEN 4790</td>
<td>Developments in Computer Hardware</td>
<td>3</td>
</tr>
<tr>
<td>EECE 4410</td>
<td>Introduction to Device Fabrication</td>
<td>3</td>
</tr>
<tr>
<td>Depth Only</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ELEN 3030</td>
<td>Analog Electronics</td>
<td>3</td>
</tr>
<tr>
<td>ELEN 3025 &amp; ELEN 3035</td>
<td>Electrical Instrumentation Laboratory and Electronics Projects Laboratory</td>
<td>4</td>
</tr>
<tr>
<td>EECE 4510</td>
<td>Digital Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>ELEN 4310</td>
<td>Control Systems</td>
<td>3</td>
</tr>
<tr>
<td>ELEN 4560</td>
<td>Introduction to Communication Systems</td>
<td>3</td>
</tr>
<tr>
<td>COSC 4290</td>
<td>Real-Time and Embedded Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

Software

Software emphasizes the design of software systems and includes concerns such as the user interface, expansibility and maintainability, efficiency in time and computing resources, software testing, security, etc. The following COEN elective courses are available in the Software area:
<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>COEN 4610</td>
<td>Object-Oriented Software Engineering</td>
<td>3</td>
</tr>
<tr>
<td>COEN 4620</td>
<td>Modern Programming Practices</td>
<td>3</td>
</tr>
<tr>
<td>COEN 4630</td>
<td>Software Testing</td>
<td>3</td>
</tr>
<tr>
<td>COEN 4650</td>
<td>Introduction to Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>COEN 4690</td>
<td>Developments in Computer Software</td>
<td>3</td>
</tr>
<tr>
<td>COEN 4830</td>
<td>Introduction to Computer Graphics</td>
<td>3</td>
</tr>
<tr>
<td>COEN 4840</td>
<td>Computer Security</td>
<td>3</td>
</tr>
<tr>
<td>COSC 3410</td>
<td>Programming Languages</td>
<td>3</td>
</tr>
<tr>
<td>COSC 3550</td>
<td>Programming Computer Games</td>
<td>3</td>
</tr>
<tr>
<td>COSC 4300</td>
<td>Network Design and Security</td>
<td>3</td>
</tr>
<tr>
<td>COSC 4400</td>
<td>Compiler Construction</td>
<td>3</td>
</tr>
<tr>
<td>COSC 4800</td>
<td>Principles of Database Systems</td>
<td>3</td>
</tr>
<tr>
<td>COSC 4860</td>
<td>Component-Based Software Construction</td>
<td>3</td>
</tr>
</tbody>
</table>

**Intelligent Systems**

Intelligent Systems includes the study of artificial intelligence, neural networks, evolutionary computing, design of algorithms, and computer security models. Students wishing to concentrate in this area are encouraged to take ELEN 3020 as one of their non-COEN electives. The following COEN elective courses are available in the Intelligent Systems area:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>COEN 4650</td>
<td>Introduction to Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>COEN 4850</td>
<td>Introduction to Intelligent Systems</td>
<td>3</td>
</tr>
<tr>
<td>or COSC 4600</td>
<td>Fundamentals of Artificial Intelligence</td>
<td></td>
</tr>
<tr>
<td>COEN 4860</td>
<td>Introduction to Neural Networks and Fuzzy Systems</td>
<td>3</td>
</tr>
<tr>
<td>COEN 4870</td>
<td>Evolutionary Computation</td>
<td>3</td>
</tr>
<tr>
<td>EECE 4520</td>
<td>Digital Image Processing</td>
<td>3</td>
</tr>
<tr>
<td>COEN 4840</td>
<td>Computer Security</td>
<td>3</td>
</tr>
<tr>
<td>COSC 3550</td>
<td>Programming Computer Games</td>
<td>3</td>
</tr>
<tr>
<td>COSC 4610</td>
<td>Data Mining</td>
<td>3</td>
</tr>
</tbody>
</table>

**Preparing for Graduate Study**

The COEN curriculum provides an excellent foundation for students wishing to pursue graduate studies in most computer engineering, computer science, and electrical engineering graduate programs.

**University Policies**

- [Academic Advising](https://bulletin.marquette.edu/policies/academic-advising/)
- [Academic Censure - Undergraduate](https://bulletin.marquette.edu/policies/academic-censure/undergraduate/)
- [Academic Integrity](https://bulletin.marquette.edu/policies/academic-integrity/)
- [Academic Misconduct](https://bulletin.marquette.edu/policies/academic-misconduct-policy/)
- [Academic Program Definitions](https://bulletin.marquette.edu/policies/academic-programs-defined/)
- [Academic Standing](https://bulletin.marquette.edu/policies/academic-standing/)
- [Accelerated Degree Programs](https://bulletin.marquette.edu/policies/accelerated-degree-programs/)
- [Advanced Standing Credit - Undergraduate](https://bulletin.marquette.edu/policies/advanced-standing-undergraduate/)
- [Attendance - Undergraduate](https://bulletin.marquette.edu/policies/attendance/undergraduate/)
- [Audit - Undergraduate](https://bulletin.marquette.edu/policies/audit/)
- [Awarding Diplomas and Certificates](https://bulletin.marquette.edu/policies/awarding-diplomas-certificates/)
- [Background Checks, Drug Testing](https://bulletin.marquette.edu/policies/background-checks-drug-testing/)
- [Class Rank](https://bulletin.marquette.edu/policies/class-rank/)
College of Engineering Policies

- Absence from Final Exams, Incomplete (I) Grade (https://bulletin.marquette.edu/engineering/policies/absence-finals-incomplete-grade/)
- Academic Dismissal/Probation/College Academic Alert (CAA) (https://bulletin.marquette.edu/engineering/policies/dismissal-probation-college-alert/)
- Academic Integrity (https://bulletin.marquette.edu/engineering/policies/academic-integrity/)
- Academic Load (https://bulletin.marquette.edu/engineering/policies/academic-load/)
- Accreditation (https://bulletin.marquette.edu/engineering/policies/accreditation/)
- Admission Requirements (https://bulletin.marquette.edu/engineering/policies/admission-requirements/)
- Articulation Agreements (https://bulletin.marquette.edu/engineering/policies/articulation-agreements/)
- Course and Grade Limitations (https://bulletin.marquette.edu/engineering/policies/course-grade-limitations/)
- Credit/No Credit (CR/NC) Grading Option (https://bulletin.marquette.edu/engineering/policies/credit-no-credit-grading-option/)
- Curriculum Substitution and/or Allowance Petition (https://bulletin.marquette.edu/engineering/policies/curriculum-substitution-allowance-petition/)
- Dean's List (https://bulletin.marquette.edu/engineering/policies/deans-list/)
- Degrees Offered (https://bulletin.marquette.edu/engineering/policies/degrees-offered/)
- Electives (https://bulletin.marquette.edu/engineering/policies/electives/)
- Grade Appeals for Engineering Courses (https://bulletin.marquette.edu/engineering/policies/grade-appeals-engineering-courses/)
- Repeating Courses (https://bulletin.marquette.edu/engineering/policies/repeating-courses/)
- Simultaneous Enrollment in Two Academic Programs (https://bulletin.marquette.edu/engineering/policies/simultaneous-enrollment-two-academic-programs/)
- Transfer Credit from Other Programs (https://bulletin.marquette.edu/engineering/policies/transfer-credit-programs/)
- Undergraduate Independent Study (https://bulletin.marquette.edu/engineering/policies/undergraduate-independent-study/)