## **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

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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:	, <u>,</u>	
Arts and Humanities Cognate		9
People and Society Cognate		9
STEM Cognate (9 credits) (fulfilled through the major)		
Total Credit Hours		129
rotal Orealt 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 211	ECE 203	Electrical Circuits Laboratory	1
ECE 212   Processors: Hardware, Software, and Interfacing   3   1   1   1   1   1   1   1   1   1	ECE 211		3
ECE 218   Data Structures   S   ECE 218   Digital Design Laboratory   1	ECE 212		
ECE 315   Digital Design Laboratory   1   1   1   1   1   1   1   1   1	ECE 218	Data Structures	
ECE 318	ECE 315	Digital Design Laboratory	
ECE 2322         Systems Programming         3           ECE 414         Computer Organization and Design         3           ECE 481         Senior Project II         1           ECE 4812         Senior Project II         1           ECE 4822         Senior Project II         1           ECE 482         Senior Project II         3           ECE 412         Software Design and Verification         3           ECE 413         Software Design and Verification         3           ECE 421         Computer Operating Systems         3           ECE 427         Or CSC 421         Principles of Computer Operating Systems         3           ECE 467         Database Systems         6           EC 470         Network Client-Server Programming         3           SE Technical Electives         Jet Structures and Algorithm Analysis         3           SE Technical Electives         Jet Structures and Algorithm Analysis         3           SE Technical Electives         Jet Structures and Algorithm Analysis         3           SE Technical Electives         Jet Structures and Algorithm Analysis         3           SE Technical Elective Electiv	ECE 316	Structured Digital Design	1
ECE 414         Computer Organization and Design         3           ECE 417         Embedded Microprocessor System Design         3           ECE 481         Senior Project II         1           ECE 482         Senior Project II         2           ECE 482         Software Engineering and Architecture         3           ECE 412         Software Design and Verification         3           ECE 413         Computer Operating Systems         3           ECE 421         Computer Operating Systems         3           ECE 427         Database Design and Management         3           5 or CSC 423         Database Systems         3           ECE 470         Network Client-Server Programming         3           SE Technical Electives         5           Other Courses         5           Computer Science Credit Hours         3           SCS 317         Data Structures and Algorithm Analysis         3           SCS 419         Programming Languages         3           Math & Basic Science Credit Hours         3           ECE 310         Introduction to Engineering Probability         3           MTH 151         Calculus I         4           MTH 162         Calculus I         3	ECE 318	Algorithms	3
ECE 414         Computer Organization and Design         3           ECE 417         Embedded Microprocessor System Design         3           ECE 481         Senior Project II         1           ECE 482         Senior Project II         2           ECE 482         Software Engineering and Architecture         3           ECE 412         Software Design and Verification         3           ECE 413         Computer Operating Systems         3           ECE 421         Computer Operating Systems         3           ECE 427         Database Design and Management         3           5 or CSC 423         Database Systems         3           ECE 470         Network Client-Server Programming         3           SE Technical Electives         5           Other Courses         5           Computer Science Credit Hours         3           SCS 317         Data Structures and Algorithm Analysis         3           SCS 419         Programming Languages         3           Math & Basic Science Credit Hours         3           ECE 310         Introduction to Engineering Probability         3           MTH 151         Calculus I         4           MTH 162         Calculus I         3	ECE 322	Systems Programming	3
ECE 481         Senior Project I         2           ECE 482         Senior Project II         2           Engineering and Technical Electives         2           ECE 412         Software Design and Verification         3           ECE 413         Computer Operating Systems         3           or CSC 421         Principles of Computer Operating Systems         3           CEE 447         Database Design and Management         3           or CSC 423         Database Systems         9           ECE 470         Network Client-Server Programming         3           SE Technical Electives         9           Other Courses           Computer Science Credit Hours           SE Technical Electives           Operamming Languages         3           Associated Elective Server Programming Languages         3           Operamming Languages         3           Associated Elective Hours           ECE 410         Introduction to Engineering Probability         3           Math 8 Basic Science Credit Hours         3           CEC 419         Programming Languages         3           MTH 151         Calculus I for Engineers Alge	ECE 414	Computer Organization and Design	3
ECE 481         Senior Project I         2           ECE 482         Senior Project II         2           Engineering and Technical Electives         2           ECE 412         Software Design and Verification         3           ECE 413         Computer Operating Systems         3           or CSC 421         Principles of Computer Operating Systems         3           CEE 447         Database Design and Management         3           or CSC 423         Database Systems         9           ECE 470         Network Client-Server Programming         3           SE Technical Electives         9           Other Courses           Computer Science Credit Hours           SE Technical Electives           Operamming Languages         3           Associated Elective Server Programming Languages         3           Operamming Languages         3           Associated Elective Hours           ECE 410         Introduction to Engineering Probability         3           Math 8 Basic Science Credit Hours         3           CEC 419         Programming Languages         3           MTH 151         Calculus I for Engineers Alge	ECE 417	Embedded Microprocessor System Design	
Engineering and Technical Electives         3           ECE 412         Software Design and Architecture         3           ECE 413         Software Design and Verification         3           ECE 421         Computer Operating Systems         3           or CSC 421         Principles of Computer Operating Systems         6           ECE 467         Database Design and Management         3           or CSC 423         Database Systems         8           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           MRH Basic Science Credit Hours         3           CSC 419         Programming Languages         3           MRH Basic Science Credit Hours         3           CE 310         Introduction to Engineering Probability         3           MRH Basic Science Credit Hours         3           CE 310         Introduction to Engineering Probability         3           MRH B	ECE 481	Senior Project I	
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         3           ECE 467         Database Design and Management         3           or CSC 423         Database Systems         9           ECE 470         Network Client-Server Programming         3           SE Technical Electives         9           Other Courses         9           Computer Science Credit Hours         2           CSC 317         Data Structures and Algorithm Analysis         3           CSC 419         Programming Languages         3           Math & Basic Science Credit Hours         3           CSC 319         Introduction to Engineering Probability         3           MTH 151         Calculus I for Engineers         5           MTH 162         Calculus I for Engineering Probability         3           MTH 210         Introduction to Linear Algebra         3           MTH 309         Discrete Mathematics I         3           PHY 221         University Physics II         3           PHY 222         Universit	ECE 482	Senior Project II	2
ECE 413         Software Design and Verification         3           ECE 421         Computer Operating Systems         3           or CSC 421         Principles of Computer Operating Systems         3           ECE 467         Database Design and Management         3           or CSC 423         Database Systems         5           ECE 470         Network Client-Server Programming         3           SE Technical Electives         9           Other Courses         9           Computer Science Credit Hours         5           CSC 317         Data Structures and Algorithm Analysis         3           CSC 419         Programming Languages         3           Math & Basic Science Credit Hours         5           CEG 310         Introduction to Engineering Probability         3           CSC 419         Programming Languages         3           MTH 151         Calculus I for Engineers         5           MTH 162         Calculus I for Engineers         5           MTH 201         Introduction to Linear Algebra         3           MTH 202         University Physics I         3           PHY 221         University Physics II         3           PHY 222         University Physics II         4<	Engineering and Technical Electives		
ECE 413         Software Design and Verification         3           ECE 421         Computer Operating Systems         3           or CSC 421         Principles of Computer Operating Systems         5           ECE 467         Database Design and Management         3           or CSC 423         Database Systems         5           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           CEC 310         Introduction to Engineering Probability         3           CSC 419         Calculus I for Engineers         5           MTH 151         Calculus I for Engineers         5           MTH 162         Calculus I for Engineers         4           MTH 20         University Physics I         3           MTH 210         Introduction to Linear Algebra         3           MTH 309         Discrete Mathematics I         3           9 YHY 221         University Physics II         3	ECE 412	Software Engineering and Architecture	3
For CSC 421         Principles of Computer Operating Systems           ECE 467         Database Design and Management           30 r 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 If for Engineers         5           MTH 162         Calculus I for Engineers         5           MTH 190         Introduction to Linear Algebra         3           MTH 190         Discrete Mathematics I         3           MTH 221         University Physics II         3           PHY 222         University Physics III         3           Or PHY 223         University Physics III Lab         1           A PHY 225         University Physics III Lab         1           A PHY 225 </td <td>ECE 413</td> <td>Software Design and Verification</td> <td></td>	ECE 413	Software Design and Verification	
ECE 467         Database Design and Management         3           or CSC 423         Database Systems         3           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 I         4           MTH 210         Introduction to Linear Algebra         3           MTH 309         Discrete Mathematics I         3           MTH 221         University Physics II         3           PHY 222         University Physics II         3           Or PHY 223         University Physics II Lab         1           HY 224         University Physics II Lab         1           MTH 25         University Physics III Lab         3           Basic Science Elective Lab         4         4 <t< td=""><td>ECE 421</td><td>Computer Operating Systems</td><td>3</td></t<>	ECE 421	Computer Operating Systems	3
FOE 470         Network Client-Server Programming         3           SE Technical Electives         9           Other Courses           Computer Science Credit Hours           CSC 317         Data Structures and Algorithm Analysis         3           SCS 419         Programming Languages         3           Math & Basic Science Credit Hours           ECE 310         Introduction to Engineering Probability         3           MTH 515         Calculus I for Engineers         5           MTH 162         Calculus I Introduction to Linear Algebra         4           MTH 309         Discrete Mathematics I         3           MTH 309         Discrete Mathematics I         3           PHY 221         University Physics II         3           PHY 222         University Physics III         3           PHY 223         University Physics III Lab         1           Or PHY 225         University Physics III Lab         1           Or PHY 225         University Physics III Lab         3           Basic Science Elective + Lab         4           General Education Requirements      <	or CSC 421	Principles of Computer Operating 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 II       3         PHY 222       University Physics II       3         or PHY 223       University Physics III Lab       1         or PHY 225       University Physics III Lab       1         Basic Science Elective       3         Basic Science Elective Lab       4         General Education Requirements       3         Written Communication Skills:       3         WRS 107       First-Year Writing I       3         WRS 107       First-Year Writing II: STEM       3         Quantitative Skills:       4	ECE 467	Database Design and Management	3
SE Technical Electives         9           Other Courses         Computer Science Credit Hours         3           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 210         Introduction to Linear Algebra         3           MTH 309         Discrete Mathematics I         3           PHY 221         University Physics I         3           PHY 222         University Physics III         3           or PHY 223         University Physics III Lab         1           or PHY 225         University Physics III Lab         1           or PHY 225         University Physics III Lab         1           Basic Science Elective + Lab         4           General Education Requirements         4           Written Communication Skills:         3           Written Communication Skills:         3           Written Communication Skills:         3           Written Communication Skills:         3           Written Communication Skills:	or CSC 423		
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 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 II Lab         1           or PHY 225         University Physics III Lab         1           saic Science Elective         3           Basic Science Elective + Lab         4           General Education Requirements         4           Written Communication Skills:         3           Written Comm	ECE 470	Network Client-Server Programming	3
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 MTH 210 Introduction to Linear Algebra 3 MTH 309 Discrete Mathematics I 3 PHY 221 University Physics II 3 PHY 222 University Physics II 3 Or PHY 223 University Physics III BY 224 University Physics III Lab Or PHY 255 Basic Science Elective + Lab General Education Requirements Written Communication Skills: Written Communication Skills: Written Skills: MTH 151 Areas of Knowledge: Areas of Knowledge (9 credits) (fulfilled through the major)  STEM Cognate (9 credits) (fulfilled through the major)	SE Technical Electives		
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 II       3         PHY 222       University Physics III       3         Or PHY 223       University Physics II Lab       1         PHY 224       University Physics II Lab       1         Or PHY 225       University Physics III Lab       3         Basic Science Elective + Lab       4         General Education Requirements         Witten Communication Skills:         WRS 105       First-Year Writing I       3         WRS 107       First-Year Writing II: STEM       3         WRS 107       First-Year Writing II: STEM       3         WRS 107       Calculus I for Engineers (fulfilled thr	Other Courses		
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 210       Introduction to Linear Algebra       3         MTH 309       Discrete Mathematics I       3         PHY 221       University Physics I       3         PHY 222       University Physics III       3         Or PHY 223       University Physics II Lab       1         Or PHY 225       University Physics III Lab       1         Dasic 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:         Areas of Knowledge:         Areas of Knowledge:         Area and Humanities Cognate       9	Computer Science Credit Hours		
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 II       3         PHY 222       University Physics III       4         Or PHY 223       University Physics III Lab       1         Or PHY 225       University Physics III Lab       1         Basic Science Elective + Lab       4         General Education Requirements       3         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:       4       9         Arts and Humanities Cognate       9         People and Society Cognate       9         STEM Cognate (9 credits) (fulfilled through the major)	CSC 317	Data Structures and Algorithm Analysis	3
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 University Physics II 3 PHY 222 University Physics II 3 Or PHY 223 University Physics III Lab 1 Or PHY 224 University Physics III Lab 1 Or PHY 225 University Physics III Lab 1 Or PHY 226 University Physics III Lab 1 Or PHY 227 University Physics III Lab 1 Or PHY 228 University Physics III Lab 1 Or PHY 25 University Physics III Lab 3 Basic Science Elective Lab 3 Basic Science Elective + Lab 5 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 People and Society Cognate 9 STEM Cognate (9 credits) (fulfilled through the major)	CSC 419	Programming Languages	
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       1         or PHY 224       University Physics II Lab       1         or PHY 225       University Physics III Lab       1         Basic Science Elective       3         Basic Science Elective + Lab       4         General Education Requirements       4         Written Communication Skills:       3         WRS 105       First-Year Writing I       3         WRS 107       First-Year Writing II: STEM       3         Quantitative Skills:       3         MTH 151       Calculus I for Engineers (fulfilled through the major)         Areas of Knowledge:       9         Arts and Humanities Cognate       9         People and Society Cognate       9         STEM Cognate (9 credits) (fulfilled through the major)	Math & Basic Science Credit Hours		
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 III       3         or PHY 223       University Physics III Lab       1         or PHY 225       University Physics III Lab       1         or PHY 225       University Physics III Lab       3         Basic Science Elective       4         General Education Requirements       3         Written Communication Skills:       Written Communication Skills:         WRS 105       First-Year Writing I       3         WRS 107       First-Year Writing II: STEM       3         Quantitative Skills:       3         MTH 151       Calculus I for Engineers (fulfilled through the major)         Areas of Knowledge:       9         Arts and Humanities Cognate       9         People and Society Cognate       9         STEM Cognate (9 credits) (fulfilled through the major)	ECE 310	Introduction to Engineering Probability	3
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 II Lab       1         or PHY 225       University Physics III Lab       1         sasic Science Elective       3         Basic Science Elective + Lab       4         General Education Requirements       4         Written Communication Skills:       WRS 105         WRS 105       First-Year Writing I       3         WRS 107       First-Year Writing II: STEM       3         Quantitative Skills:       WR 151       Calculus I for Engineers (fulfilled through the major)         Areas of Knowledge:       9         Arts and Humanities Cognate       9         People and Society Cognate       9         STEM Cognate (9 credits) (fulfilled through the major)	MTH 151	Calculus I for Engineers	5
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 II Lab 1 or PHY 226 University Physics III Lab 1 saic Science Elective University Physics III 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)	MTH 162	Calculus II	4
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 II Lab 1 or PHY 226 University Physics III Lab 1 saic Science Elective University Physics III 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)	MTH 210	Introduction to Linear Algebra	3
PHY 222 University Physics II University Physics III University Physics III University Physics III University Physics II Lab I University Physics II Lab I University Physics III Lab I Lab III L	MTH 309	Discrete Mathematics I	3
PHY 222 University Physics II University Physics III University Physics III University Physics III University Physics II Lab I University Physics II Lab I University Physics III Lab I Lab III L	PHY 221	University Physics I	3
PHY 224 University Physics II Lab or PHY 225 University Physics III Lab Basic Science Elective Basic Science Elective + Lab 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 5 STEM Cognate (9 credits) (fulfilled through the major)	PHY 222	University Physics II	
or PHY 225 University Physics III Lab  Basic Science Elective Basic Science Elective + Lab Basic Science Elective + Lab 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 People and Society Cognate STEM Cognate (9 credits) (fulfilled through the major)	or PHY 223	University Physics III	
Basic Science Elective + Lab  General Education Requirements  Written Communication Skills:  WRS 105  WRS 107  First-Year Writing I  Quantitative Skills:  MTH 151  Calculus I for Engineers (fulfilled through the major)  Areas of Knowledge:  Arts and Humanities Cognate  People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	PHY 224	University Physics II Lab	1
Basic Science Elective + Lab  General Education Requirements  Written Communication Skills:  WRS 105  First-Year Writing I  WRS 107  First-Year Writing II: STEM  Quantitative Skills:  MTH 151  Calculus I for Engineers (fulfilled through the major)  Areas of Knowledge:  Arts and Humanities Cognate  People and Society Cognate  9  STEM Cognate (9 credits) (fulfilled through the major)	or PHY 225	University Physics III Lab	
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)	Basic Science Elective		3
Written Communication Skills:  WRS 105 First-Year Writing I  WRS 107 First-Year Writing II: STEM  Quantitative Skills:  MTH 151 Calculus I for Engineers (fulfilled through the major)  Areas of Knowledge:  Arts and Humanities Cognate People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	Basic Science Elective + Lab		4
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)	General Education Requirements		
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  People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	Written Communication Skills:		
Quantitative Skills:  MTH 151  Calculus I for Engineers (fulfilled through the major)  Areas of Knowledge:  Arts and Humanities Cognate  People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	WRS 105	First-Year Writing I	3
MTH 151 Calculus I for Engineers (fulfilled through the major)  Areas of Knowledge: Arts and Humanities Cognate People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	WRS 107	First-Year Writing II: STEM	3
Areas of Knowledge: Arts and Humanities Cognate  People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	Quantitative Skills:		
Arts and Humanities Cognate  People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	MTH 151	Calculus I for Engineers (fulfilled through the major)	
People and Society Cognate  STEM Cognate (9 credits) (fulfilled through the major)	Areas of Knowledge:		
STEM Cognate (9 credits) (fulfilled through the major)	Arts and Humanities Cognate		9
	People and Society Cognate		9
Total Credit Hours 127	STEM Cognate (9 credits) (fulfilled through the major)		
	Total Credit Hours		127

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

0.1.		O Pa 11
Code EGN 123	Title	Credit Hours
	Computing and Digital Solutions for the future Introduction to Engineering II	3
ECE 112		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

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

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

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

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 <sup>1</sup>		3
Basic Science Lab Elective <sup>1</sup>		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 <sup>2</sup>	1
CE Technical Elective <sup>1</sup>		3
People and Society Cognate 1		3
Arts and Humanities Cognate <sup>1</sup>		3
	Credit Hours	17
Spring		
ECE 421	Computer Operating Systems	3
ECE 482	Senior Project II	2
CE Technical Elective <sup>1</sup>		3
CE Technical Elective <sup>1</sup>		3
CE Technical Elective <sup>1</sup>		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		
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
	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  Arts and Humanities Cognate   Spring	University Physics II Lab or University Physics III Lab	1
	or University Physics III Lab	
Spring	One distriction	3
Shring	Credit Hours	16
	FI - 1 - 101 - 11 - 11	
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 <sup>1</sup>	- P. II	3
	Credit Hours	16
Junior Year		
Fall	Floring I	0
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 <sup>1</sup>	- P. II	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 <sup>2</sup>		3
Basic Science Lab Elective <sup>2</sup>		1
People and Society Cognate <sup>1</sup>		3
	Credit Hours	17
Senior Year		
Fall		
ECE 417	Embedded Microprocessor System Design	3
ECE 481	Senior Project I <sup>3</sup>	1
CSC 317	Data Structures and Algorithm Analysis	3
SE Technical Elective <sup>1</sup>		3
Basic Science Elective <sup>2</sup>		3
Arts and Humanities Cognate <sup>1</sup>		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 <sup>1</sup>		3
SE Technical Elective <sup>1</sup>		3
People and Society Cognate <sup>1</sup>		3
	Credit Hours	17
	Total Credit Hours	127

See description of electives under the Departmental Electives Section.

With advisor approval

# 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	
ECE 118		3
WRS 105	Introduction to Programming  First-Year Writing I	3
MTH 151	-	3 5
_	Calculus I for Engineers	
Arts and Humanities Cognate <sup>1</sup>	On Patterns	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
I	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	٦

<sup>&</sup>lt;sup>3</sup> Offered only in the Fall semester.

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 <sup>2</sup>	1
CE Core Elective <sup>1</sup>		3
Advanced Bioscience Elective <sup>1</sup>		3
People and Society Cognate <sup>1</sup>		3
Arts and Humanities Cognate <sup>1</sup>		3
	Credit Hours	16
Spring		
ECE 421	Computer Operating Systems	3
ECE 482	Senior Project II	2
CE Elective <sup>1</sup>		3
CE Elective <sup>1</sup>		3
People and Society Cognate 1		3
Arts and Humanities Cognate <sup>1</sup>		3
	Credit Hours	17
	Total Credit Hours	138

See description of electives under the Departmental Electives Section.

### **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:

- 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.

Offered only in the Fall semester.

#### B.S. in Computer Engineering

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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.