

# Bachelor of Science in Computer Engineering

## Computer Engineering (BSCE)

Lee A. Belfore II, Chief Departmental Advisor

The computer engineering undergraduate degree program, available in both synchronous online and face-to-face formats, is designed to provide both a broad engineering background and a comprehensive foundation in the technical principles underlying the computer area. Students develop a background through course work in mathematics, the basic sciences, and general engineering. The technical core consists of course work from electrical engineering to address hardware aspects of computer engineering and course work from computer science to address software aspects.

There are two majors available in the Bachelor of Science in Computer Engineering degree: Computer Engineering major and Modeling & Simulation Engineering major. Adequate elective freedom is available to students in each major. The Computer Engineering major has a built-in minor in computer science, and four technical electives allow for specialization in one or more of four additional areas: computer hardware systems, computer networks, cyber security, or data analytics engineering. The Modeling and Simulation major allows students to select three technical elective courses. In addition, course work in General Education Skills and Ways of Knowing is required to assure a well-rounded program of study.

Students pursuing a Bachelor of Science in Computer Engineering degree (BSCE) are intended in their degree until Engineering Fundamental/foundational courses (I.E. Calculus I & II, Calculus-based University Physics I, Programming I, Chemistry I, and Engineering introductory courses) are completed.

### Computer Engineering Program Educational Objectives

The computer engineering program seeks to prepare graduates who, after the first few years of their professional career, have:

1. established themselves as practicing engineering professionals in industry or government, or engaged in graduate study
2. demonstrated their ability to work successfully as members of a professional team and function effectively as responsible professionals
3. demonstrated their ability to adapt to new technology and career challenges.

### Student Outcomes

The computer engineering student outcomes are as follows. Graduates must attain:

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.

### Accreditation

The Bachelor of Science in Computer Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>. (<http://www.abet.org>)

### Requirements

#### Lower-Division General Education

Written Communication ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#written">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#written</a> )	6
Oral Communication ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#oral">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#oral</a> )	3
Mathematics ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#math">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#math</a> )	3
Language and Culture ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#language">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#language</a> )	0-6
Information Literacy and Research ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#information">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#information</a> )	3
Human Behavior ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#behavior">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#behavior</a> )	3
Human Creativity ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#creativity">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#creativity</a> )	3
Interpreting the Past ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#interpret">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#interpret</a> )	3
Literature ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#literature">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#literature</a> )	3
Philosophy and Ethics ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#philosophy">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#philosophy</a> )	3
The Nature of Science ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#nature">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#nature</a> )	8
Impact of Technology ( <a href="http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#impact">http://catalog.odu.edu/undergraduate/requirements-undergraduate-degrees/#impact</a> )	3

The General Education requirements in information literacy and research, impact of technology, and philosophy and ethics are met through the major. The upper-division General Education requirement is met through a built-in minor in Computer Science.

#### Upper-Division General Education

Met in the major through a built-in minor in computer science.

#### Requirements for Graduation

Requirements for graduation include the following:

- Minimum of 120 credit hours.
- Minimum of 30 credit hours overall and 12 credit hours of upper-level courses in the major program from Old Dominion University.
- Minimum overall cumulative grade point average of C (2.00) in all courses taken.
- Minimum overall cumulative grade point average of C (2.00) in all courses taken toward the major.
- Minimum overall cumulative grade point average of C (2.00) in all courses taken toward a minor.
- Completion of ENGL 110C, ENGL 211C or ENGL 231C, and the writing intensive (W) course in the major with a grade of C or better. The W course must be taken at Old Dominion University.
- Completion of Senior Assessment.

# Computer Engineering

Computer Engineering majors must earn a grade of C or better in all 200-level ECE courses and all CS courses prior to taking the next course in the sequence.

Any ECE course registration issues are to be resolved with the ECE Academic Coordinator and Program Manager.

## General Education

Complete lower-division requirements	33-39
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Complete upper-division requirements (satisfied in the major through a built-in minor in computer science)

## Computer Engineering Major

Complete computer engineering departmental and major requirements as shown on the degree program guide	89
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<b>Total Credit Hours</b>	<b>122-128</b>
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## Computer Engineering Areas of Specialization

Students in the Bachelor of Science in Computer Engineering degree program may focus their studies in one or more specialized areas by electing to take courses in computer hardware systems, computer networks, cyber security, or data analytics engineering.

The computer hardware systems area requires completion of four courses selected from the following: ECE 341, ECE 346, ECE 441, ECE 443, and ECE 483.

The computer networks area requires completion of the following four courses: ECE 355, ECE 451, ECE 452, and ECE 455.

The cyber security area requires completion of four courses selected from the following: ECE 346, ECE 355, ECE 416, ECE 419, ECE 455, ECE 470 and ECE 483.

The data analytics engineering area requires completion of the following four courses: ECE 350, ECE 441, ECE 445, and ECE 450.

## Degree Program Guide\*

The Degree Program Guide is a suggested curriculum to complete this degree program in four years. It is just one of several plans that will work and is presented only as broad guidance to students. Each student is strongly encouraged to develop a customized plan in consultation with their academic advisor. Additional information can also be found in Degree Works.

## Computer Engineering (BSCE)

Course	Title	Credit Hours
<b>Freshman</b>		
<b>Fall</b>		
ENGN 121	Introduction to Engineering and Technology	4
CHEM 121N	Foundations of Chemistry I Lecture	3
CHEM 122N or CHEM 120	Foundations of Chemistry I Laboratory ** or Foundations of Chemistry I Laboratory for Online Degree Programs	1
MATH 211	Calculus I (Grade of C or better required)	4
ENGL 110C	English Composition (Grade of C or better required)	3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ENGN 122	Computer Programming for Engineering	4
MATH 212	Calculus II (Grade of C or better required)	4

COMM 101R	Public Speaking	3
PHYS 231N	University Physics I	4
<b>Credit Hours</b>		<b>15</b>
<b>Sophomore</b>		
<b>Fall</b>		
MATH 307 or MATH 280	Ordinary Differential Equations or Transfer Credit for Ordinary Differential Equations	3
ECE 201	Circuit Analysis I	3
ECE 241	Fundamentals of Computer Engineering	4
PHYS 232N	University Physics II	4
ECE 250	Object-Oriented Programming in C++ for Engineers	3
<b>Credit Hours</b>		<b>17</b>
<b>Spring</b>		
ECE 202	Circuit Analysis II	3
ECE 287	Fundamental Electric Circuit Laboratory	2
ENGL 231C or ENGL 211C	Writing, Rhetoric, and Research: Special Topics (Grade of C or better required) or Writing, Rhetoric, and Research	3
CS 252	Introduction to Unix for Programmers	1
CS 261	Java for Programmers	1
CS 381	Introduction to Discrete Structures	3
Literature Way of Knowing		3
<b>Credit Hours</b>		<b>16</b>
<b>Junior</b>		
<b>Fall</b>		
ECE 302 or ECE 306 or ECE 350 or ECE 314		3
ECE 304	Probability, Statistics, and Reliability	3
ECE 341	Digital System Design	3
CS 361	Data Structures and Algorithms	3
Human Creativity Way of Knowing		3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ECE 355	Introduction to Networks and Data Communications	3
ECE 342	Field Programmable Gate Arrays Design Laboratory	2
ECE 346	Microcontrollers	3
ECE 381	Introduction to Discrete-time Signal Processing	3
CS 350 or CS 330	Introduction to Software Engineering or Object-Oriented Design and Programming	3
Technical Elective ***		3
<b>Credit Hours</b>		<b>17</b>

<b>Senior</b>		
<b>Fall</b>		
ECE 481W	Preparatory ECE Senior Design (Grade of C or better required)	3
ECE 443	Computer Architecture	3
Technical Elective ***		3
ENMA 480	Ethics and Philosophy in Engineering Applications	3
Interpreting the Past Way of Knowing		3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ECE 482	ECE Senior Design	3
CS 471	Operating Systems	3
Technical Elective ***		3
Human Behavior Way of Knowing		3
<b>Credit Hours</b>		<b>12</b>
<b>Total Credit Hours</b>		<b>122</b>

- \* Does not include the University's General Education language and culture requirement. Additional hours may be required.
- \*\* CHEM 120 is for online program students only.
- \*\*\* Computer Engineering major students need three technical elective courses selected from one of three options: (1) three 400-level ECE technical elective courses; (2) two 400-level ECE technical elective courses and one 300-level ECE technical elective course or one approved 300- or 400-level CS/MATH/Engineering course; (3) two 400-level ECE technical elective courses and one approved 300- or 400-level CS course or one approved 300- or 400-level CS/MATH/Engineering course.

## Computer Engineering Major (BSCE) Dual Degree with Computer Science (BSCS)

Course	Title	Credit Hours
<b>Freshman</b>		
<b>Fall</b>		
ENGN 121	Introduction to Engineering and Technology <sup>2</sup>	4
CHEM 121N	Foundations of Chemistry I Lecture	3
CHEM 122N or CHEM 120	Foundations of Chemistry I Laboratory <sup>1</sup> or Foundations of Chemistry I Laboratory for Online Degree Programs	1
MATH 211	Calculus I (Grade of C or better required)	4
ENGL 110C	English Composition (Grade of C or better required)	3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ENGN 122	Computer Programming for Engineering <sup>3</sup>	4
Human Creativity Way of Knowing		3
MATH 212	Calculus II (Grade of C or better required)	4
PHYS 231N	University Physics I	4
<b>Credit Hours</b>		<b>15</b>

<b>Sophomore</b>		
<b>Fall</b>		
MATH 307 or MATH 280	Ordinary Differential Equations or Transfer Credit for Ordinary Differential Equations	3
ECE 201	Circuit Analysis I	3
PHYS 232N	University Physics II	4
ENGL 211C or ENGL 231C	Writing, Rhetoric, and Research (Grade of C or better required) or Writing, Rhetoric, and Research: Special Topics	3
ECE 250	Object-Oriented Programming in C++ for Engineers	3
<b>Credit Hours</b>		<b>16</b>
<b>Spring</b>		
ECE 202	Circuit Analysis II	3
ECE 287	Fundamental Electric Circuit Laboratory	2
CS 252	Introduction to Unix for Programmers	1
CS 261	Java for Programmers	1
COMM 101R	Public Speaking	3
CS 381	Introduction to Discrete Structures	3
Human Behavior Way of Knowing		3
<b>Credit Hours</b>		<b>16</b>
<b>Junior</b>		
<b>Fall</b>		
ECE 241	Fundamentals of Computer Engineering	4
ECE 302 or ECE 306 or ECE 314 or ECE 350		3
CS 330	Object-Oriented Design and Programming	3
CS 390	Introduction to Theoretical Computer Science	3
CS 315	Computer Science Undergraduate Colloquium	1
Literature Way of Knowing		3
<b>Credit Hours</b>		<b>17</b>
<b>Spring</b>		
ECE 355	Introduction to Networks and Data Communications	3
ECE 341	Digital System Design	3
ECE 381	Introduction to Discrete-time Signal Processing	3
CS 361	Data Structures and Algorithms	3
CS 450 or CS 418	Database Concepts or Web Programming	3
<b>Credit Hours</b>		<b>15</b>
<b>Senior</b>		
<b>Fall</b>		
MATH 316	Introductory Linear Algebra	3
ECE 304	Probability, Statistics, and Reliability <sup>4</sup>	3
CS 350	Introduction to Software Engineering	3

ENMA 480	Ethics and Philosophy in Engineering Applications <sup>5</sup>	3
ECE Technical Elective I <sup>6</sup>		3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ECE 346	Microcontrollers <sup>7</sup>	3
CS 417	Computational Methods and Software	3
CS 355	Principles of Programming Languages	3
CS Upper Level Elective I		3
Interpreting the Past Way of Knowing		3
<b>Credit Hours</b>		<b>15</b>
<b>Fifth Year</b>		
<b>Fall</b>		
ECE 342	Field Programmable Gate Arrays Design Laboratory	2
ECE 481W	Preparatory ECE Senior Design (Grade of C or better required to meet the University Writing Intensive requirement)	3
ECE 443	Computer Architecture <sup>8</sup>	3
CS 410	Professional Workforce Development I	3
CS Upper Level Elective II		3
<b>Credit Hours</b>		<b>14</b>
<b>Spring</b>		
ECE 482	ECE Senior Design	3
CS 471	Operating Systems	3
CS 411W	Professional Workforce Development II (Grade of C or better required to meet the University Writing Intensive requirement)	3
CS Upper Level Elective III		3
ECE Technical Elective II <sup>6</sup>		3
<b>Credit Hours</b>		<b>15</b>
<b>Total Credit Hours</b>		<b>153</b>

- \* Does not include the University's General Education language and culture requirement. Additional hours may be required.
- 1 CHEM 120 is for online program students only.
- 2 ENGN 121 satisfies the Computer Science Information Literacy & Research requirement.
- 3 ENGN 122 satisfies the Introduction to Programming requirement in the Computer Science curriculum.
- 4 ECE 304 satisfies the STAT 330 requirement in Computer Science curriculum
- 5 ENMA 480 satisfies the Computer Science Philosophy & Ethics requirement.
- 6 Computer Engineering students pursuing the dual degree with Computer Science have two remaining ECE 400-level Technical Elective courses.
- 7 ECE 346 satisfies the CS 170 requirement in Computer Science curriculum.
- 8 ECE 443 satisfies the CS 270 requirement in Computer Science curriculum.

The General Education requirements in information literacy and research, impact of technology, and philosophy and ethics are met through the major. The upper-division General Education requirement is met through a built-in minor in computer science and through the completion of a second major/degree.

Computer engineering and computer science majors must earn a grade of C or better in all 200-level ECE courses and all CS courses prior to taking the next course in the sequence.

Any ECE course registration issues are to be resolved with the ECE Academic Coordinator and Program Manager.

*The five-year plan is a suggested curriculum to complete this degree program in five years. It is just one of several plans that will work and is presented only as broad guidance to students. Each student is strongly encouraged to develop a customized plan in consultation with their academic advisor. Additional information can also be found in Degree Works.*

## Computer Engineering Major (BSCE) Dual Degree with Cyber Operations Major (BS Cybersecurity)

Course	Title	Credit Hours
<b>Freshman</b>		
<b>Fall</b>		
ENGN 121	Introduction to Engineering and Technology <sup>2</sup>	4
CHEM 121N	Foundations of Chemistry I Lecture	3
CHEM 122N or CHEM 120	Foundations of Chemistry I Laboratory <sup>1</sup> or Foundations of Chemistry I Laboratory for Online Degree Programs	1
MATH 211	Calculus I (Grade of C or better required)	4
ENGL 110C	English Composition (Grade of C or better required)	3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ENGN 122	Computer Programming for Engineering <sup>3</sup>	4
MATH 212	Calculus II (Grade of C or better required)	4
COMM 101R	Public Speaking	3
PHYS 231N	University Physics I	4
<b>Credit Hours</b>		<b>15</b>
<b>Sophomore</b>		
<b>Fall</b>		
MATH 307 or MATH 280	Ordinary Differential Equations or Transfer Credit for Ordinary Differential Equations	3
ECE 201	Circuit Analysis I	3
ECE 241	Fundamentals of Computer Engineering	4
PHYS 232N	University Physics II	4
ECE 250	Object-Oriented Programming in C++ for Engineers	3
<b>Credit Hours</b>		<b>17</b>
<b>Spring</b>		
ECE 202	Circuit Analysis II	3

ECE 287	Fundamental Electric Circuit Laboratory	2
CYSE 200T	Cybersecurity, Technology, and Society	3
CS 261	Java for Programmers	1
CS 252	Introduction to Unix for Programmers	1
CS 381	Introduction to Discrete Structures	3
ENGL 211C or ENGL 231C	Writing, Rhetoric, and Research (Grade of C or better required) or Writing, Rhetoric, and Research: Special Topics	3
<b>Credit Hours</b>		<b>16</b>
<b>Junior</b>		
<b>Fall</b>		
ECE 302 or ECE 306 or ECE 314 or ECE 350		3
ECE 355	Introduction to Networks and Data Communications	3
ECE 341	Digital System Design	3
CS 361	Data Structures and Algorithms	3
CRJS 215S or SOC 201S	Introduction to Criminology or Introduction to Sociology	3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ECE 304	Probability, Statistics, and Reliability	3
ECE 346	Microcontrollers <sup>4</sup>	3
ECE 381	Introduction to Discrete-time Signal Processing	3
CS 350 or CS 330	Introduction to Software Engineering or Object-Oriented Design and Programming	3
ECE 342	Field Programmable Gate Arrays Design Laboratory	2
ENMA 480	Ethics and Philosophy in Engineering Applications	3
<b>Credit Hours</b>		<b>17</b>
<b>Senior</b>		
<b>Fall</b>		
ECE 481W	Preparatory ECE Senior Design (Grade of C or better required to meet the University Writing Intensive requirement)	3
ECE 443	Computer Architecture <sup>5</sup>	3
CYSE 301	Cybersecurity Techniques and Operations	3
CS 471	Operating Systems	3
<b>Credit Hours</b>		<b>12</b>
<b>Spring</b>		
ECE 482	ECE Senior Design	3
ECE 419	Cyber Physical System Security <sup>6</sup>	3
ECE 455	Network Engineering and Design <sup>6</sup>	3
CYSE 406 or CRJS 406	Cyber Law or Cyber Law	3

Interpreting the Past Way of Knowing		3
<b>Credit Hours</b>		<b>15</b>
<b>Fifth Year</b>		
<b>Fall</b>		
ECE 416	Cyber Defense Fundamentals <sup>6</sup>	3
CYSE 425W	Cybersecurity Strategy and Policy (Grade of C or better required to meet the University Writing Intensive requirement)	3
CS 467	Introduction to Reverse Software Engineering	3
ECE 470	Foundations of Cyber Security	3
Cyber Approved Program Elective <sup>7</sup>		3
Human Creativity Way of Knowing		3
<b>Credit Hours</b>		<b>18</b>
<b>Spring</b>		
CS 390	Introduction to Theoretical Computer Science	3
CS 466	Principles and Practice of Cyber Defense	3
CYSE 368 or CYSE 494	Cybersecurity Internship or Entrepreneurship in Cybersecurity	3
PHIL 355E	Cybersecurity Ethics	3
Literature Way of Knowing		3
<b>Credit Hours</b>		<b>15</b>
<b>Total Credit Hours</b>		<b>155</b>

\* Does not include the University's General Education language and culture requirement. Additional hours may be required.

<sup>1</sup> CHEM 120 is for online program students only.

<sup>2</sup> ENGN 121 satisfies the Cyber Operations Information Literacy & Research requirement.

<sup>3</sup> ENGN 122 satisfies the CS 150 requirement in Cyber Operations curriculum.

<sup>4</sup> ECE 346 satisfies the CS 170 requirement in Cyber Operations curriculum.

<sup>5</sup> ECE 443 satisfies the CS 270 requirement in Cyber Operations curriculum.

<sup>6</sup> These courses are required courses for the Cyber Operations curriculum & ECE Technical Electives for Computer Engineering curriculum.

<sup>7</sup> Cyber Approval Program Elective remaining options: CS 476, CYSE 407, ECE 483, and IT 417.

The General Education requirements in information literacy and research, impact of technology, and philosophy and ethics are met through the major. The upper-division General Education requirement is met through a built-in minor in computer science and through the completion of a second major/degree.

Computer engineering and cyber operations majors must earn a grade of C or better in all 200-level ECE courses and all CS courses prior to taking the next course in the sequence.

Any ECE course registration issues are to be resolved with the ECE Academic Coordinator and Program Manager.

*The five-year plan is a suggested curriculum to complete this degree program in five years. It is just one of several plans that will work and is presented only as broad guidance to students. Each student is strongly encouraged to develop a customized plan in consultation with their*

academic advisor. Additional information can also be found in Degree Works.

# Computer Engineering Major (BSCE) Dual Degree with Cybersecurity Major (BS Cybersecurity)

Course	Title	Credit Hours
<b>Freshman</b>		
<b>Fall</b>		
ENGN 121	Introduction to Engineering and Technology <sup>2</sup>	4
CHEM 121N	Foundations of Chemistry I Lecture	3
CHEM 122N or CHEM 120	Foundations of Chemistry I Laboratory <sup>1</sup> or Foundations of Chemistry I Laboratory for Online Degree Programs	1
MATH 211	Calculus I (Grade of C or better required)	4
ENGL 110C	English Composition (Grade of C or better required)	3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ENGN 122	Computer Programming for Engineering	4
MATH 212	Calculus II (Grade of C or better required)	4
COMM 101R	Public Speaking	3
PHYS 231N	University Physics I	4
<b>Credit Hours</b>		<b>15</b>
<b>Sophomore</b>		
<b>Fall</b>		
MATH 307 or MATH 280	Ordinary Differential Equations or Transfer Credit for Ordinary Differential Equations	3
ECE 201	Circuit Analysis I	3
ECE 241	Fundamentals of Computer Engineering	4
PHYS 232N	University Physics II	4
ECE 250	Object-Oriented Programming in C++ for Engineers	3
<b>Credit Hours</b>		<b>17</b>
<b>Spring</b>		
ECE 202	Circuit Analysis II	3
ECE 287	Fundamental Electric Circuit Laboratory	2
CYSE 200T	Cybersecurity, Technology, and Society	3
CS 252	Introduction to Unix for Programmers	1
CS 261	Java for Programmers	1
CS 381	Introduction to Discrete Structures	3
ENGL 211C or ENGL 231C	Writing, Rhetoric, and Research (Grade of C or better required) or Writing, Rhetoric, and Research: Special Topics	3
<b>Credit Hours</b>		<b>16</b>

## Junior

### Fall

ECE 302 or ECE 306 or ECE 314 or ECE 350		3
ECE 341	Digital System Design	3
CS 361	Data Structures and Algorithms	3
CYSE 201S	Cybersecurity and the Social Sciences	3
CYSE 250	Basic Cybersecurity Programming and Networking	3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ECE 304	Probability, Statistics, and Reliability	3
ECE 342	Field Programmable Gate Arrays Design Laboratory	2
ECE 346	Microcontrollers	3
ECE 381	Introduction to Discrete-time Signal Processing	3
CS 350 or CS 330	Introduction to Software Engineering or Object-Oriented Design and Programming	3
CRJS 215S or SOC 201S	Introduction to Criminology (Human Behavior Way of Knowing) <sup>3</sup> or Introduction to Sociology	3
<b>Credit Hours</b>		<b>17</b>

## Senior

### Fall

ECE 481W	Preparatory ECE Senior Design (Grade of C or better required to meet the University Writing Intensive requirement)	3
ECE 443	Computer Architecture	3
ECE 355	Introduction to Networks and Data Communications	3
ECE 452	Introduction to Wireless Communication Networks <sup>4</sup>	3
CYSE 301	Cybersecurity Techniques and Operations	3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ECE 482	ECE Senior Design	3
ECE 419	Cyber Physical System Security <sup>4</sup>	3
ECE 455	Network Engineering and Design <sup>4</sup>	3
CS 471	Operating Systems	3
CYSE 406 or CRJS 406	Cyber Law or Cyber Law	3
Interpreting the Past Way of Knowing		3
<b>Credit Hours</b>		<b>18</b>

## Fifth Year

### Fall

ECE 416	Cyber Defense Fundamentals <sup>4</sup>	3
CYSE 300	Introduction to Cybersecurity	3
CS 462	Cybersecurity Fundamentals	3
PHIL 355E	Cybersecurity Ethics	3



IDS 300W	Interdisciplinary Theory and Concepts (Grade of C or better required to meet the University Writing Intensive requirement)	3
Human Creativity Way of Knowing		3
<b>Credit Hours</b>		<b>18</b>
<b>Spring</b>		
IDS 493	IDS Electronic Portfolio Project	3
CYSE 368 or CYSE 494	Cybersecurity Internship or Entrepreneurship in Cybersecurity	3
CYSE 425W or POLS 425W	Cybersecurity Strategy and Policy (Grade of C or better required to meet the University Writing Intensive requirement) or Cybersecurity Strategy and Policy	3
ENMA 480	Ethics and Philosophy in Engineering Applications	3
Literature Way of Knowing		3
<b>Credit Hours</b>		<b>15</b>
<b>Total Credit Hours</b>		<b>161</b>

- \* Does not include the University's General Education language and culture requirement. Additional hours may be required.
- 1 CHEM 120 is for online program students only.
- 2 ENGN 121 satisfies the Cybersecurity Information Literacy & Research requirement.
- 3 CRJS 215S or SOC 201S satisfies the University's Human Behavior Way of Knowing requirement.
- 4 These courses are required courses for Cybersecurity curriculum (satisfying 2 Principles & 2 Application Courses) & ECE Technical Electives for Computer Engineering curriculum.

The General Education requirements in information literacy and research, impact of technology, and philosophy and ethics are met through the major. The upper-division General Education requirement is met through a built-in minor in computer science and through the completion of a second major/degree.

Computer engineering and cybersecurity majors must earn a grade of C or better in all 200-level ECE courses and all CS courses prior to taking the next course in the sequence.

Any ECE course registration issues are to be resolved with the ECE Academic Coordinator and Program Manager.

*The five-year plan is a suggested curriculum to complete this degree program in five years. It is just one of several plans that will work and is presented only as broad guidance to students. Each student is strongly encouraged to develop a customized plan in consultation with their academic advisor. Additional information can also be found in Degree Works.*

## Electrical Engineering (BSEE) Dual Major/Degree with Computer Engineering Major (BSCE)

Course	Title	Credit Hours
<b>Freshman</b>		
<b>Fall</b>		
ENGN 121	Introduction to Engineering and Technology	4
CHEM 121N	Foundations of Chemistry I Lecture	3

CHEM 122N or CHEM 120	Foundations of Chemistry I Laboratory ** or Foundations of Chemistry I Laboratory for Online Degree Programs	1
MATH 211	Calculus I (Grade of C or better required)	4
ENGL 110C	English Composition (Grade of C or better required)	3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ENGN 122	Computer Programming for Engineering	4
MATH 212	Calculus II (Grade of C or better required)	4
COMM 101R	Public Speaking	3
PHYS 231N	University Physics I	4
<b>Credit Hours</b>		<b>15</b>
<b>Sophomore</b>		
<b>Fall</b>		
MATH 307 or MATH 280	Ordinary Differential Equations or Transfer Credit for Ordinary Differential Equations	3
ENGL 211C or ENGL 231C	Writing, Rhetoric, and Research (Grade of C or better required) or Writing, Rhetoric, and Research: Special Topics	3
ECE 201	Circuit Analysis I	3
PHYS 232N	University Physics II	4
CS 381	Introduction to Discrete Structures	3
Human Creativity Way of Knowing		3
<b>Credit Hours</b>		<b>19</b>
<b>Spring</b>		
ECE 202	Circuit Analysis II	3
ECE 287	Fundamental Electric Circuit Laboratory	2
ECE 241	Fundamentals of Computer Engineering	4
CS 252	Introduction to Unix for Programmers	1
ECE 250	Object-Oriented Programming in C++ for Engineers	3
MATH 312 or MATH 285	Calculus III or Transfer Credit for Calculus III	4
<b>Credit Hours</b>		<b>17</b>
<b>Junior</b>		
<b>Fall</b>		
ECE 302	Linear System Analysis	3
ECE 304	Probability, Statistics, and Reliability	3
ECE 461	Automatic Control Systems	3
ECE 341	Digital System Design	3
CS 261	Java for Programmers	1
Interpreting the Past Way of Knowing		3
<b>Credit Hours</b>		<b>16</b>

<b>Spring</b>		
ECE 303	Introduction to Electrical Power	3
ECE 313	Electronic Circuits	4
ECE 346	Microcontrollers	3
ECE 381	Introduction to Discrete-time Signal Processing	3
CS 361	Data Structures and Algorithms	3
ECE 451	Communication Systems	3
<b>Credit Hours</b>		<b>19</b>
<b>Senior</b>		
<b>Fall</b>		
ECE 342	Field Programmable Gate Arrays Design Laboratory	2
ECE 323	Electromagnetics	3
ECE 481W	Preparatory ECE Senior Design (Grade of C or better required)	3
ECE 443	Computer Architecture	3
ECE 332	Microelectronic Materials and Processes	3
ECE 355	Introduction to Networks and Data Communications	3
<b>Credit Hours</b>		<b>17</b>
<b>Spring</b>		
ECE 482	ECE Senior Design	3
CS 350 or CS 330	Introduction to Software Engineering or Object-Oriented Design and Programming	3
CS 471	Operating Systems	3
ENMA 480	Ethics and Philosophy in Engineering Applications	3
Human Behavior Way of Knowing		3
Literature Way of Knowing		3
<b>Credit Hours</b>		<b>18</b>
<b>Total Credit Hours</b>		<b>136</b>

\* Does not include the University's General Education language and culture requirement. Additional hours may be required.

\*\* CHEM 120 is for online program students only.

The General Education requirements in information literacy and research, impact of technology, and philosophy and ethics are met through the major. The upper-division General Education requirement is met through a built-in minor in computer science and through the completion of a second major/degree.

Electrical & Computer engineering majors must earn a grade of C or better in all 200-level ECE courses and all CS courses prior to taking the next course in the sequence.

Any ECE course registration issues are to be resolved with the ECE Academic Coordinator and Program Manager. Students must have a 3.00 GPA or better and must obtain approval from their advisor and college dean to register for more than 18 hours in a semester.

*The five-year plan is a suggested curriculum to complete this degree program in five years. It is just one of several plans that will work and is presented only as broad guidance to students. Each student is strongly encouraged to develop a customized plan in consultation with their*

*academic advisor. Additional information can also be found in Degree Works.*

*Students seeking two degrees must complete a minimum of 150 credit hours.*

## Modeling & Simulation Engineering Major (BSCE) Dual Degree with Computer Science (BSCS)

Course	Title	Credit Hours
<b>Freshman</b>		
<b>Fall</b>		
ENGN 121	Introduction to Engineering and Technology <sup>2</sup>	4
CHEM 121N	Foundations of Chemistry I Lecture	3
CHEM 122N or CHEM 120	Foundations of Chemistry I Laboratory <sup>1</sup> or Foundations of Chemistry I Laboratory for Online Degree Programs	1
MATH 211	Calculus I (Grade of C or better required)	4
ENGL 110C	English Composition (Grade of C or better required)	3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ENGN 122	Computer Programming for Engineering <sup>3</sup>	4
MATH 212	Calculus II (Grade of C or better required)	4
PHYS 231N	University Physics I	4
Human Creativity Way of Knowing		3
<b>Credit Hours</b>		<b>15</b>
<b>Sophomore</b>		
<b>Fall</b>		
MATH 307 or MATH 280	Ordinary Differential Equations or Transfer Credit for Ordinary Differential Equations	3
ECE 201	Circuit Analysis I	3
PHYS 232N	University Physics II	4
ENGL 211C or ENGL 231C	Writing, Rhetoric, and Research (Grade of C or better required) or Writing, Rhetoric, and Research: Special Topics	3
ECE 250	Object-Oriented Programming in C++ for Engineers	3
<b>Credit Hours</b>		<b>16</b>
<b>Spring</b>		
ECE 202	Circuit Analysis II	3
ECE 287	Fundamental Electric Circuit Laboratory	2
CS 261	Java for Programmers	1
CS 252	Introduction to Unix for Programmers	1
CS 381	Introduction to Discrete Structures	3
COMM 101R	Public Speaking	3
Human Behavior Way of Knowing		3
<b>Credit Hours</b>		<b>16</b>



<b>Junior</b>		
<b>Fall</b>		
ECE 241	Fundamentals of Computer Engineering	4
ECE 302	Linear System Analysis	3
CS 330	Object-Oriented Design and Programming	3
CS 390	Introduction to Theoretical Computer Science	3
CS 315	Computer Science Undergraduate Colloquium	1
Literature Way of Knowing		3
<b>Credit Hours</b>		<b>17</b>
<b>Spring</b>		
ECE 381	Introduction to Discrete-time Signal Processing	3
ECE 341	Digital System Design	3
ECE 304	Probability, Statistics, and Reliability <sup>4</sup>	3
CS 361	Data Structures and Algorithms	3
CS 450 or CS 418	Database Concepts or Web Programming	3
<b>Credit Hours</b>		<b>15</b>
<b>Senior</b>		
<b>Fall</b>		
MATH 316	Introductory Linear Algebra	3
ECE 306	Discrete System Modeling and Simulation	3
CS 350	Introduction to Software Engineering	3
ENMA 480	Ethics and Philosophy in Engineering Applications <sup>5</sup>	3
ECE Technical Elective I <sup>6</sup>		3
<b>Credit Hours</b>		<b>15</b>
<b>Spring</b>		
ECE 320	Continuous System Modeling and Simulation	3
ECE 346	Microcontrollers <sup>7</sup>	3
ECE 348	Simulation Software Design	3
CS 417	Computational Methods and Software	3
CS 355	Principles of Programming Languages	3
CS Upper Level Elective I		3
<b>Credit Hours</b>		<b>18</b>
<b>Fifth Year</b>		
<b>Fall</b>		
ECE 481W	Preparatory ECE Senior Design (Grade of C or better required to meet the University Writing Intensive requirement)	3
ECE 406	Computer Graphics and Visualization	3
ECE 443	Computer Architecture <sup>8</sup>	3
ENMA 410	Agile Project Management	3
CS 410	Professional Workforce Development I	3

CS Upper Level Elective II		3
<b>Credit Hours</b>		<b>18</b>
<b>Spring</b>		
ECE 482	ECE Senior Design	3
CS 471	Operating Systems	3
CS 411W	Professional Workforce Development II (Grade of C or better required to meet the University Writing Intensive requirement)	3
CS Upper Level Elective III		3
Interpreting the Past Way of Knowing		3
<b>Credit Hours</b>		<b>15</b>
<b>Total Credit Hours</b>		<b>160</b>

*	Does not include the University's General Education language and culture requirement. Additional hours may be required.
1	CHEM 120 is for online program students only.
2	ECE 111 satisfies the Computer Science Information Literacy & Research requirement.
3	ENGN 122 satisfies the Introduction to Programming requirement in the Computer Science curriculum.
4	ECE 304 satisfies the STAT 330 requirement in Computer Science curriculum
5	ENMA 480 satisfies the Computer Science Philosophy & Ethics requirement.
6	Computer Engineering - Modeling & Simulation Engineering Major students pursuing the dual degree with Computer Science have one remaining ECE 400-level Technical Elective course.
7	ECE 346 satisfies the CS 170 requirement in Computer Science curriculum.
8	ECE 443 satisfies the CS 270 requirement in Computer Science curriculum.

The General Education requirements in information literacy and research, impact of technology, and philosophy and ethics are met through the major. The upper-division General Education requirement is met through a built-in minor in computer science and through the completion of a second major/degree.

Modeling & Simulation Engineering and Computer Science majors must earn a grade of C or better in all 200-level ECE courses and all CS courses prior to taking the next course in the sequence.

Any ECE course registration issues are to be resolved with the ECE Academic Coordinator and Program Manager.

*The five-year plan is a suggested curriculum to complete this degree program in five years. It is just one of several plans that will work and is presented only as broad guidance to students. Each student is strongly encouraged to develop a customized plan in consultation with their academic advisor. Additional information can also be found in Degree Works.*

## Linked Bachelor's/Master's Degree Programs

These are designed to allow qualified students to secure a space in a master's program available in the Frank Batten College of Engineering and Technology while they are still pursuing their undergraduate degrees. An eligible student can choose a master's program in the same discipline as his/her bachelor's program or in a complementary discipline. Subject to the approval of the undergraduate and graduate program directors, a student enrolled in a linked program can count up to six credit hours of course

work towards both the undergraduate and the graduate degrees. Full-time students may be able to complete the requirements for the bachelor's degree in four years and the master's degree in one additional year. Students in linked programs must earn a minimum of 150 credit hours (120 discrete credit hours for the undergraduate degree and 30 discrete credit hours for the graduate degree).

Students who are matriculated in an undergraduate major in the Frank Batten College of Engineering and Technology with a GPA of at least 3.00 overall and 3.00 in the major are eligible to apply for admission to a linked bachelor's/master's program. Transfer students who desire to be admitted to a linked program at the time they join an undergraduate major at Old Dominion University are eligible to apply if their overall GPA at their previous institution is 3.25 or higher. Prerequisite courses may be required for engineering technology majors to pursue a master's degree in engineering.

Continuance in a linked bachelor's/master's program requires maintenance of a GPA of 3.00 or higher overall and in the major.

## **Bachelor-to-PhD Programs**

For a select number of exceptionally well-qualified students, the college has established a linked doctoral program that enables students to be admitted directly into the PhD program upon completion of the baccalaureate degree. A select number of exceptionally well-qualified students can be admitted to the Bachelor/PhD program in their junior year while they are pursuing one of the undergraduate programs at Old Dominion University. This program encourages admitted students to work closely with faculty members and pursue a research experience. Just as in the linked Bachelor/MS program, six credit hours of graduate course work may again be counted towards the undergraduate degree and doctoral course work mentioned above for the Bachelor/PhD program. For linked bachelor's to doctoral programs, students must earn a minimum of 198 credit hours (120 discrete credit hours for the undergraduate degree and 78 discrete credit hours for the graduate degree). Students in these programs must maintain a GPA of 3.50 or better throughout their bachelor's and doctoral studies.

The student may opt to obtain the master's degree along the way to the doctorate. To obtain the master's degree, the student must utilize the six graduate credits obtained as part of their undergraduate program, use 18 credits of the graduate course work that is part of the PhD, and work with the Graduate Program Director to plan the final 6 credits.