

B.S. IN COMPUTER ENGINEERING

Overview

Computer engineering is concerned with the characterization, design, analysis and implementation of hardware, software and the overall architecture of computers and computer systems, and with the development of applications enabled by such configurations. This ranges from embedded microprocessors and associated software supporting a variety of familiar devices, to large-scale distributed computer systems interconnected by high-speed telecommunication networks controlled by sophisticated communication protocols. Since modern electronic computing systems are digital in nature, the program provides in-depth coverage of a range of topics dealing with digital information processing systems. Among the topics covered are digital system design, computer organization and architecture, operating systems, software engineering, programming, data structures, algorithms, database systems, microprocessor-based systems, and embedded systems.

The department also offers electives in digital communications, computer networks, wireless and mobile networks, very large scale integration (VLSI), microelectronics, nanotechnology, application specific integrated circuits (ASIC), microelectromechanical systems (MEMS), image processing and computer vision, artificial intelligence, machine learning, data mining, agent technology, and cybersecurity (application, information, network, systems security etc.).

Software Engineering Option

Software Engineering is concerned primarily with the systematic and disciplined approach to developing software systems. It requires the application of both computer engineering and computer science principles and practices to the creation, operation, and maintenance of software systems and applications. The Software Engineering Option of the Bachelor of Science in Computer Engineering degree at the University of Miami is a unique interdisciplinary program developed and administered collaboratively by the Department of Electrical and Computer Engineering and the Department of Computer Science.

This Option prepares students for successful careers in software engineering. Software systems are becoming increasingly complex, and emerging technologies are pushing the boundaries of reusable components and software quality assurance. To prepare students to meet these challenges, this Option establishes a solid foundation of software system fundamentals, coupled with strong hands-on experience and an understanding of professional practice and conduct.

In addition to the core curriculum in software engineering, students are introduced to the paradigms of real-time, adaptive, and collaborative software systems, through a wide range of technical elective courses from both the Department of Electrical and Computer Engineering and the Department of Computer Science. Students may also use courses from other departments with academic advisor approval. The technical electives allow students to apply the knowledge they have gained to different application areas. This provides valuable hands-on experience in contemporary application areas, which enhances the students' potential career development opportunities.

Students pursuing the Software Engineering Option of the Bachelor of Science in Computer Engineering degree must earn at least 15 credit hours in Computer Science as part of their degree requirements.

Pre-Med Option

Our Department offers a pre-medical option that allows motivated students to obtain the rigorous education of a bachelors degree in computer engineering while simultaneously completing the basic science requirements necessary for applying to medical or dental school. Much of the excitement in engineering involves applications of electrical and computer engineering to problems in health, such as the development of nano-scale biosensors, or the signal processing analysis of DNA sequences or the development and/or use of new hardware and software tools to better serve both medical professionals and patients. With the rapid advancement and application of technology in the medical field, the pre-med option ensures that students learn and understand the fundamentals of Electrical and Computer Engineering while preparing them for entry into either medical school, advanced graduate study, or industry.

Curriculum Requirements: B.S. in Computer Engineering

Code	Title	Credit Hours
Common Engineering Requirements		
EGN 123	Computing and Digital Solutions for the future	3
ECE 112	Introduction to Engineering II	2
ECE 118	Introduction to Programming	3
ECE 201	Electrical Circuit Theory	3
ECE 202	Electronics I	3
ECE 203	Electrical Circuits Laboratory	1
ECE 211	Logic Design	3
ECE 212	Processors: Hardware, Software, and Interfacing	3
ECE 218	Data Structures	3
ECE 315	Digital Design Laboratory	1

ECE 316	Structured Digital Design	1
ECE 318	Algorithms	3
ECE 322	Systems Programming	3
ECE 414	Computer Organization and Design	3
ECE 417	Embedded Microprocessor System Design	3
ECE 421	Computer Operating Systems	3
ECE 467	Database Design and Management	3
ECE 481	Senior Project I	1
ECE 482	Senior Project II	2
Engineering and Technical Electives		
ECE 206	Circuits, Signals, and Systems	3
ECE 302	Electronics II	3
ECE 303	Electronics Laboratory	1
ECE 454	Digital System Design and Testing	3
ECE 455	Design-for-Testability Laboratory	1
CE Technical Electives		12
Other Courses		
Math & Basic Science Credit Hours		
ECE 310	Introduction to Engineering Probability	3
MTH 151	Calculus I for Engineers	5
MTH 162	Calculus II	4
MTH 210	Introduction to Linear Algebra	3
MTH 309	Discrete Mathematics I	3
MTH 311	Introduction to Ordinary Differential Equations	3
PHY 221	University Physics I	3
PHY 222	University Physics II	3
or PHY 223	University Physics III	
PHY 224	University Physics II Lab	1
or PHY 225	University Physics III Lab	
Basic Science Elective		3
Basic Science Elective + Lab		4
General Education Requirements		
Written Communication Skills:		
WRS 105	First-Year Writing I	3
WRS 107	First-Year Writing II: STEM	3
Quantitative Skills:		
MTH 151	Calculus I for Engineers (fulfilled through the major)	
Areas of Knowledge:		
Arts and Humanities Cognate		9
People and Society Cognate		9
STEM Cognate (9 credits) (fulfilled through the major)		
Total Credit Hours		129

Curriculum Requirements: B.S. in Computer Engineering - Software Engineering Option

Code	Title	Credit Hours
Common Engineering Requirements		
EGN 123	Computing and Digital Solutions for the future	3
ECE 112	Introduction to Engineering II	2
ECE 118	Introduction to Programming	3
ECE 201	Electrical Circuit Theory	3
ECE 202	Electronics I	3

ECE 203	Electrical Circuits Laboratory	1
ECE 211	Logic Design	3
ECE 212	Processors: Hardware, Software, and Interfacing	3
ECE 218	Data Structures	3
ECE 315	Digital Design Laboratory	1
ECE 316	Structured Digital Design	1
ECE 318	Algorithms	3
ECE 322	Systems Programming	3
ECE 414	Computer Organization and Design	3
ECE 417	Embedded Microprocessor System Design	3
ECE 481	Senior Project I	1
ECE 482	Senior Project II	2
Engineering and Technical Electives		
ECE 412	Software Engineering and Architecture	3
ECE 413	Software Design and Verification	3
ECE 421	Computer Operating Systems	3
or CSC 421	Principles of Computer Operating Systems	
ECE 467	Database Design and Management	3
or CSC 423	Database Systems	
ECE 470	Network Client-Server Programming	3
SE Technical Electives		9
Other Courses		
Computer Science Credit Hours		
CSC 317	Data Structures and Algorithm Analysis	3
CSC 419	Programming Languages	3
Math & Basic Science Credit Hours		
ECE 310	Introduction to Engineering Probability	3
MTH 151	Calculus I for Engineers	5
MTH 162	Calculus II	4
MTH 210	Introduction to Linear Algebra	3
MTH 309	Discrete Mathematics I	3
PHY 221	University Physics I	3
PHY 222	University Physics II	3
or PHY 223	University Physics III	
PHY 224	University Physics II Lab	1
or PHY 225	University Physics III Lab	
Basic Science Elective		3
Basic Science Elective + Lab		4
General Education Requirements		
Written Communication Skills:		
WRS 105	First-Year Writing I	3
WRS 107	First-Year Writing II: STEM	3
Quantitative Skills:		
MTH 151	Calculus I for Engineers (fulfilled through the major)	
Areas of Knowledge:		
Arts and Humanities Cognate		9
People and Society Cognate		9
STEM Cognate (9 credits) (fulfilled through the major)		
Total Credit Hours		127

Curriculum Requirements: B.S. in Computer Engineering Pre-Med Option

Code	Title	Credit Hours
EGN 123	Computing and Digital Solutions for the future	3
ECE 112	Introduction to Engineering II	2
ECE 118	Introduction to Programming	3
ECE 201	Electrical Circuit Theory	3
ECE 202	Electronics I	3
ECE 203	Electrical Circuits Laboratory	1
ECE 211	Logic Design	3
ECE 212	Processors: Hardware, Software, and Interfacing	3
ECE 218	Data Structures	3
ECE 315	Digital Design Laboratory	1
ECE 316	Structured Digital Design	1
ECE 318	Algorithms	3
ECE 322	Systems Programming	3
ECE 414	Computer Organization and Design	3
ECE 417	Embedded Microprocessor System Design	3
ECE 421	Computer Operating Systems	3
ECE 467	Database Design and Management	3
ECE 481	Senior Project I	1
ECE 482	Senior Project II	2
CE Core Elective		3
Engineering and Technical Electives		
CE Elective		6
Other Courses		
Math & Basic Science Credit Hours		
ECE 310	Introduction to Engineering Probability	3
MTH 151	Calculus I for Engineers	5
MTH 162	Calculus II	4
MTH 210	Introduction to Linear Algebra	3
MTH 309	Discrete Mathematics I	3
PHY 221	University Physics I	3
PHY 222	University Physics II	3
PHY 224	University Physics II Lab	1
PHY 223	University Physics III	3
PHY 225	University Physics III Lab	1
Biology and Chemistry Credit Hours		
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
BIL 160	Evolution and Biodiversity	4
BIL 161	Evolution and Biodiversity Laboratory	1
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
CHM 221	Introduction to Structure and Dynamics	4
CHM 205	Chemical Dynamics Laboratory	1
CHM 222	Organic Reactions and Synthesis	4
CHM 206	Organic Reactions and Synthesis Laboratory	1-2
Advanced BioScience Elective		3
General Education Requirements		
Written Communication Skills:		
WRS 105	First-Year Writing I	3
WRS 107	First-Year Writing II: STEM	3

Quantitative Skills:	
MTH 151	Calculus I for Engineers (fulfilled through the major)
Areas of Knowledge:	
Arts and Humanities Cognate	9
People and Society Cognate	9
STEM Cognate (9 credits) (fulfilled through the major)	
Total Credit Hours	137-138

Suggested Plan of Study: B.S. in Computer Engineering

Freshman Year		Credit Hours
Fall		
EGN 123	Computing and Digital Solutions for the future	3
ECE 118	Introduction to Programming	3
WRS 105	First-Year Writing I	3
MTH 151	Calculus I for Engineers	5
Credit Hours		14
Spring		
ECE 112	Introduction to Engineering II	2
ECE 218	Data Structures	3
WRS 107	First-Year Writing II: STEM	3
MTH 162	Calculus II	4
PHY 221	University Physics I	3
Credit Hours		15
Sophomore Year		
Fall		
ECE 211	Logic Design	3
ECE 318	Algorithms	3
MTH 210	Introduction to Linear Algebra	3
PHY 222 or 223	University Physics II (Substitutes PHY 206) or University Physics III	3
PHY 224 or 225	University Physics II Lab or University Physics III Lab	1
Arts and Humanities Cognate ¹		3
Credit Hours		16
Spring		
ECE 201	Electrical Circuit Theory	3
ECE 212	Processors: Hardware, Software, and Interfacing	3
ECE 315	Digital Design Laboratory	1
ECE 310	Introduction to Engineering Probability	3
MTH 309	Discrete Mathematics I	3
People and Society Cognate ¹		3
Credit Hours		16
Junior Year		
Fall		
ECE 202	Electronics I	3
ECE 203	Electrical Circuits Laboratory	1
ECE 316	Structured Digital Design	1
ECE 322	Systems Programming	3
ECE 414	Computer Organization and Design	3
Basic Science Elective ¹		3
Arts and Humanities Cognate ¹		3
Credit Hours		17

Spring		
ECE 302	Electronics II	3
ECE 454	Digital System Design and Testing	3
ECE 455	Design-for-Testability Laboratory	1
ECE 467	Database Design and Management	3
MTH 311	Introduction to Ordinary Differential Equations	3
Basic Science Elective ¹		3
Basic Science Lab Elective ¹		1
Credit Hours		17
Senior Year		
Fall		
ECE 206	Circuits, Signals, and Systems	3
ECE 303	Electronics Laboratory	1
ECE 417	Embedded Microprocessor System Design	3
ECE 481	Senior Project I ²	1
CE Technical Elective ¹		3
People and Society Cognate ¹		3
Arts and Humanities Cognate ¹		3
Credit Hours		17
Spring		
ECE 421	Computer Operating Systems	3
ECE 482	Senior Project II	2
CE Technical Elective ¹		3
CE Technical Elective ¹		3
CE Technical Elective ¹		3
People and Society Cognate ¹		3
Credit Hours		17
Total Credit Hours		129

Suggested Plan of Study: B.S. in Computer Engineering - Software Engineering Option

Freshman Year		
		Credit Hours
Fall		
EGN 123	Computing and Digital Solutions for the future	3
ECE 118	Introduction to Programming	3
WRS 105	First-Year Writing I	3
MTH 151	Calculus I for Engineers	5
Credit Hours		14
Spring		
ECE 112	Introduction to Engineering II	2
ECE 218	Data Structures	3
WRS 107	First-Year Writing II: STEM	3
MTH 162	Calculus II	4
PHY 221	University Physics I	3
Credit Hours		15
Sophomore Year		
Fall		
ECE 211	Logic Design	3
ECE 318	Algorithms	3
MTH 210	Introduction to Linear Algebra	3
PHY 222 or 223	University Physics II (Substitutes PHY 206) or University Physics III	3

PHY 224 or 225	University Physics II Lab or University Physics III Lab	1
Arts and Humanities Cognate ¹		3
	Credit Hours	16
Spring		
ECE 201	Electrical Circuit Theory	3
ECE 212	Processors: Hardware, Software, and Interfacing	3
ECE 310	Introduction to Engineering Probability	3
ECE 315	Digital Design Laboratory	1
MTH 309	Discrete Mathematics I	3
People and Society Cognate ¹		3
	Credit Hours	16
Junior Year		
Fall		
ECE 202	Electronics I	3
ECE 203	Electrical Circuits Laboratory	1
ECE 322	Systems Programming	3
ECE 412	Software Engineering and Architecture	3
ECE 414	Computer Organization and Design	3
Arts and Humanities Cognate ¹		3
	Credit Hours	16
Spring		
ECE 316	Structured Digital Design	1
ECE 413	Software Design and Verification	3
ECE 421 or CSC 421	Computer Operating Systems or Principles of Computer Operating Systems	3
ECE 467 or CSC 423	Database Design and Management or Database Systems	3
Basic Science Elective ²		3
Basic Science Lab Elective ²		1
People and Society Cognate ¹		3
	Credit Hours	17
Senior Year		
Fall		
ECE 417	Embedded Microprocessor System Design	3
ECE 481	Senior Project I ³	1
CSC 317	Data Structures and Algorithm Analysis	3
SE Technical Elective ¹		3
Basic Science Elective ²		3
Arts and Humanities Cognate ¹		3
	Credit Hours	16
Spring		
ECE 470	Network Client-Server Programming	3
ECE 482	Senior Project II	2
CSC 419	Programming Languages	3
SE Technical Elective ¹		3
SE Technical Elective ¹		3
People and Society Cognate ¹		3
	Credit Hours	17
	Total Credit Hours	127

¹ See description of electives under the Departmental Electives Section.

² With advisor approval

³ Offered only in the Fall semester.**Suggested Plan of Study: B.S. in Computer Engineering - Pre-Med Option**

Freshman Year		
Fall		Credit Hours
EGN 123	Computing and Digital Solutions for the future	3
ECE 118	Introduction to Programming	3
WRS 105	First-Year Writing I	3
MTH 151	Calculus I for Engineers	5
Arts and Humanities Cognate ¹		3
	Credit Hours	17
Spring		
ECE 112	Introduction to Engineering II	2
ECE 218	Data Structures	3
WRS 107	First-Year Writing II: STEM	3
MTH 162	Calculus II	4
PHY 221	University Physics I	3
People and Society Cognate ¹		3
	Credit Hours	18
Sophomore Year		
Fall		
ECE 211	Logic Design	3
ECE 318	Algorithms	3
CHM 121	Principles of Chemistry	4
CHM 113	Chemistry Laboratory I	1
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
	Credit Hours	16
Spring		
ECE 201	Electrical Circuit Theory	3
ECE 212	Processors: Hardware, Software, and Interfacing	3
MTH 210	Introduction to Linear Algebra	3
PHY 222	University Physics II	3
PHY 224	University Physics II Lab	1
BIL 160	Evolution and Biodiversity	4
BIL 161	Evolution and Biodiversity Laboratory	1
	Credit Hours	18
Junior Year		
Fall		
ECE 315	Digital Design Laboratory	1
ECE 322	Systems Programming	3
ECE 414	Computer Organization and Design	3
MTH 309	Discrete Mathematics I	3
PHY 223	University Physics III	3
CHM 221	Introduction to Structure and Dynamics	4
CHM 205	Chemical Dynamics Laboratory	1
	Credit Hours	18
Spring		
ECE 202	Electronics I	3
ECE 203	Electrical Circuits Laboratory	1
ECE 310	Introduction to Engineering Probability	3

ECE 316	Structured Digital Design	1
ECE 467	Database Design and Management	3
PHY 225	University Physics III Lab	1
CHM 222	Organic Reactions and Synthesis	4
CHM 206	Organic Reactions and Synthesis Laboratory	2
Credit Hours		18
Senior Year		
Fall		
ECE 417	Embedded Microprocessor System Design	3
ECE 481	Senior Project I ²	1
CE Core Elective ¹		3
Advanced Bioscience Elective ¹		3
People and Society Cognate ¹		3
Arts and Humanities Cognate ¹		3
Credit Hours		16
Spring		
ECE 421	Computer Operating Systems	3
ECE 482	Senior Project II	2
CE Elective ¹		3
CE Elective ¹		3
People and Society Cognate ¹		3
Arts and Humanities Cognate ¹		3
Credit Hours		17
Total Credit Hours		138

¹ See description of electives under the Departmental Electives Section.

² Offered only in the Fall semester.

Mission

The mission of the Department of Electrical and Computer Engineering is to achieve and maintain, through a continuous improvement process, excellence in undergraduate and graduate education, research, and service to the community and the nation. We endeavor to accomplish this by providing high-quality education and research programs which will impart the requisite knowledge and skills to our students enabling them to assume leadership roles in contributing to the advancement of the underlying electrical and computer engineering technologies which sustain the current world economy, to promote a strong commitment to life-long learning, to prepare them for a variety of alternative career paths and to participate as responsible citizens in a rapidly changing and shrinking global community.

Program Educational Objectives

We expect that the alumni of the Computer Engineering Program will exhibit the following:

1. Successful careers in dynamic and multidisciplinary fields with the ability to apply computer engineering practices within societal, global, and environmental contexts in an ethical manner.
2. Demonstrating life-long learning through activities such as completion of graduate degrees and/or professional development.

Student Learning Outcomes

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. 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.
3. An ability to communicate effectively with a range of audiences.
4. 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.
5. 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.

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.