Computer Engineering

Department Information

- **Department Web Site:**
  www.ndsu.edu/ece/ (http://www.ndsu.edu/ece/)
- **Credential Offered:**
  B.S.Cpr.E.
- **Official Program Curriculum:**
  catalog.ndsu.edu/undergraduate/program-curriculum/computer-engineering/ (http://catalog.ndsu.edu/undergraduate/program-curriculum/computer-engineering/)

Computer engineering deals with both hardware and software aspects of computer systems. Students take both essential electrical and computer engineering classes along with core classes specific to computer engineering design. Demand for computer engineers is strong due to the growing use of computers in all aspects of products and the need for engineers competent in computing practices.

The Program

Computer engineering is a degree program in the College of Engineering and provides a background in three broad areas: computer hardware, software, and hardware-software integration. Fundamental topics included in the program are embedded systems, computer architecture, digital systems, embedded machine learning, algorithms and operating systems. In addition, the program includes core subjects that are common to all engineering disciplines and basic university studies in humanities and social sciences. The Bachelor of Science in Computer Engineering program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the commission's General Criteria and Program Criteria for Electrical, Computer, Communications, Telecommunication(s) and Similarly Named Engineering Programs.

Areas of Specialization

The Computer Engineering program allows students to tailor their studies within broad parameters. Students are encouraged to develop an individual program of study in close consultation with their advisers. Examples are available to illustrate how specialization may be obtained in a number of different technical areas. Students may mix and match from the examples to suit their particular interests.

Technical areas include the following:

Computer Architecture/Digital VLSI – VLSI designers and computer architects design computer system hardware, including how the CPU communicates with various types of memory and high-performance multi-processor systems. VLSI design focusses on the lower levels of abstraction: transistor-level and physical-level design; whereas computer architecture focuses on the higher levels of abstraction: architecture and gate-level designs.

Cyber Physical Systems – deals with the interaction of computing elements monitoring/controlling physical entities, often in a large network.

Embedded Systems – deals with the design of a dedicated computer system to perform a specific task, often requiring real-time constraints. An example is a smartphone.

Computer Systems – deals with the close interaction between a system's hardware and software.

The Facilities

The Electrical and Computer Engineering building is part of an eight building engineering complex. The building contains specialized laboratories and equipment. Numerous grants and donations from the National Science Foundation and private industry have provided valuable equipment. Laboratories along with department and University computer capabilities support education and research. Students also have full access to computer clusters located in the ECE building and throughout the campus. These and other major computer resources are tied to local, regional, national and international computer networks, and remote access is provided for all ECE software.

Selective Admission

Transfer students from international institutions must have a 3.00 GPA.

Further, the department policy is that transfer courses equivalent to ECE 173 (or CSCI 160), ECE 275, EE 206 and all required math must have a C or better before enrolling in ECE courses listed in the curriculums for Junior & Senior years.

High School Preparation

High school students should attempt to complete one unit of physics, four units of mathematics and one unit of chemistry.

Career Opportunities

Graduates may find work as design engineers (computer hardware, software and systems), computer consultants, sales and customer support engineers or as engineers involved with computer-aided manufacturing and testing.

Research and Graduate Study

Graduate studies leading to a master's degree or doctoral degree are offered in the department. Further details are available in the *Graduate Bulletin*.

Cooperative Education Program

The Cooperative Education Program allows students to alternate classroom study with a series of paid professional work experiences related to electrical and computer engineering. These experiences increase in complexity as the student's background increases. The program provides opportunities for pre-graduation experience in the profession, exploration of several career opportunities, money for education, an enriched degree and enhanced opportunities for employment following graduation.

First Year			
Fall	**Credits**	**Spring**	**Credits**
MATH 098[1]	3	MATH 103[1]	3
ENGL 110	3	CHEM 121	3
COMM 110	3	ENGL 120	3
GEN ED Wellness	2	ECE 111	3
GEN ED Social/Behavioral Science and Global Perspective	3		
	14		**12**
Second Year			
Fall	**Credits**	**Spring**	**Credits**
MATH 105[1]	3	MATH 165[1]	4
MATH 129[1]	3	CSCI 161	4
CSCI 160[1,4]	4	CSCI 222	3
GEN ED Humanities/Fine Arts and Cultural Diversity	3	ECE 275[1]	4
		GEN ED Science Lab (CHEM 121L or PHYS 251L)	1
	13		**16**
Third Year			
Fall	**Credits**	**Spring**	**Credits**
MATH 166[1]	4	MATH 265[1]	4
EE 206[1]	4	PHYS 251	4
ECE 375	3	ECE 320	3
ENGR 327	3	ECE 311	4
GEN ED Upper Level English	3		
	17		**15**
Fourth Year			
Fall	**Credits**	**Spring**	**Credits**
MATH 266[1]	3	ECE 403	2
ECE 376	4	ECE 341	3
ECE 374	4	CpE Core[3]	3
ECE 343	4	CpE Core[3]	3
ECE 401	1	ECE Elective	3
ECE Elective	3		
	19		**14**

Fifth Year	
Fall	**Credits**
ECE 405	3
CpE Core[3]	3
CpE Core[3]	3
Tech Elective[2]	3
GEN ED Social/Behavioral Science	3
	15

Total Credits: 135

1

1. This course requires the student to earn a "C" or better, in order to take upper level ECE courses.

2

Choose from the approved Tech Elective List.

3

CpE Core Options:

1. **ECE 474 Computer Architecture** (prereq: ECE 374)
2. **ECE 477 Hardware design for Machine Learning** (prereqs: ECE 374 and ECE 375)
3. **ECE 423 VLSI Design** (prereqs: ECE 311 and ECE 321)
4. **ECE 425 Intro to Semiconductors** (prereqs: ECE 320)
5. **CSCI 474 Operating System Concepts** (prereqs: CSCI 374)
6. **CSCI 467 Algorithm Analysis** (prereqs: MATH 166, CSCI 161 and CSCI 222 or MATH 270)

4

ECE 173 is also an approved course for this requirement.

First Year				
Fall	**Credits**		**Spring**	**Credits**
MATH 103[1]	3		MATH 105[1]	3
CHEM 121	3		ECE 111	3
ENGL 110	3		ENGL 120	3
COMM 110	3		GEN ED Social/Behavioral Science and Global Perspective	3
GEN ED Wellness	2		GEN ED Science Lab (CHEM 121L or PHYS 251L)	1
	14			**13**
Second Year				
Fall	**Credits**		**Spring**	**Credits**
MATH 165[1]	4		MATH 166[1]	4
MATH 129[1]	3		EE 206[1]	4
CSCI 160[1,4]	4		CSCI 161	4
ECE 275[1]	4		ECE 375	3
CSCI 222	3		GEN ED Humanities/Fine Arts and Cultural Diversity	3
	18			**18**
Third Year				
Fall	**Credits**		**Spring**	**Credits**
MATH 265[1]	4		ECE 401	1
PHYS 251	4		MATH 266	3

ECE 311	4	ECE 320	3
Tech Elective[2]	3	ECE 343	4
GEN ED Upper Level English	3	GEN ED Social/Behavioral Science	3
	18		**14**

Fourth Year			
Fall	**Credits**	**Spring**	**Credits**
ECE 403	2	ECE 405	3
ECE 376	4	ECE 341	3
ECE 374	4	CpE Core[3]	3
ENGR 327	3	CpE Core[3]	3
ECE Elective	3	CpE Core[3]	3
CpE Core[3]	3	ECE Elective	3
	19		**18**

Total Credits: 132

1

This course requires the student earn a "C" or better, in order to take upper level ECE courses.

2

Choose from the approved Technical Elective List.

3

CpE Core Options:

1. **ECE 474 Computer Architecture** (prereq: ECE 374)
2. **ECE 477 Hardware design for Machine Learning** (prereqs: ECE 374 and ECE 375)
3. **ECE 423 VLSI Design** (prereqs: ECE 311 and ECE 321)
4. **ECE 425 Intro to Semiconductors** (prereqs: ECE 320)
5. **CSCI 474 Operating System Concepts** (prereqs: CSCI 374)
6. **CSCI 467 Algorithm Analysis** (prereqs MATH 166, CSCI 161 and CSCI 222 or MATH 270)

4

ECE 173 is also an approved course for this requirement.

First Year			
Fall	**Credits**	**Spring**	**Credits**
MATH 105[1]	3	MATH 165[1]	4
CSCI 160[1,4]	4	MATH 129[1]	3
CHEM 121	3	CSCI 161	4
COMM 110	3	ECE 111	3
ENGL 110	3	ENGL 120	3
	16		**17**

Second Year			
Fall	**Credits**	**Spring**	**Credits**
MATH 166[1]	4	MATH 265[1]	4
EE 206[1]	4	PHYS 251	4
ECE 275[1]	4	CSCI 222	3
GEN ED Wellness	2	ECE 311	4
GEN ED Science Lab (CHEM 121L or PHYS 251L)	1	GEN ED Social/Behavioral Science and Global Perspective	3
	15		**18**

Third Year				
Fall	**Credits**		**Spring**	**Credits**
MATH 266[1]		3	ECE 401	1
ECE 320		3	ECE 374	4
ECE 376		4	ECE 343	4
ECE 375		3	CpE Core[3]	3
GEN ED Humanities/Fine Arts and Cultural Diversity		3	Tech Elective[2]	3
		16		**15**

Fourth Year				
Fall	**Credits**		**Spring**	**Credits**
ECE 403		2	ECE 405	3
ECE 341		3	CpE Core[3]	3
ENGR 327		3	CpE Core[3]	3
CpE Core[3]		3	ECE Elective	3
ECE Elective		3	GEN ED Social/Behavioral Science	3
GEN ED Upper Level English		3		
		17		**15**

Total Credits: 129

1

This course requires a student to earn a "C" or better, in order to take upper level ECE courses.

2

Choose from the approved Tech Elective List.

3

CpE Core Options:

1. **ECE 474 Computer Architecture** (prereq: ECE 374)
2. **ECE 477 Hardware design for Machine Learning** (prereqs: ECE 374 and ECE 375)
3. **ECE 423 VLSI Design** (prereqs: ECE 311 and ECE 321)
4. **ECE 425 Intro to Semiconductors** (prereqs: ECE 320)
5. **CSCI 474 Operating System Concepts** (prereqs: CSCI 374)
6. **CSCI 467 Algorithm Analysis** (prereqs MATH 166, CSCI 161 and CSCI 222 or MATH 270)

4

ECE 173 is also an approved course for this requirement.

Sample Program Guide

IMPORTANT DISCLAIMER: This guide is not an official curriculum. This guide is a sample four-year degree plan of how students might plan this major with other degree requirements to complete their education in four years.Student plans will vary from this sample due to a variety of factors, such as, but not limited to, start year, education goals, transfer credit, and course availability. To ensure proper degree completion, enrolled students should utilize Degree Map (https://www.ndsu.edu/registrar/degreemap/) and Schedule Planner (https://www.ndsu.edu/onestop/degree-map-and-planning/) in Campus Connection and consult regularly with academic advisors to ensure graduation requirements are being met.

Freshman				
Fall	**Credits**		**Spring**	**Credits**
MATH 165[1]		4	MATH 166[1]	4
ENGL 110		3	CHEM 121	3
CSCI 160[5]		4	ENGL 120	3
ECE 111		3	CSCI 161	4
GEN ED Humanities/Fine Arts		3	GEN ED Science Lab (CHEM 121L or PHYS 251L)	1

			GEN ED Wellness		2
		17			**17**
Sophomore					
Fall	**Credits**		**Spring**	**Credits**	
MATH 265[1]		4	MATH 266[1]		3
EE 206[1]		4	COMM 110		3
ECE 275[1]		4	ECE 375		3
MATH 129[1]		3	ECE 311		4
			PHYS 251		4
		15			**17**
Junior					
Fall	**Credits**		**Spring**	**Credits**	
ECE 341		3	ECE 343		4
ENGR 327 (Fulfills Gen Ed Humanities & Fine Arts (A)		3	ECE 376		4
ECE 374		4	ECE 401		1
ECE 320		3	CPE Core[4]		3
CSCI 222		3			
		16			**12**
Senior					
Fall	**Credits**		**Spring**	**Credits**	
ECE 403		2	ECE 405		3
ENGL/Upper Level Writing[2]		3	ECE Elective		3
ECE Elective		3	CPE Core[4]		3
Tech Elective[3]		3	CPE Core[4]		3
GEN ED Social/Behavioral Science and Global Perspectives		3	CPE Core[4]		4
			GEN ED Social/Behavioral Science and Cultural Diversity		3
		14			**19**

Total Credits: 127

1

This course requires the student to earn a "C" or better, in order to take upper level ECE courses.

2

Choose from ENGL 320, 321, 324 or 459

3

Choose from the approved Tech Elective list

4

CpE Core Options:

1. **ECE 474 Computer Architecture** (prereq: ECE 374)
2. **ECE 477 Hardware design for Machine Learning** (prereqs: ECE 374 and ECE 375)
3. **ECE 423 VLSI Design** (prereqs: ECE 311 and ECE 321)
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5

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