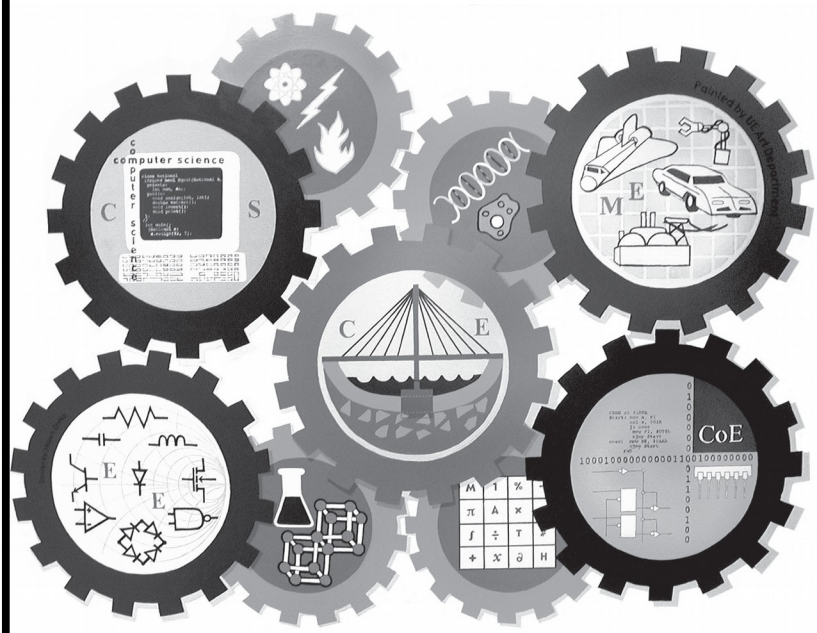
2020-2021




# Computer Engineering

## Guide Book

University of Evansville

COMPUTER ENGINEERING
PROGRAM GUIDE BOOK
2020-2021

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ABET Engineering Accreditation Commission

The computer engineering program at the University of Evanville is accredited by the Engineering Accreditation Commission of ABET, www.abet.org.

Revised August 2020

# Program Objectives

The Computer Engineering program has the following Educational Objectives and Student Outcomes:

**Objective 1:** *Graduates will be engaged in a professional career and continued or advanced study in their chosen field. This implies that graduates will recognize the value and necessity of lifelong learning.*

- **Outcome 1a.** Students will have an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics. (ABET EAC Outcome 1)
- **Outcome 1b.** Students will have an ability to acquire and apply new knowledge as needed, using appropriate learning strategies. (ABET EAC Outcome 7)

**Objective 2:** *Graduates will be engaged in applications of problem solving and communication skills for a wide variety of problems in engineering or computer science, either as individuals or in teams.*

- **Outcome 2a.** Students will have an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives. (ABET EAC Outcome 5)
- **Outcome 2b.** Students will have an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. (ABET EAC Outcome 2)
- **Outcome 2c.** Students will have an ability to communicate effectively with a range of audiences. (ABET EAC Outcome 3)
- **Outcome 2d.** Students will have an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions. (ABET EAC Outcome 6)

**Objective 3:** *Graduates will be active participants in a local, national, or global engineering or computer science community.*

- **Outcome 3a.** Students will have an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. (ABET EAC Outcome 4)

# Plan of Study – Standard

**Bachelor of Science in Computer Engineering**

| FALL | | | | SPRING | | | |
|---|---|---|---|---|---|---|---|
| **FRESHMAN** | | | | | | | |
| CHEM | 118 | Prin. of Chemistry | 4 | CS | 210 | Fund. of Prog. I | 3 |
| ENGR | 101 | Intro to Engineering | 3 | MATH | 222 | Calculus II | 4 |
| FYS | 112 | First Year Seminar | 3 | PHYS | 210 | Calculus Physics I | 4 |
| MATH | 221 | Calculus I | 4 | | | General Education | 3 |
| | | Foreign Lang. 111* | 3 | | | Foreign Lang. 112* | 3 |
| | | | 17 | | | | 17 |
| **SOPHOMORE** | | | | | | | |
| CS | 215 | Fund. Of Prog II | 3 | CS | 290 | Obj Oriented Design | 3 |
| EE | 210 | Circuits | 3 | EE | 215 | Circuits & Systems | 3 |
| MATH | 324 | Diff. Equations | 3 | EE | 254 | Logic Design | 3 |
| PHYS | 211 | Calculus Physics II | 4 | EE | 342 | Electronics I | 3 |
| | | General Education | 3 | MATH | 323 | Calculus III | 4 |
| | | | 16 | | | | 16 |
| **JUNIOR** | | | | | | | |
| EE | 310 | Linear Systems | 3 | CS | 315 | Algor & Data Struct | 3 |
| EE | 354 | Digital System | 3 | CS | 320 | Comp. Architecture | 3 |
| EE | 356 | Small Comp. Soft. | 3 | or CS | 470 | Operating Systems | |
| or CS | 475 | Networks | | EE | 360 | Control Systems | 3 |
| ENGR | 390 | Engineering Math. | 3 | EE | 380 | Intermediate EE Lab | 2 |
| MATH | 370 | Discrete Math. | 3 | EE | 454 | Micro. Applications | 3 |
| | | General Education | 3 | EE | 458 | Embedded Systems | 3 |
| | | | | or | | General Education | |
| | | | | EE/CS | 494 | Senior Project Sem. | 0 |
| | | | 18 | | | | 17 |
| **SENIOR** | | | | | | | |
| EE | 356 | Small Comp. Soft. | 3 | CS | 320 | Comp. Architecture | 3 |
| or CS | 475 | Networks | | or CS | 470 | Operating Systems | |
| EE/CS | 495 | Senior Project I | 3 | EE/CS | 497 | Senior Project II | 3 |
| | | EE/CS Elective | 3 | | | CoE Elective | 3 |
| | | CoE Elective | 3 | | | CoE Elective | 3 |
| | | General Education | 3 | EE | 458 | Embedded Systems | 3 |
| | | Health Elective | 1 | or | | General Education | |
| | | | | | | General Education | 3 |
| | | | 16 | | | | 18 |

**Figure 1: Four-year Degree Plan for a BSCoE Degree**

* Only if necessary to meet University foreign language requirement.

# Electives

The electives in the computer engineering program can be classified into two categories: computer engineering electives and general education electives. There are restrictions on which courses can be taken in each category.

**Computer Engineering Electives**

There are four computer engineering electives in the program taken during the senior year. These four electives must be chosen from the following courses in consultation with a computer engineering advisor. In addition, at least one of the following courses must be included in the four electives chosen: CS 380, EE 311, EE 343.

**Electrical Engineering Courses**

| Course | Title |
|---|---|
| EE 311 | Linear Systems and DSP II |
| EE 343 | Electronics II |
| EE 410 | Analog Circuit Synthesis |
| EE 456 | Small Computer System Design |
| EE 458 | Embedded Systems and Real-Time Programming |
| EE 465 | Digital Control Systems |

**Computer Science Courses**

| Course | Title |
|---|---|
| CS 350 | Computer/Human Interaction |
| CS 355 | Computer Graphics |
| CS 375 | UNIX System Programming |
| CS 380 | Programming Languages |
| CS 381 | Formal Languages |
| CS 430 | Artificial Intelligence |
| CS 472 | Concurrent and Parallel Programming |
| CS 473 | Mobile Application Development |

It is important in choosing these three electives that the student gain additional depth in an area of computer engineering and get some additional design experience. The electives can be grouped into the following areas of specialization:

**Hardware Systems**

EE 311 Linear Systems and DSP II
EE 343 Electronics II or EE 410 Analog Circuit Synthesis
EE 465 Digital Control Systems

**Software Topics**

CS 375 UNIX System Programming
CS 480 Compilers

**Advanced Computer Science Topics**
CS 350 Computer/Human Interaction
CS 355 Computer Graphics
CS 430 Artificial Intelligence

**Small Real-Time Systems**
EE 343 Electronics II
EE 456 Small Computer System Design

**If you are going to graduate school**
EE 311 Linear Systems and DSP II
CS 381 Formal Languages
CS 473 Mobile Application Development

Students who wish to take an elective outside the areas of specialization must do so in consultation with their computer engineering advisor.

**General Education Electives**

The general education program has the following outcomes:

1. Critical reading and thinking – 3 hours
2. Engagement with imaginative expressions of the human condition – 3 hours
3. Knowledge of human history and the historical context of knowledge – 3 hours
4. Engagement with fundamental beliefs about human identity, core values, and humankind's place in the world – 3 hours
5. Understanding of human aesthetic creation and artistic creativity – 3 hours
6. Linguistic and cultural competence in a language other than one's own – 3 hours
7. Quantitative literacy – 3 hours
8. Scientific literacy – 7 hours
9. Understanding of core concepts of society, human behavior and civic knowledge – 6 hours
10. Knowledge and responsibility in relation to health and wellness – 1 hour
11. Ability to think critically and communicate effectively, orally and in writing/capstone – 3 hours

Outcome 1, critical reading and thinking, is met by taking First Year Seminar 112. Students who do not meet the writing entrance requirements must take First Year Seminar 111 as a prerequisite to First Year Seminar 112.

Outcome 6, linguistic and cultural competence in a language other than one's own, may be met with a foreign language competency test. Students who have successfully completed two years of foreign language their final two

years in high school can, in general, meet this requirement by passing the competency test.

Outcome 7, quantitative literacy, and outcome 8, scientific literacy, are met automatically by the math and science requirement for a degree in engineering or computer science.

Outcome 11, ability to think critically and communicate effectively, orally and in writing/capstone, is met by taking Electrical Engineering 495, the electrical and computer engineering senior design project.

In addition to taking courses to meet the outcomes above, students must complete the writing overlay requirement, which consists of four courses. In computer engineering these are FYS 112, EE 495, EE 497, and one additional writing course that may also satisfy one of the outcomes. Outcomes 2, 3, and 5 have courses that satisfy the writing overlay requirement. Students should meet with an advisor and carefully choose courses in these outcomes to meet the writing overlay.

A complete list of courses that meet the general education and writing overlay requirements is available online at www.evansville.edu/registrar.

**Engineering Management Minor**

A minor in engineering management is offered by the College of Engineering and Computer Science in cooperation with the Schroeder School of Business. For electrical and computer engineering students, the engineering management minor can be earned by taking the following courses.

*Engineering Management Minor (18 hours)*

| | |
|---|---|
| ECON 101 | Principles of Macroeconomics |
| or | |
| ECON 102 | Principles of Microeconomics |
| ENGR 390 | Applied Engineering Mathematics |
| ENGR 409 | Engineering Economy and Decision Making |
| COMM 380 | Intercultural Communication |
| or | |
| ID 150 | The American Corporation |
| MGT 310 | Production/Operations Management |
| MGT 331 | International Business Strategy |
| or | |
| MGT 377 | Organizational Behavior |

All computer engineering students pursuing this minor should see an advisor to carefully choose courses which also meet general education requirements.

With careful curriculum planning, computer engineering students can earn an engineering management minor by taking just three additional courses.

**Mathematics Minor**

To obtain a minor in mathematics from the College of Arts and Sciences students must take MATH 221, MATH 222 and four mathematics courses numbered 300 or above (including ENGR 390 and PHYS 305). Students who satisfy the Computer Engineering degree requirements automatically satisfy the requirements for the minor in mathematics.

**Computer Science Minor**

A minor in computer science is offered by the College of Engineering and Computer Science. Computer engineering students can earn a computer science minor by taking the following courses:

ENGR 123 Programming for Engineers
or
CS210 Fundamentals of Programming I

CS220 Logic Design and Machine Organization
or
EE 254 Logic Design

CS 215 Fundamentals of Programming II
CS 290 Object Oriented Design
Plus 9 hours of 300 or 400 level CS courses

Computer engineering students automatically satisfy the requirements for the minor in computer science.

# Co-op Program

Computer engineering majors are encouraged to participate in cooperative education (the co-op program). In this program, a student completes the BSCoE degree requirements in five years, but at the end of that time, the student has a BSCoE plus four terms of industrial experience as a computer engineer.

The typical computer engineering co-op student goes to school the first two and at the end of the sophomore year, the co-op student goes to work and works through the summer. The student is back in school in the fall and out to work in the spring. Thereafter, the student alternates between work and school.

| CO-OP PLAN | | | |
|---|---|---|---|
| **Year** | **Fall** | **Spring** | **Summer** |
| 1 | School 1 | School 2 | Work Option |
| 2 | School 3 | School 4 | Work 1 |
| 3 | School 5 | Work 2 | School/Work Option |
| 4 | Work 3 | School 6 | Work 4 |
| 5 | School 7 | School 8 | |

Some students who are exceptionally well-prepared to enter the work force may begin their co-op period in the summer after the freshman year. This is unusual, and most students begin after the sophomore year. The summer after the junior year may be either school or work as needed. Many students work through this summer, thereby completing a full calendar year on the job.

To enter the co-op program, students should enroll in Experiential Education 90. This is a noncredit course which should be taken during the fall of the sophomore year. This course covers such topics as resume writing, interviewing, and what is expected on the job. During the spring of the sophomore year, the typical co-op student interviews with prospective employers. The career placement office takes care of contacting employers and arranging interviews for students. Actual placement in a co-op position is dependent on the outcome of the interview process.

Co-op students in computer engineering have a wide range of employers to choose from. Employers are located in the immediate Evansville area, in the surrounding region of Indiana, Kentucky, and Illinois, and in various places throughout the country. The companies listed below are some of the companies that have employed computer engineering co-op students in the past. If a student wants to work for a company with which we do not presently have a co-op program, the Center for Career Development will contact that company and attempt to establish a program. The requirement to qualify as a legitimate co-op employer is that the company provides a computer engineering opportunity for a prospective engineer that is relevant to the student's education and chosen profession.

| | | |
|---|---|---|
| Intel Corporation | General Electric | Boeing |
| Whirlpool Corporation | NWSC Crane | Wright-Patterson AFB |
| Vectren Energy Delivery | Alcoa | Toyota |

The real value of the co-op program is in the experience that it provides the student. A co-op job can be a financial benefit, but one term at work does not typically cover the cost of one term of education. The co-op program gives employers a chance to look at a student as a prospective employee without making a commitment to long-term employment. Likewise, the co-op

program gives the student a chance to look at a company and gain some experience before entering the work force as a working professional.

Co-op students normally get a higher salary offer upon graduation than do non-co-op students. In many cases the co-op employer provides a long-term employment opportunity for the co-op student upon graduation. About 25 percent of computer engineering students participate in the co-op program.

# Harlaxton College Option

The University of Evansville's Harlaxton College is located just outside of Grantham, England, in the rolling English countryside. Harlaxton is about a one-hour ride by train from London. Engineering students who choose to spend a semester studying at Harlaxton have easy access to England's culture, history, and entertainment.

Harlaxton is housed in a large Victorian manor house where about 300 students and faculty members live and hold classes. The manor house has a state dining room, a library, and a number of historic state rooms where classes are held. A soccer field, sports hall, student lounges, bistro, and tennis courts are also available on the grounds.

Engineering students who wish to study one semester in England are encouraged to do so during the first semester of their sophomore year. At Harlaxton, engineering students typically take calculus, British studies, and general education classes. Harlaxton is on the semester system and all classes earn credit at UE in the same way they would if they were taken in Evansville. Since the engineering program requires a number of general education classes, all classes taken at Harlaxton count as required courses toward the engineering degree. Tuition at Harlaxton is the same as tuition at the UE Evansville campus, and all scholarships and loans may be applied to Harlaxton costs.

Students at Harlaxton College are encouraged to travel on weekends. The college arranges eight to 10 weekend field trips to locations such as Stonehenge, Nottingham, London, and Scotland. During some semesters, less frequent but longer trips are arranged to Ireland and the continent.

Harlaxton College has its own resident British faculty as well as visiting faculty from the home campus and other selected universities in the United States. Likewise, students at Harlaxton come from the Evansville campus, England, and various other campuses around the United States.

# Plan of Study – Harlaxton Option

**Bachelor of Science in Computer Engineering**

| FALL | | | | SPRING | | | |
|---|---|---|---|---|---|---|---|
| | | | FRESHMAN | | | | |
| CHEM | 118 | Prin. of Chemistry | 4 | CS | 210 | Fund. of Prog. I | 3 |
| ENGR | 101 | Intro to Engineering | 3 | EE | 210 | Circuits | 3 |
| FYS | 112 | First Year Seminar | 3 | MATH | 222 | Calculus II | 4 |
| MATH | 221 | Calculus I | 4 | | | General Education | 3 |
| | | Foreign Lang. 111* | 3 | | | Foreign Lang. 112* | 3 |
| | | | 17 | | | | 17 |
| | | | SOPHOMORE | | | | |
| ID | H282 | British Studies I | 3 | CS | 215 | Fund of Prog II | 3 |
| ID | H283 | British Studies 2 | 3 | EE | 215 | Circuits & Systems | 3 |
| MATH | 324 | Diff. Equations | 3 | EE | 254 | Logic Design | 3 |
| | | General Education | 3 | EE | 342 | Electronics I | 3 |
| | | General Education | 3 | MATH | 323 | Calculus III | 4 |
| | | Health and Wellness | 1 | | | | |
| | | | 16 | | | | 16 |
| | | | JUNIOR | | | | |
| CS | 290 | Obj Oriented Design | 3 | CS | 315 | Algor & Data Struct | 3 |
| | | | | or EE | 458 | Real-Time OS | |
| EE | 310 | Linear Systems | 3 | CS | 320 | Comp. Architecture | 3 |
| EE | 354 | Digital System | 3 | or CS | 470 | Operating Systems | |
| EE | 356 | Small Comp. Soft. | 3 | EE | 360 | Control Systems | 3 |
| or CS | 475 | Networks | | EE | 380 | Intermediate EE Lab | 2 |
| MATH | 370 | Discrete Math. | 3 | EE | 454 | Micro. Applications | 3 |
| | | General Education | 3 | EE/CS | 494 | Senior Project Sem. | 0 |
| | | | | PHYS | 210 | Calculus Physics I | 4 |
| | | | 18 | | | | 18 |
| | | | SENIOR | | | | |
| EE | 356 | Small Comp. Soft. | 3 | CS | 315 | Algor & Data Struct | 3 |
| or CS | 475 | Networks | | or EE | 458 | Real-Time OS | |
| EE/CS | 495 | Senior Project I | 3 | CS | 320 | Comp. Architecture | 3 |
| | | | | or CS | 470 | Operating Systems | |
| ENGR | 390 | Engineering Math | 3 | EE/CS | 497 | Senior Project II | 3 |
| PHYS | 211 | Calculus Physics II | 4 | | | CoE Elective | 3 |
| | | EE/CS Elective | 3 | | | CoE Elective | 3 |
| | | | | | | CoE Elective | 3 |
| | | | 16 | | | | 18 |

**Figure 2: Four-year Degree Plan for a BSCoE Degree - Harlaxton**

* Only if necessary to meet University foreign language requirement.

Figure 2 shows a typical four-year degree plan in which an computer engineering student can take the fall semester of the sophomore year at Harlaxton College.

**Harlaxton College Costs**

While the tuition at Harlaxton is the same as on the UE Evansville campus and all scholarships apply to Harlaxton, there are additional costs, namely those of travel. The typical airplane round-trip is about $1,500, and the typical student at Harlaxton College will spend an additional $4,000 on weekend trips, souvenirs, and other miscellaneous expenses.

# Honors Program

The Honors Program is open to selected students. Typically students apply when admitted to the University, but also may apply during the first year of study. Admittance to the Honors Program is determined by the University Honors Committee on the basis of standardized test scores, high school grade point average, extracurricular activities, and an essay. The Honors Program provides participants with the opportunity to interact with other Honors Program students both socially and academically. Special honors courses and other academic events are available for honors students. Honors students are able to register early, live in the honors residence hall, and receive a University Honors designation on official transcript.

To successfully complete the Honors Program, a student must fulfill the following requirements.

- Achieve a GPA of 3.5 or above by the time of graduation
- Complete 15 credit hours of honors courses
- Complete an honors project
- Earn 4 honors participation points per semester

Honors courses are designated as such by the registrar. In addition, a limited number of courses may be contracted formally as honors courses, generally requiring additional or alternative course work. A sufficiently complex computer science senior project can be approved as an honors project. Often these projects are more research-oriented than the typical senior project.

Honors participation points are earned by attending Honors Program activities. Each semester a major event is held that is worth 3 honors participation points. Currently the fall event is a formal banquet and the spring event is a Nerd Wars Trivia night. In addition, 6-8 smaller events are organized that are worth 1 honors participation point each. These events include group attendance at athletic events, theater and music performances, other academic or social events, and Honors Project presentations. Students

studying at Harlaxton College or other study abroad programs are granted the 4 honors participation points for that semester automatically in recognition of the study abroad experience.

**Alternative Courses** (points vary)

Alternative honors courses include courses taken for independent study and contract courses. A contract course is a non-honors course in which a contract is written requiring additional or alternative course work. The contract must be approved by the instructor, the department chair, and the honors director.

**Honors Activities** (points vary)

Students may receive honors program points for activities other than traditional course work. These might include a summer research experience for undergraduates (REU) program, an internal research project, a paper or poster presentation, a summer internship, completion of the co-op program, participation in an IEEE or ACM sponsored contest, participation in community projects, or a leadership role in a student professional organization.

# Undergraduate Research

There are numerous opportunities to conduct undergraduate research. All students are encouraged to participate in at least one undergraduate research project during their four years at UE. Students who have an interest in graduate school are strongly encouraged to participate in multiple programs. Some of the undergraduate research opportunities available to students studying electrical or computer engineering or computer science are described below.

**NSF Sponsored Research Experience for Undergraduates (REU)**

This program is sponsored by the National Science Foundation. It allows undergraduates to participate in research projects at major research institutions across the country. Participating students typically have a B+ or better grade point average and have achieved junior status. Most REUs provide a stipend (about $2,000 to $3,000 for 10 weeks) and some provide a housing or moving allowance. All REUs take place during the summer. For more information see the website at www.nsf.gov/crssprgm/reu/ index.jsp.

**UE Sponsored Undergraduate Research**

The University of Evansville also sponsors summer research projects which typically provide a housing allowance or a stipend. Almost all academic areas participate in these projects which are awarded to students on a

competitive basis. All result in a student publication or presentation at a national or regional conference.

**Special Topics and Independent Study**

Many professors are willing to sponsor research projects during the school year. Students typically register for Electrical Engineering 498 or Computer Science 498 and receive 1 to 3 hours of credit for such study.

**National Competition Projects**

The Department of Electrical Engineering and Computer Science participates in several regional and national competitions, and all students in the department (including freshmen) are eligible to participate in these projects. The southeast region of the Institute of Electrical and Electronics Engineers sponsors a robot competition each year. This is a team project and is usually completed as part of the senior design. Trinity University in Connecticut sponsors a national firefighting robot competition in which a robot must find its way through a maze, locate a candle, and extinguish it. More recently the department has begun competing in a robotic football competition that takes place at Notre Dame.

# Faculty and Staff

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# Electrical Engineering Courses

**EE 210 Circuits** (3) Prereq: MATH 222. Coreq: MATH 323. Fall, spring.

**EE 215 Circuits and Systems** (3) Prereq: EE 210. Coreq: MATH 324. Spring, summer.

**EE 224 Electrical Engineering Programming Lab** (2) Prereq: EE 210, ENGR 123 or CS 210

**EE 254 Logic Design** (3) Prereq: None. Spring.

**EE 310 Linear Systems and DSP I** (3) Prereq: EE 215, MATH 324. Fall.

**EE 311 Linear Systems and DSP II** (3) Prereq: EE 310. Spring.

**EE 320 Engineering Electromagnetics** (3) Prereq: EE 215, MATH 323, Physics 211. Fall.

**EE 330 Introduction to Power Systems** (3) Prereq: EE 215.

**EE 342 Electronics I** (3) Prereq: EE 210. Coreq: EE 254. Fall.

**EE 343 Electronics II** (3) Prereq: EE 215, EE 342. Spring.

**EE 354 Digital Systems** (3) Prereq: EE 254, ENGR 123 or CS 210. Fall.

**EE 356 Small Computer Software** (3) Prereq: ENGR 123 or CS 210, EE 254 or CS 220. Fall.

**EE 360 Linear Control Systems** (3) Prereq: EE 310. Spring.

**EE 380 Intermediate Electrical Projects Lab** (2) Prereq: EE 310, EE 342, EE 354. Spring.

**EE 410 Analog Circuit Synthesis** (3) Prereq: EE 310, EE 343.

**EE 415 Digital Image Processing** (3) Prereq: EE 310.

**EE 421 Photonics I** (3) Prereq: EE 215. Coreq: EE 320. Spring.

**EE 422 Photonics II** (3) Prereq: EE 421.

**EE 425 Lines Waves and Antennas** (3) Prereq: EE 320.

**EE 430 Energy Conversion Systems** (3) Prereq: EE 210, MATH 222.

**EE 432 Analysis of Power Systems** (3) Prerequisite: EE 330 or EE 430.

**EE 437 Power System Planning** (3) Prereq: EE 330.

**EE 438 Electric Power Quality** (3) Prereq: None.

**EE 440 Communication Electronics** (3) Prereq: EE 320, EE 470. Fall.

**EE 445 Industrial Electronics and Controls** (3) Prereq: EE 342.

**EE 454 Microcontroller Applications** (3) Prereq: EE 354. Spring.

**EE 456 Small Computer System Design** (3) Prereq: EE 354, EE 454.

**EE 458 Embedded Systems and Real-Time Programming** (3) Prereq: CS 215 or EE 354. Spring.

**EE 465 Digital Control Systems** (3) Prereq: EE 360.

**EE 470 Analog and Digital Comm. Theory** (3) Prereq: EE 310. Fall.

**EE 471 Wireless Comm Theory** (3) Prereq: EE 470. Spring.

**EE 494 Senior Project Seminar** (0) Prereq: 12 hours of 300-level electrical engineering courses. Spring.

**EE 495 Senior Project Phase 1** (3) Prereq: EE 380, EE 494, GPA of at least 2.0. Fall, spring.

**EE 497 Senior Project Phase 2** (3) Prereq: EE 495. Fall, spring.

**EE 498 Independent Study in Electrical Engineering** (variable credit) Requires faculty sponsor and approved detailed study plan.

**EE 499 Special Topics in Electrical Engineering** (1-3) Prerequisites will be announced when scheduled.

# Computer Science Courses

**CS 101 Introduction to Computer Science** (3) Fall.

**CS 210 Fundamentals of Programming I** (3) Prereq: None. Fall, spring.

**CS 215 Fundamentals of Programming II** (3) Prereq: CS 210. Fall, spring.

**CS 220 Logic Design and Machine Organization** (3) Prereq: None. Spring.

**CS 290 Object-Oriented Design** (3) Prereq: CS 215. Spring.

**CS 310 Puzzle Programming** (1) Prereq: CS 215. Fall.

**CS 315 Algorithms and Data Structures** (3) Prereq: CS 215, MATH 370. Spring.

**CS 320 Computer Architecture** (3) Prereq: CS 210, CS 220 or EE 254. Spring.

**CS 350 Computer/Human Interaction** (3) Prereq: CS 215.

**CS 355 Computer Graphics** (3) Prereq: CS 215, MATH 323.

**CS 375 UNIX System Programming** (3) Prereq: CS 215.

**CS 376 Small Computer Software** (3) Prereq: ENGR 123 or CS 210, EE 254 or CS 220. Fall.

**CS 380 Programming Languages** (3) Prereq: CS 215. Fall.

**CS 381 Formal Languages** (3) Prereq: CS 210, MATH 370. Fall.

**CS 390 Software Engineering** (3) Prereq: CS 215. Recom: CS 290. Fall.

**CS 391 Software Engineering II** (3) Prereq: CS 390. Spring.

**CS 415 Cryptography** (3) Prereq: CS 215, MATH 370.

**CS 430 Artificial Intelligence** (3) Prereq: CS 215. Recom: CS 315, CS 380.

**CS 440 Databases** (3) Prereq: CS 215, MATH 222.

**CS 455 Advanced Graphics** (3) Prereq: CS 355.

**CS 470 Operating Systems** (3) Prereq: CS 215. Recom: CS 320. Spring.

**CS 472 Concurrent and Parallel Programming** (3) Prereq: CS 470

**CS 473 Mobile Application Development** (3) Prereq: CS 215. Recom: CS 290

**CS 475 Networks** (3) Prereq: CS 215, MATH 222.

**CS 478 Embedded Systems and Real-Time Programming** (3) Prereq: EE 354 or CS 215. Spring.

**CS 494 Senior Project Seminar** (0) Prereq: 12 hours of 300-level computer science courses. Computer engineers may substitute EE 494. Spring.

**CS 495 Senior Project Phase I** (3) Prereq: CS 494, GPA of at least 2.0. Computer engineers may substitute EE 495. Fall.

**CS 497 Senior Project Phase II** (3) Prereq: CS 495. Computer engineers may substitute EE 497.

**CS 498 Independent Study in Computer Science** (variable credit) Requires faculty sponsor and approved detailed study plan.

**CS 499 Special Topics in Computer Science** (1-3) Prerequisites will be announced when scheduled.

# Frequently Asked Questions

*What degrees are offered by the Department of Electrical Engineering and Computer Science?*

- Bachelor of Science in Computer Engineering
- Bachelor of Science in Computer Science
- Bachelor of Science in Electrical Engineering
- Bachelor of Science in Software Engineering

*What are the general education requirements for the engineering degree?*

Refer to page 5 of this guide.

*Is it necessary for engineering and computer science majors to take a foreign language?*

The requirement is for six hours of course work or demonstrated proficiency. On entry, all students have the opportunity to take a proficiency exam in a foreign language of their choice. Students who have had two or more years of a foreign language during the last two years of high school usually pass this exam.

*What is the average class size in electrical engineering and computer science?*

The student to faculty ratio is about 13:1. Lower division classes tend to run 20 to 30 students per section. Upper division classes are smaller with 12 to 18 being typical.

*What is the size of the engineering program at UE?*

The College of Engineering and Computer Science offers degrees in electrical engineering, mechanical engineering, civil engineering, computer engineering, and computer science. Electrical Engineering, Computer Engineering and Computer Science are in the Electrical Engineering and Computer Science (EECS) department while Mechanical and Civil Engineering are in the Mechanical Engineering and Civil Engineering department (MECE). There are approximately 200 students in the college, split equally between the two departments.

*I am undecided between electrical engineering, computer engineering, and computer science. How soon do I have to choose my major?*

All three majors share a common freshman year. At the beginning of the sophomore year, electrical engineering and computer engineering majors take the electrical engineering circuits courses that are not taken by the computer science majors. You should

decide between electrical engineering, computer engineering and computer science by the end of the freshman year.

*Is a personal computer required in electrical engineering, computer engineering, or computer science?*

Yes, all students are expected to have their own computer. Faculty assume that students have access to a computer at home or in the residence hall for homework and projects. Laptops are preferred over desktops for their convenience, but are not required.

Several courses require that the student use a computer during the lecture or laboratory section of the course. University computers are available in the classroom/lab in that case, but students typically prefer to use their own laptops.

A lot of the software used in the EECS department will run on all three major operating systems (Windows, Mac, and Linux) and much of the software that is used is available for free to students. Students have 24-hour access to university computers that are required to specialized software. Virtual-machine software and/or dual-boot technology makes it relatively easy for students to run other operating systems regardless of whether they are using Windows, Macs or Linux.

The majority of engineering students have Windows computers while Computer Science students are more evenly divided in their preference between Windows and Macs. The EECS department computers dual-boot Windows and Linux and Mac computers are available in the Computer Science lab. Chromebook computers are not recommended for engineering students.

*Can I study abroad and still complete the program in four years?*

Yes, UE's Harlaxton College is located in Grantham, England, about one hour northeast of London. Electrical engineering, computer science, and computer engineering majors can spend one semester at our British campus and still graduate in four years. Tuition, room and board, and financial aid are the same as they are on the Evansville campus. Engineering students typically go to Harlaxton during the fall term of their sophomore year. At Harlaxton they take calculus and general education classes. Often, technical sophomore level classes are taught at Harlaxton by visiting faculty members from the engineering college.

*How does the co-op program work?*

Students attend two regular school years, then go to work during the summer after their sophomore year. They are back in school during the fall and out to work during the spring. After the sophomore year

students alternate work and school between summer, fall, and spring. It is a five-year program. After five years, students obtain a bachelor's degree and have about two years work experience. About 25 percent of students choose the co-op program.

Interested students attend Experiential Education 90, a noncredit course during the first term of the sophomore year. In this class students learn about employment opportunities and résumé writing and also attend a job interview. UE arranges interviews, but the final job placement is made between the student and the employer. Most employers are in the local region, but there are choices nationwide. The Center for Career Development is very good at working with employers to establish co-op programs when students wish to work for employers with whom we do not already have an agreement in place.

*What do I do if I want to go to graduate school after earning my degree?*

It is common for students who receive an undergraduate degree in engineering or computer science to attend graduate school at a different university. At UE about 20 percent of electrical and computer engineering and computer science majors go on to graduate school after completing their undergraduate degree. For students who have a 3.5 grade point average or better and who do relatively well on the Graduate Record Examination (GRE), graduate school is usually paid for by a fellowship or an assistantship. These typically cover 100 percent of tuition and provide modest living expenses. Over the past five years, UE graduates in electrical engineering, computer engineering, and computer science have gone on to attend graduate school at universities such as Cornell, Tufts, University of Illinois, University of Wisconsin, University of Missouri, Indiana University, Georgia Tech, Rensselaer Polytechnic, Iowa State, Duke, Vanderbilt University, and others.

*How should I prepare for graduate school?*

Good grades are very important. This is particularly true of courses in your major. Typically students who continue on to graduate school have a 3.5 grade point average or better. Most graduate schools also consider your grades on the Graduate Record Examination (GRE). Undergraduates who intend to go on to graduate school are encouraged to get some research experience as an undergraduate student. This can be done at UE or by participating in the summer research programs for undergraduates sponsored by the National Science Foundation.

Graduate school applications are typically due in December of the year in which you graduate with the expectation that you will enter graduate school in the following fall.

*What is the GRE?*

The Graduate Record Examination is given in two parts: a general test and a test in a specific area called a subject test. The general test measures verbal, quantitative, and analytical skills that have been developed over a long period of time and are not necessarily related to any particular field of study. The subject test is given in different areas such as mathematics. The subject test is designed to measure the qualifications of a student in a particular field of study and is used to compare students from different universities and different backgrounds. Most graduate schools require only the general test.

Students who plan to take the GRE should register for the exam very early in their senior year. The general test is most often computer based. Students register for a time slot, go to a testing center to take the exam, and get their scores immediately upon completion. In Evansville, the general test is given by Prometric Testing Center at 923 South Kenmore Drive in the Hebron Office Plaza. The website www.gre.org has useful information about the GRE, including a free test practice book.

*Tell me about a professional engineering license in electrical engineering, computer engineering, and computer science.*

Professional engineering licenses are granted by individual states. Procedures for getting a license vary from state to state, but is generally a two-step process. A candidate must have four years of engineering experience and pass the Fundamentals of Engineering (FE) exam. Most states count a four-year engineering degree as four years of experience; thus many graduating seniors in engineering take the FE exam. In step two of the process, a candidate must have additional engineering experience and pass the Professional Engineering (PE) exam in a particular area such as computer engineering.

Engineering licensure is not required in order to practice engineering unless you practice in an area that involves public health and safety. Such areas might include engineering consulting, engineers who work for public utilities, or engineers who work for the government. Most electrical and computer engineers find that a professional engineering license is not required by their employer nor by their job assignment. Computer scientists rarely, if ever, participate in the professional engineering license procedure.

At UE, the Fundamentals of Engineering exam is not required of those graduating in electrical engineering, computer engineering, or computer science. However, a review course for the exam is available and students who wish to take the exam may do so in the semester that they graduate.

Refer to the web site www.ncees.org for additional information on the FE and PE exams.

*How does the computer engineering differ from electrical engineering and from computer science?*

Computer science deals with software. Computer scientists typically work on large programs and on software applications in which many users will directly apply their software for a specific problem.

Electrical engineering deals with hardware. This may involve power systems, computers, electronics, systems, electro-optics, device fabrication, or other areas. Software may be involved but it is typically peripheral to the problem being solved.

Computer engineering deals with those applications that involve both hardware and software. A typical application might be an engine controller for an automobile. The computer engineer knows enough about the hardware to do the electronics involved in interfacing the controller to the engine, and she will know enough about the software to write the program for the controller. Such systems are said to be "embedded." Computer engineers may also be involved with computer architecture or in networking.

*What are some examples of senior design projects in computer engineering?*

A few senior project titles from the past several years include: "A Self-Playing Guitar," "Elevator Simulation – Three Elevators, 21 Stories," "Pulsed Power Generator," "The Fire Fighting Robot," "Autonomous Mail Delivery Robot," etc. Senior projects often are centered on intercollegiate hardware contests. The EECS department regularly competes in the Fire Fighting Robot Contest at Trinity College in Connecticut, the IEEE Hardware Competition at SouthEastcon, and the robotic football competition at Notre Dame.

*What are the areas of specialty in computer engineering?*

Computer engineering majors at UE have twelve hours (four courses) of technical electives and no free electives. Areas of specialization include signal procesing, computer hardware, graphics, networks, real-time systems or artificial intelligence.

*How much mathematics is required in the computer engineering program?*

Computer engineering majors at UE are required to take three semesters of calculus, one semester of differential equations, one semester of discrete mathematics and a mathematics elective.

*Is the UE computer engineering program accredited by ABET?*

The computer engineering program at UE is accredited by the Accreditation Board for Engineering and Technology (ABET). The first accreditation for computer engineering was in 1996.

*How does the computer engineering program differ from computer engineering technology programs?*

The computer engineering (CoE) degree program emphasizes design and invention, whereas the computer engineering technology (CoET) program emphasizes maintenance and repair.

Course titles are often similar in the two programs, but course content differs considerably. Since the CoE program emphasizes design and invention, it requires considerably more in-depth understanding at a more fundamental level. This implies that the CoE program contains more science and mathematics and uses that science and mathematics in the engineering course work. CoET programs have a different emphasis that requires more hands-on activity and lab work.

As an example, if you wanted your computer network repaired, you would ask a technician to do that since that is what he is trained to do. On the other hand, if you were designing new computer network or were putting them into production, you would ask an engineer to do that because she has the fundamentals and background necessary for design.

NOTES

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