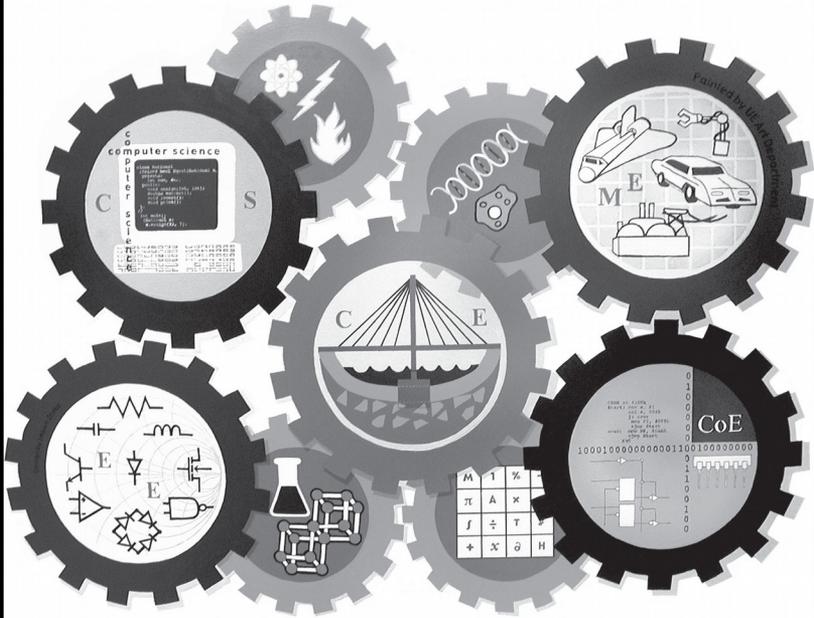


2020-2021



# Computer Science Guide Book

**UE** University  
of Evansville



COMPUTER SCIENCE PROGRAM  
GUIDE BOOK  
2020-2021

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Computing  
Accreditation  
Commission

The computer science program at the University of Evansville is accredited by the Computing Accreditation Commission of ABET, [www.abet.org](http://www.abet.org).

Revised August 2020

# Program Objectives

The Computer Science 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 apply computer science theory and software development fundamentals to produce computing-based solution. (ABET CAC Outcome 6)
- **Outcome 1b.** Students will have an ability to analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions. (ABET CAC Outcome 1)

**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 as a member or leader of a team engaged in activities appropriate to the program's discipline. (ABET CAC Outcome 5)
- **Outcome 2b.** Students will have an ability to design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline. (ABET CAC Outcome 2)
- **Outcome 2c.** Students will have an ability to communicate effectively in a variety of professional contexts. (ABET CAC Outcome 3)

**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 professional responsibilities and make informed judgments in computing practice based on legal and ethical principles. (ABET CAC Outcome 4).

# Plan of Study – Standard

## Bachelor of Science in Computer Science

FALL		FRESHMAN		SPRING	
FRESHMAN					
CHEM 118	or BIOL 119	4	CS 210	Fund of Prog I	3
CS 101	Intro to Comp Sci	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
		<u>17</u>			<u>17</u>
SOPHOMORE					
CS 215	Fund of Prog II	3	CS 220	Logic Design	3
MATH 323	Calculus III	4	CS 290	Obj Oriented Design	3
	Nat Sci Elective	4	MATH 370	Discrete Math	3
	General Education	3		Math Elective	3
	Free Elective	3		General Education	3
		<u>17</u>		Free Elective	3
					<u>18</u>
JUNIOR					
CS 380	Prog Languages	3	CS 315	Algorithms & DS	3
or CS 381	Formal Languages		CS 320	Comp Architecture	3
CS 390	Software Engr	3	or CS 470	Operating Systems	
	CS Elective	3	CS 494	Senior Project Sem.	0
	General Education	3		CS Elective	3
	Free Elective	3		General Education	3
		<u>15</u>		Free Elective	3
					<u>15</u>
SENIOR					
CS 380	Prog. Languages	3	CS 320	Comp. Architecture	3
or CS 381	Formal Languages		or CS 470	Operating Systems	
CS 495	Senior Project I	3	CS 497	Senior Project II	3
	CS Elective	3		CS Elective	3
	General Education	3		Prof Dev Elective	3
	Free Elective	3		Free Elective	3
	Health Elective	1			
		<u>16</u>			<u>15</u>

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

\* Only if necessary to meet University foreign language requirement.

# Electives

The electives in the computer science program can be classified in six categories: mathematics elective, natural science electives, computer science electives, general education electives, professional development elective, and free electives. There are some restrictions on which courses can be taken in each of these categories and these are discussed below.

## Mathematics Electives

Choose one from Engineering 390, Mathematics 341, or Mathematics 365.

## Natural Science Electives

The two natural science electives must be chosen to complete a two-semester sequence in one of biology, chemistry, or physics in combination with the required physics course (Physics 210). The University requires that two of the courses be in different disciplines. Thus there are four possible combinations that fulfill the computer science program natural science requirements.

### Natural Science Course Combinations

Physics 210, Chemistry 118, Physics 211

Physics 210, Chemistry 118, Chemistry 240 or 280

Physics 210, Biology 119, Physics 211

Physics 210, Biology 119 and 120

## Computer Science Electives

The four computer science electives should be chosen from the following list in consultation with a computer science advisor.

### Hardware-Oriented Courses

Course	Title
--------	-------

CS 376	Windows Application Development
--------	---------------------------------

CS 478	Embedded Systems and Real-Time Programming
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EE 354	Digital Systems
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EE 454	Microcontroller Applications
--------	------------------------------

EE 456	Small Computer System Design
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### Software-Oriented Courses

CS 350	Computer/Human Interaction
--------	----------------------------

CS 355	Computer Graphics
--------	-------------------

CS 375	UNIX System Programming
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CS 391	Software Engineering II
--------	-------------------------

CS 395	Software Project Management
--------	-----------------------------

CS 413	Software Security
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CS 415	Cryptography
CS 440	Databases
CS 445	Programming in the Large
CS 455	Advanced Graphics
CS 472	Concurrent and Parallel Programming
CS 473	Mobile Application Development
CS 491	Software Quality Assurance
CS 499	Special Topics in Computer Science

### **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 Computer Science 495, the senior design course.

In addition to taking courses to meet the outcomes above, students must complete the writing overlay requirement, which consists of four courses. In computer science these are FYS 112, CS 495, CS 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](http://www.evansville.edu/registrar).

### **Professional Development Elective (3 hours)**

This elective may not be used to fulfill a general education requirement.

- Choose one course from the following: Communication 210, 382, 485; Economics 101; Philosophy 111, 121, 231, 241, 316, 317; Writing 330 when topic is technical writing.

### **Free Electives**

The 18 hours of free electives may be taken as any course in the University that is given for University credit with a few exceptions. Courses labeled Chemistry 10x; Computer Science 105, 205; English Language; Mathematics 1xx; and Physics 1xx may not be counted as free electives. At least 9 hours of the free elective requirement must be chosen from courses at the 300 or 400 level.

The abundance of electives in the computer science program allows computer science students enough room in their program to concentrate in a field of application that meets the student's interests and future goals. Courses suitable for concentration in some common areas of application are shown below.

### **Mathematics Minor**

To earn 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 Science degree requirements only need to take one additional mathematics course numbered 300 or above to satisfy the mathematics minor requirements. A Free Elective may be used to meet this requirement. Taking both Mathematics 341 and Mathematics 365 is recommended.

## **Computational Mathematics/Graduate School**

- Mathematics elective: Mathematics 341
- Natural science electives: Chemistry 118, Physics 211
- Computer science electives: Computer Science 355, Computer Science 415, Computer Science 430, Computer Science 455
- Professional development elective: Philosophy 231
- Free electives: Mathematics 365, Mathematics 445, Mathematics 466, Mathematics 495

A second Bachelor of Science degree in mathematics requires a total of 154 hours. This typically can be completed in eight semesters by taking 18 hours each term where possible plus 12 hours of summer school or pre-admission transfer credit.

## **Computational Science**

- Mathematics elective: Mathematics 365
- Natural science and free electives: minor in biology, chemistry, or physics
- Free electives: Mathematics 373, Philosophy 345

## **Artificial Intelligence/Cognitive Science**

- Mathematics elective: Mathematics 341
- Natural science electives: Biology 120
- Computer science electives: Computer Science 350, Computer Science 430
- Professional development elective: Philosophy 231
- General education and free electives: Cognitive Science 111, Philosophy 241, Philosophy 447, minor in psychology or minor in cognitive science.

## **Embedded Systems**

- Natural science electives: Chemistry 118, Physics 211
- Computer science electives: Computer Science 376, Computer Science 458, Computer Science 475, Electrical Engineering 354, Electrical Engineering 454, Electrical Engineering 456
- Free electives: Electrical Engineering 210, Electrical Engineering 215, Mathematics 324

## **Internet Applications**

- Computer science electives: Computer Science 350, Computer Science 375, Computer Science 415, Computer Science 430, Computer Science 440, Computer Science 473, Computer Science 475

- General education and free electives: Communication 130, Communication 251, Communication 351, Communication 352, Communication 485, Economics 102, Management 311, Management 445, Marketing 325, Psychology 121

### **Business**

- General education and free electives: minor in business administration.

### **Statistics and Data Science**

- Free electives: Minor in Statistics and Data Science

## **Co-op Program**

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

The typical computer science co-op student goes to school the first two years 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.

<b>CO-OP PLAN</b>			
<b>Year</b>	<b>Fall</b>	<b>Spring</b>	<b>Summer</b>
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 Center for Career Development 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 science 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. 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 science opportunity for a prospective computer science student that is relevant to the student's education and chosen profession.

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 science 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, and bistro also are available on the grounds.

Computer science students who wish to study one semester in England are encouraged to do so during the first semester of their sophomore year. At Harlaxton, computer science students typically take differential equations (or

# Plan of Study – Harlaxton Option

## Bachelor of Science in Computer Science

FALL		FRESHMAN		SPRING		
CHEM 118	or BIOL 119	4	CS 210	Fund of Prog I		3
CS 101	Intro to Comp Sci	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
		<u>17</u>				<u>17</u>
SOPHOMORE						
ID H282	British Studies I	3	CS 215	Fund of Prog II		3
ID H283	British Studies II	3	CS 220	Logic Design		3
	General Education	3	MATH 370	Discrete Math		3
	General Education	3		Math Elective		3
	Free Elective	3		General Education		3
		<u>15</u>		Free Elective		<u>3</u>
						<u>18</u>
JUNIOR						
CS 380	Prog Languages	3	CS 290	Object Oriented Des		3
or CS 381	Formal Languages		CS 315	Algorithms and DS		3
CS 390	Software Engr	3	CS 320	Comp Architecture		3
MATH 323	Calculus III	4	or CS 470	Operating Systems		
	Nat Sci Elective	4	CS 494	Senior Project Sem		0
	CS Elective	3		CS Elective		3
				Free Elective		3
		<u>17</u>		Health & Wellness		<u>1</u>
						<u>16</u>
SENIOR						
CS 380	Prog Languages	3	CS 320	Comp Architecture		3
or CS 381	Formal Languages		or CS 470	Operating Systems		
CS 495	Senior Project I	3	CS 497	Senior Project II		3
	CS Elective	3		CS Elective		3
	Free Elective	3		Free Elective		3
	Free Elective	3		Prof Dev Elective		3
		<u>15</u>				<u>15</u>

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

\* Only if necessary to meet University foreign language requirement.

another free elective), 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 computer science program requires a number of general education classes and free electives, all classes taken at Harlaxton count towards the computer science 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 and various other campuses around the United States.

Figure 2 shows a typical four-year degree plan in which a computer science 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, students living off-campus will need to pay for room and board. In addition, there are travel costs. 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 the 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 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](http://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 University of Notre Dame.

# Faculty and Staff

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Department of Electrical Engineering and Computer Science Fax Line	KC 266	812-488-2662

# 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.
- CS 495 Senior Project Phase I (3) Prereq: CS 494, GPA of at least 2.0. Fall.
- CS 497 Senior Project Phase II (3) Prereq: CS 495.

**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

*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 10 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 for 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 differential equations (or other free elective) 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 scores 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 academic 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 and there is not subject test for Engineering or Computer Science. Students who plan to take the GRE should register for the exam very early in their senior year. The general test is 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](http://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](http://www.ncees.org) for additional information on the FE and PE exams.

*What is the difference between computer science and computer engineering?*

Computer science deals primarily with software. There are some hardware-related topics in computer science such as computer architecture and logic design, but computer scientists deal mostly with the design and development of algorithms and software for computer solutions to problems. Computer scientists design and implement programs that tend to be large and reusable. This makes documentation and program structure very important.

Computer engineers deal with both hardware and software. They tend to use computers in “embedded systems” in which a small computer (often a microcontroller) runs a fixed program that directly controls some electrical device. For example, microwave ovens and automobiles have embedded computers which run a program that controls their behavior. To design and develop such a system, computer engineers must understand the hardware (the electronics and circuitry) as well as the software (the program that runs on the computer). The computer engineering degree is thus a combination of electrical engineering and computer science.

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

Just about any project with a significant computational component is acceptable. Computer science students have developed mobile and web applications. In fall 2017, a student developed an iOS app for volunteer first responders for a local fire protection district that allows them to report back to the central dispatch whether they are able to respond and whether they will report to the fire station or to the accident site. In spring 2017, a student developed a web application for a major healthcare services company to replace a paper-based record-keeping system for lab specimens.

At the other end of the spectrum, students have done research in computer science, computational mathematics, and cognitive science. Also in spring 2017, a student developed a minimal operating system for the ARM processor to explore whether the memory safety features of the new Rust language would be helpful in writing low-level software as claimed or a hindrance.

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

The computer science program at UE provides for 12 hours (four courses) of technical electives and 18 hours (six courses) of free electives. Technical electives are chosen from computer science or electrical engineering courses. Free electives should be chosen in an area of application such as a minor in mathematics, natural science, etc., or for more depth in computer science. Areas of specialty include computational mathematics, artificial intelligence or cognitive science, graphics, computational science, Internet applications, and embedded systems.

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

Computer science majors at UE are required to take three semesters of calculus, one semester of discrete mathematics (combinatorics), and one mathematics elective, which may be applied engineering mathematics, probability, or linear algebra.

## NOTES

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