

# Computer Engineering

Accredited by the Engineering Accreditation Commission of ABET, [www.abet.org](http://www.abet.org)

## 1. University Requirements: (23-24)

Writing, Rhetoric and American Cultures (WRA)	4
Integrative Studies in Humanities (IAH)	8
IAH 201-210 and IAH 211 or >	
Integrative Studies in Social Sciences (ISS)	8
ISS 2XX and ISS 3XX	
Bioscience (one of the following):	
BS 161, ENT 205, IBIO 150, MMG 141,	
MMG 201, PLB 105, PSL 250	3-4

## 2. College Requirements: (32)

*CEM 141	General Chemistry	4
*CSE 231	Introduction to Programming I	4
*EGR 100	Introduction to Engineering Design	2
*MTH 132	Calculus I	3
*MTH 133	Calculus II	4
MTH 234	Multivariable Calculus	4
MTH 235	Differential Equations	3
*PHY 183	Physics for Scientists & Engineers I	4
PHY 184	Physics for Scientists & Engineers II	4

\*College Admission Requirement

## 3. Major Requirements: (65)

### a. Complete one of the following courses: (1)

CEM 161	Chemistry Laboratory I	1
PHY 191	Physics Laboratory for Scientists I	1

### b. All of the following courses: (39)

CSE 232	Introduction to Programming II	4
CSE 260	Discrete Structures in Computer Sci	4
CSE 325	Computer Systems	3
CSE 331	Algorithms and Data Structures	3
ECE 201	Circuits and Systems I	3
ECE 202	Circuits and Systems II	3
ECE 203	Electronic Circuits and Systems Lab	1
ECE 230	Digital Logic Fundamentals	3
ECE 280	Electrical Engineering Analysis	3
ECE 302	Electronic Circuits	3
ECE 303	Electronics Laboratory	1
ECE 331	Microprocessors & Digital Systems	4
ECE 366	Introduction to Signal Processing	3
ECE 390	Ethics, Professionalism and Contemporary Issues	1

### c. One of the following courses: (4)

ECE 480	Senior Design (W)	4
ECE 489	Independent Senior Design	4

## d. Electives: (21)

Complete 21 credits of electives as specified. Take at least 15 credits from the Focus Tracks including at least 6 credits from the Core track and at least one course with a lab (L). Additional credits to meet the 21 credit requirement may be taken from Focus Track courses, any 400-level Computer Science and Engineering (CSE) or Electrical and Computer Engineering (ECE) courses, or by completing an approved 3 or 4 credit experiential, out-of-classroom education experience obtained through engineering cooperative education or independent study.

### Focus Tracks

#### a. Core

At least 6 credits from the following:

CSE 335	Object-Oriented Software Design	4
CSE 420	Computer Architecture	3
ECE 430	Embedded Cyber Physical Sys (L)	4
CSE 422	Computer Networks	3
	or	
ECE 442	Intro to Communication Networks	3
CSE 425	Intro to Computer Security	3
	or	
ECE 456	Intro to Comm & Network Security	3
<i>Both CSE 422 and ECE 442 may not be used to fulfill this requirement.</i>		
<i>Both CSE 425 and ECE 456 may not be used to fulfill this requirement.</i>		

#### b. Hardware

ECE 410	VSL Design (L)	4
ECE 411	Electronic Design Automation (L)	4
ECE 431	Smart Sensor Systems (L)	3
ECE 445	Biomedical Instrumentation (L)	3

#### c. Software Systems

CSE 410	Operating Systems	3
CSE 415	Parallel Programming	3
CSE 431	Algorithm Engineering	3
CSE 435	Software Engineering	3
CSE 450	Translation of Prog Languages	3
CSE 476	Mobile Applications Development	3
CSE 480	Database Systems	3

#### d. Intelligent Systems

CSE 404	Introduction to Machine Learning	3
CSE 440	Introduction to Artificial Intelligence	3
CSE 482	Big Data Analysis	3
ECE 434	Autonomous Vehicles (L)	3
ECE 446	Biomedical Signal Processing	3
ECE 466	Digital Signal Proc Filter Design	3
STT 351	Probability & Statistics for Engr	3
MTH 314	Matrix Algebra w/Comput Apls	3

#### e. Electrical Systems

ECE 305	Electromagnetic Fields & Waves I	4
ECE 313	Control Systems	3
ECE 377	Principles of Electronic Devices	3
ECE 404	Radio Frequency ELEC Circuits (L)	4
ECE 417	Robotics (L)	4

## Other Electives (Variable)

### Total Credits Required for Degree 128

The requirements listed apply to students admitted to the major of Computer Engineering beginning Fall, 2021. The Department of Electrical and Computer Engineering (ECE) constantly reviews program requirements and reserves the right to make changes as necessary. Students are encouraged to consult with their advisor to obtain assistance in planning an appropriate schedule. Students who have questions about Computer Engineering should contact the Electrical and Computer Engineering Department Advising Office, 2212 Engineering Building, phone (517) 355-5242.

**Concentrations**

The department offers the following concentrations to student wishing an area of specialization in their degree. Concentrations are available to, but not required of, any student enrolled in the Bachelor of Science degree in Computer Engineering. Courses completed to satisfy Requirement 3c. may also be used to satisfy the requirements of a concentrations. NOTE: Completing the Bachelor of Science degree in Computer Engineering with a concentration may require more than 128 credits. Upon completion of the required courses for a concentration, certification will appear on the student's official transcript.

**Biomedical Engineering Concentration: (15-17)**

This concentration is for students who plan to pursue graduate work in biomedical areas or seek employment in selected medical-related areas. To earn a Bachelor of Science degree in Computer Engineering with a biomedical engineering concentration, students must complete requirements 1., 2., and 3. above and the following:

**1. Complete 6 credits from the following:**

ANTR 350	Human Gross Anatomy for Pre-Health Professionals	3
BS 161	Cell and Molecular Biology	3
PSL 250	Introductory Physiology	4
PSL 310	Physiology for Pre-Health Professionals	4

**2. Complete 9 credits from the following:**

BE 444	Biosensors for Medical Diagnostics	3
ECE 445	Biomedical Instrumentation (L)	3
ECE 446	Biomedical Signal Processing Introduction	3
ECE 447	to Biomedical Imaging	3
ECE 448	Modeling and Analysis of Bioelectrical Systems	3
ECE 449	Fundamentals of Acoustics	3

*Note: Students may enroll in 3 or 4 credits of ECE 490 or 491 with biomedical engineering content as approved by the student's advisor for partial fulfillment of this requirement.*

**Cybersecurity: (15)**

This concentration is for students interested in the theory and practice of communication networks and security. To earn a Bachelor of Science degree in Computer Engineering with a cybersecurity concentration, students must complete requirements 1., 2., and 3. above and the following:

**1. Complete all of the following:**

ECE 442	Intro Communication Networks	3
ECE 456	Intro Communication & Network Security	3
ECE 457	Communication Systems	3

**2. Complete 2 courses from the following:**

CSE 402	Biometrics and Pattern Recognition	3
CSE 410	Operating Systems	3
CSE 425	Intro to Computer Security	3
CSE 482	Big Data Analysis	3

**Robotics and Automation: (13-14)**

This concentration is for students interested in graduate work or employment in robotics or automation areas. To earn a Bachelor of Science degree in Computer Engineering with a robotics and automation concentration, students must complete requirements 1., 2., and 3. above and the following:

**1. Complete the following course:**

ECE 417	Robotics (L)	4
---------	--------------	---

**2. Complete at least 9 credits from the following:**

ECE 415	Computer Aided Manufacturing (L)	3
ECE 416	Digital Control (L)	3
ECE 430	Embedded Cyber-Physical Systems (L)	4
ECE 431	Smart Sensors Systems (L)	3
ECE 434	Autonomous Vehicles (L)	3
ECE 466	Digital Signal Processing	3

**Smart Systems: (13-15)**

This concentration is for students interested in the design and implementation of smart devices and systems for graduate work or employment in consumer electronics, wearables, and internet of things (IoT) fields. To earn a Bachelor of Science degree in Computer Engineering with a smart systems concentration, students must complete requirements 1., 2., and 3. above and the following:

**Complete at least 13 credits from the following:**

ECE 410	VLSI Design (L)	4
ECE 411	Electronic Design Automation (L)	4
ECE 430	Embedded Cyber-Physical Systems (L)	4
ECE 431	Smart Sensors Systems (L)	3
ECE 445	Biomedical Instrumentation (L)	3
ECE 466	Digital Signal Processing	3
CSE 404	Introduction to Machine Learning	3
CSE 420	Computer Architecture	3
CSE 440	Introduction Artificial Intelligence	3
CSE 476	Mobile App Development	3
CSE 482	Big Data Analysis	3

**Software Systems: (13-15)**

This concentration is for students wishing to focus on software development for graduate work or employment in embedded systems, cloud services and other software intensive fields. To earn a Bachelor of Science degree in Computer Engineering with a software systems concentration, students must complete requirements 1., 2., and 3. above and the following:

**Complete at least 13 credits from the following:**

CSE 410	Operating Systems	3
CSE 415	Parallel Programming	3
CSE 435	Software Engineering	3
CSE 450	Translation Programming Languages	3
CSE 476	Mobile App Development	3
ECE 430	Embedded Cyber-Physical Systems (L)	4

## Computer Engineering

### Sample Program

Freshman Year				Sophomore Year			
Fall	Credits	Spring	Credits	Fall	Credits	Spring	Credits
Bioscience	3/4	CSE 231	4	CSE 232	4	CSE 260	4
CEM 141	4	MTH 133	4	ECE 230	3	General Elective	3
EGR 100	2	PHY 183	4	CEM 161	1	ECE 202 & 203	4
MTH 132	3	ISS 2XX	4	ECE 201	3	ECE 280	3
WRA 101	4			MTH 234	4	MTH 235	3
<b>Total</b>	<b>16/17</b>	<b>Total</b>	<b>16</b>	<b>Total</b>	<b>15</b>	<b>Total</b>	<b>17</b>

  

Junior Year				Senior Year			
Fall	Credits	Spring	Credits	Fall	Credits	Spring	Credits
ECE 331	4	CSE 325	3	Major Elective #1	3	Major Elective #4	3
ECE 302 & 303	4	CSE 331	3	Major Elective #2	4	ECE 480 or 489	4
PHY 184	4	General Elec	3	Major Elective #3	4	Major Elective #5	3
IAH 201-210	4	ECE 366	3	ECE 390	1	Major Elective #6	4
		ISS 3XX	4	IAH 211 or higher	4	General Elec	2
<b>Total</b>	<b>16</b>	<b>Total</b>	<b>16</b>	<b>Total</b>	<b>16</b>	<b>Total</b>	<b>16</b>

Last Revised April 2021

### Program Educational Objectives

The bachelor's degree in electrical/computer engineering provides its graduates with a solid foundation on which they can build successful and sustainable careers in the ever-changing global work environment. The program prepares its graduates for a variety of career paths including engineering positions directly after program completion, entry to engineering graduate school, and entry to other professional graduate-level schools, and eventual leadership in scientific, technical, organizational, and entrepreneurial arenas.

Specifically, the electrical/computer engineering program graduates will:

- be independent and critical thinkers who identify problems and develop effective solutions;
- be competent and ethical engineers practicing in a diverse range of fields;
- maintain and increase their technical expertise through lifelong learning;
- use their expertise to the benefit of the larger community.