Computer Engineering, B.S.Cp.E.

Degree Offered

- Bachelor of Science in Computer Engineering (B.S.Cp.E.)

Nature of the Program

Computer engineers design, develop, test, and oversee the manufacture and maintenance of embedded computer hardware and software. As such, computer engineering combines portions of the knowledge of electrical engineers and computer scientists. Embedded computer systems include applications in the automotive, communications, radio and television, consumer electronics, aircraft, robotics, and health-care industries. In addition, computer engineers design, develop, test, manufacture, and maintain complex systems including digital communications systems such as cell phone networks, secure computer networks, and system-level software such as operating systems and applications software. The Bachelor of Science degree in Computer Engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org, under the General Criteria and the Program Criteria for Computer Engineering.

Fundamental courses in the computer engineering areas of hardware and software are taken during the second year with general fundamental engineering courses included. The third and fourth years in the curriculum concentrate on areas of computer engineering in both software and hardware with technical electives provided to allow the student to acquire more depth in a preferred area of expertise.

Program Educational Objectives

The Program Educational Objectives (PEO) of the Computer Engineering (CpE) program at West Virginia University is to produce graduates who will apply their knowledge and skills to achieve success in their careers in industry, research, government service or graduate study. It is expected that in the first five years after graduation our graduates will achieve success and proficiency in their profession, be recognized as leaders, and contribute to the well-being of society.

Click here to view the Suggested Plan of Study (p. 3)

Curriculum in Computer Engineering

General Education Foundations

Please use this link to view a list of courses that meet each GEF requirement. **(**http://registrar.wvu.edu/gef/**)**

NOTE: Some major requirements will fulfill specific GEF requirements. Please see the curriculum requirements listed below for details on which GEFs you will need to select.

Code	Title	Hours
General Education Foundations		
F1 - Composition & Rhetoric		3-6
ENGL 101 & ENGL 102	Introduction to Composition and Rhetoric and Composition, Rhetoric, and Research	
or ENGL 103	Accelerated Academic Writing	
F2A/F2B - Science & Technology		4-6
F3 - Math & Quantitative Reasoning		3-4
F4 - Society & Connections		3
F5 - Human Inquiry & the Past		3
F6 - The Arts & Creativity		3
F7 - Global Studies & Diversity		3
F8 - Focus (may be satisfied by completion of a minor, double major, or dual degree)		9
Total Hours		31-37

Please note that not all of the GEF courses are offered at all campuses. Students should consult with their advisor or academic department regarding the GEF course offerings available at their campus.

Degree Requirements

Students must meet the following criteria to qualify for a Bachelor of Science in Computer Engineering degree:

- Complete a minimum of 122 credit hours
- Satisfy WVU's undergraduate degree requirements
- Satisfy Statler College's undergraduate degree requirements (http://catalog.wvu.edu/undergraduate/collegeofengineeringandmineralresources/#policiestext)
- Complete all courses listed in the curriculum requirements with the required minimum grades
- Attain an overall grade point average of 2.00 or better
- Attain a WVU grade point average of 2.00 or better
- Attain a Statler grade point average of 2.00 or better
- A maximum of one math or science courses with a grade of D+, D, or D- may apply towards a Statler College degree
- Complete a survey regarding their academic and professional experiences at WVU, as well as post-graduation job placement or continuing education plans.

The Statler GPA is computed based on all work taken at WVU with a subject code within Statler College (BIOM, BMEG, CE, CHE, CPE, CS, CSEE, CYBE, EE, ENGR, ENVE, ETEC, IENG, IH&S, MAE, MINE, PDA, PNGE, ROBE, SAFM, SENG) excluding ENGR 140, ENGR 150, and CS 101. The WVU GPA is computed based on all work taken at WVU. The Overall GPA is computed based on all work taken at WVU and transfer work.

Curriculum Requirements

Code	Title	Hours
University Requirements		19
Fundamentals of Engineering Requirements		5
Math and Science Requirements		30
Computer Engineering Program Requirements		68
Total Hours		122

University Requirements

Code	Title	Hours
General Education Foundations (GEF) 1, 2, 3, 4, 5, 6, 7, and 8 (31-37 Credits)		
Outstanding GEF Requirements 1, 4, 5, 6, and 7		18
ENGR 191	First-Year Seminar	1
Total Hours		19

Fundamentals of Engineering Requirements

Code	Title	Hours
A minimum grade of C- is required in all Fundamentals of Engineering courses.		
ENGR 101	Engineering Problem Solving 1	2
Engineering Problem Solving (Select one of the following):		3
CHE 102	Introduction to Chemical Engineering	
ENGR 102	Engineering Problem Solving 2	
ENGR 103	Introduction to Nanotechnology Design	
MAE 102	Introduction to Mechanical and Aerospace Engineering Design	
Total Hours		5

Math and Science Requirements

Code	Title	Hours
A minimum grade of C- is required in all Math and Science courses.		
MATH 155	Calculus 1 (GEF 3)	4
MATH 156	Calculus 2 (GEF 8)	4
MATH 251	Multivariable Calculus	4
MATH 261	Elementary Differential Equations	4
MATH 375	Applied Modern Algebra	3
PHYS 111 & 111L	General Physics 1 and General Physics 1 Laboratory (GEF 2)	4

PHYS 112 & 112L	General Physics 2 and General Physics 2 Laboratory (GEF 8)	4
STAT 215	Introduction to Probability and Statistics (GEF 8)	3
Total Hours		30

Computer Engineering Program Requirements

Code	Title	Hours
CPE 271 & 271L	Introduction to Digital Logic Design and Digital Logic Laboratory	4
CPE 310 & 310L	Microprocessor Systems and Microprocessor Systems Laboratory	4
CPE 453	Data and Computer Communications	3
CPE 410S	Microcomputer Structures and Interfacing	3
or CPE 442	Introduction to Digital Computer Architecture	
or CPE 484	Real-Time Systems Development	
CS 110 & 110L	Introduction to Computer Science and Introduction to Computer Science Laboratory	4
CS 111 & 111L	Introduction to Data Structures and Introduction to Data Structures Laboratory	4
CS 330 & 330L	Introduction to Software Engineering and Introduction to Software Engineering Laboratory	4
CS 350	Computer System Concepts	3
CS 450	Operating Systems Structure	4
CSEE 380	Engineering for Societal Impact	2
CSEE 480S	Capstone Project - Design	2
or CSEE 480	Capstone Project - Design	
CSEE 481S	Capstone Project - Implementation	3
or CSEE 481	Capstone Project - Implementation	
EE 221 & 221L	Introduction to Electrical Engineering and Introduction to Electrical Engineering Laboratory	4
EE 223 & 223L	Electrical Circuits and Electrical Circuits Laboratory	4
EE 251 & 251L	Digital Electronics and Digital Electronics Laboratory	4
EE 327	Signals and Systems 1	3
EE 355 & 355L	Analog Electronics and Analog Electronics Laboratory	4
CPE Elective (400-level or higher course in CPE subject code) [*, **]		3
Lane Department Elective (400-level or higher course in BIOM, CPE, CS, CSEE, CYBE, EE, or ROBE subject codes) [*, **]		3
Statler College Elective (300-level or higher course offered by Statler College) [**]		3
Total Hours		68

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Students choosing an AOE in Cybersecurity are not required to take the CPE Elective (3 credits) or the Lane Departmental Elective (3 credits).

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A maximum of 3 credits of any applicable 491 course may be used toward elective requirements.

Suggested Plan of Study

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.Cp.E. degree program that completes degree requirements in four years is as follows.

First Year

Fall	Hours	Spring	Hours
CS 110 & 110L	4	CS 111 & 111L	4
ENGL 101 (GEF 1)	3	ENGR 102	3
ENGR 101	2	MATH 156 (GEF 8)	4
ENGR 191	1	PHYS 111 & 111L (GEF 2)	4
MATH 155 (GEF 3)	4		
GEF 5	3		
	17		15

Second Year

Fall	Hours	Spring	Hours
CPE 271 & 271L	4	CS 350	3
EE 221 & 221L	4	EE 223 & 223L	4
MATH 251	4	EE 251 & 251L	4
PHYS 112 & 112L (GEF 8)	4	MATH 261	4
	16		15

Third Year

Fall	Hours	Spring	Hours
CPE 310 & 310L	4	CPE 410S, 442, or 484	3
CSEE 380	2	CS 330 & 330L	4
EE 327	3	ENGL 102 (GEF 1)	3
EE 355 & 355L	4	STAT 215 (GEF 8)	3
GEF 6	3	GEF 7	3
	16		16

Fourth Year

Fall	Hours	Spring	Hours
CPE 453	3	CSEE 481S	3
CSEE 480S	2	CPE Elective	3
CS 450	4	Lane Department Elective	3
MATH 375	3	Statler College Elective	3
GEF 4	3		
	15		12

Total credit hours: 122

Areas of Emphasis

- Artificial Intelligence
- Cybersecurity

AREA OF EMPHASIS IN ARTIFICIAL INTELLIGENCE

Code	Title	Hours
CS 472	Artificial Intelligence	3
CS 474	Introduction to Responsible and Safe AI	3
Select two of the following:		6
CPE 420	Introduction to Neural Networks	

CS 460	Introduction to Big Data Engineering	
CS 473	Introduction to Data Mining	
CS 476S	Applied Artificial Intelligence Studio	
EE 465	Introduction to Digital Image Processing	
Total Hours		12

AREA OF EMPHASIS IN CYBERSECURITY

Code	Title	Hours
CPE 453	Data and Computer Communications	3
CYBE 366	Secure Software Development	3
CYBE 465	Cybersecurity Principles and Practice	3
CYBE 467	Ethical Hacking & Penetration Testing	3
Select one of the following:		3
CYBE 435	Computer Incident Response	
CYBE 466	Host Based Cyber Defense	
Total Hours		15

Dual Degree Programs

- Lane Department Programs (p. 5)
- B.S.Cp.E. Computer Engineering and B.S. Robotics Engineering (p. 5)

Lane Department Programs

Students can simultaneously pursue two bachelor's degrees in the Lane Department. To successfully complete both degrees, students must meet all requirements of both programs and complete a minimum of 150 credit hours. As part of those 150 credit hours, 30 credit hours must be unique from the primary degree course requirements. Exact credit hours and classes will vary per student based on their choice of technical electives and emphasis courses.

The most common Lane Department major combinations are:

- Computer Engineering and Electrical Engineering
- Computer Engineering and Computer Science

Please refer to the catalog descriptions of each individual program for course and academic requirements which can include minimum grades and GPA, and elective choices.

B.S.Cp.E. Computer Engineering and B.S. Robotics Engineering Degree Requirements

Students must meet the following criteria to qualify for a Bachelor of Science in Computer Engineering and a Bachelor of Science in Robotics Engineering degree:

- Complete a minimum of 153 credit hours
- Satisfy WVU's undergraduate degree requirements
- Satisfy Statler College's undergraduate degree requirements (http://catalog.wvu.edu/undergraduate/collegeofengineeringandmineralresources/#policiestext)
- Complete all courses listed in the curriculum requirements with the required minimum grades
- Attain an overall grade point average of 2.00 or better
- Attain a WVU grade point average of 2.00 or better
- Attain a Statler grade point average of 2.00 or better
- A maximum of one math or science courses with a grade of D+, D, or D- may apply towards a Statler College degree
- Complete a survey regarding their academic and professional experiences at WVU, as well as post-graduation job placement or continuing education plans.

The Statler GPA is computed based on all work taken at WVU with a subject code within Statler College (BIOM, BMEG, CE, CHE, CPE, CS, CSEE, CYBE, EE, EMGT, ENGR, ENVE, ETEC, IENG, IH&S, MAE, MINE, MPGE, MSEN, PDA, PNGE, ROBE, SAFM, SENG) excluding ENGR 140, ENGR

150, and CS 101. The WVU GPA is computed based on all work taken at WVU. The Overall GPA is computed based on all work taken at WVU and transfer work.

Curriculum Requirements

Code	Title	Hours
University Requirements		16
Fundamentals of Engineering Requirements		2
Math and Science Requirements		30
Computer Engineering and Robotics Engineering Program Requirments		105-106
Total Hours		153-154

University Requirements

Code	Title	Hours
General Education Foundations (GEF) 1, 2, 3, 4, 5, 6, 7, and 8 (31-37 Credits)		
Outstanding GEF Requirements 1, 5, 6, and 7		15
ENGR 191	First-Year Seminar	1
Total Hours		16

Fundamentals of Engineering Requirements

Code	Title	Hours
A minimum grade of C- is required in all Fundamentals of Engineering courses.		
ENGR 101	Engineering Problem Solving 1	2
Total Hours		2

Math and Science Requirements

Code	Title	Hours
A minimum grade of C- is required in all Math and Science courses.		
MATH 155	Calculus 1 (GEF 3)	4
MATH 156	Calculus 2 (GEF 8)	4
MATH 251	Multivariable Calculus	4
MATH 261	Elementary Differential Equations	4
MATH 375	Applied Modern Algebra	3
PHYS 111 & 111L	General Physics 1 and General Physics 1 Laboratory (GEF 2B)	4
PHYS 112 & 112L	General Physics 2 and General Physics 2 Laboratory (GEF 8)	4
STAT 215	Introduction to Probability and Statistics (GEF 8)	3
Total Hours		30

Computer Engineering and Robotics Engineering Program Requirements

Code	Title	Hours
CPE 271 & 271L	Introduction to Digital Logic Design and Digital Logic Laboratory	4
CPE 310 & 310L	Microprocessor Systems and Microprocessor Systems Laboratory	4
CPE 453	Data and Computer Communications	3
CPE 410S	Microcomputer Structures and Interfacing	3
or CPE 442	Introduction to Digital Computer Architecture	
or CPE 484	Real-Time Systems Development	
CS 110 & 110L	Introduction to Computer Science and Introduction to Computer Science Laboratory	4

CS 111 & 111L	Introduction to Data Structures and Introduction to Data Structures Laboratory	4
CS 330 & 330L	Introduction to Software Engineering and Introduction to Software Engineering Laboratory	4
CS 350	Computer System Concepts	3
CS 450	Operating Systems Structure	4
ECON 201	Principles of Microeconomics (GEF 4)	3
EE 221 & 221L	Introduction to Electrical Engineering and Introduction to Electrical Engineering Laboratory	4
EE 223 & 223L	Electrical Circuits and Electrical Circuits Laboratory	4
EE 251 & 251L	Digital Electronics and Digital Electronics Laboratory	4
EE 327	Signals and Systems 1	3
EE 355 & 355L	Analog Electronics and Analog Electronics Laboratory	4
MAE 102	Introduction to Mechanical and Aerospace Engineering Design	3
or ENGR 102	Engineering Problem Solving 2	
MAE 202	Sophomore Seminar	1
MAE 211 & 211L	Mechatronics and Mechatronics Laboratory	3
MAE 212L	Introduction to Computer Aided Design	1
MAE 241	Statics	3
MAE 242	Dynamics	3
MAE 243	Mechanics of Materials	3
MAE 316	Analysis of Engineering Systems	3
MAE 342	Dynamics of Machines	3
MAE 411 & 411L	Advanced Mechatronics and Advanced Mechatronics Laboratory	3
MAE 460	Automatic Controls	3
ROBE 313	Fundamentals of Robotic Systems	3
ROBE 412	Mobile Robotics	3
ROBE 413	Robotic Manipulators	3
ROBE 414	Robot Autonomy	3
Capstone Sequence (Select One Pathway)		6-7
CSEE 380 & CSEE 480S & CSEE 481S	Engineering for Societal Impact and Capstone Project - Design and Capstone Project - Implementation (7 Total Hours)	
ROBE 471S & ROBE 472S	Principles of Engineering Design and Engineering Systems Design (6 Total Hours)	
Technical Elective *		3
Total Hours		105-106

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See BS CpE (http://catalog.wvu.edu/undergraduate/collegeofengineeringandmineralresources/lanedepartmentofcomputerscienceand/computer_engineering/#majortext) and BS Robotics (http://catalog.wvu.edu/undergraduate/collegeofengineeringandmineralresources/departmentofmechanicalandaerospace/robe/#majortext) degrees for list of technical electives. Except CPE 412 Mobile Robotics.

Suggested Plan of Study

It is important for students to take courses in the order specified as much as possible; all prerequisites and concurrent requirements must be observed. A typical B.S.Cp.E. / B.S. Robotics degree program that completes degree requirements in five years is listed below.

First Year

Fall	Hours	Spring	Hours
CS 110 & 110L	4	CS 111 & 111L	4
ENGL 101	3	MAE 102	3
ENGR 101	2	MATH 156	4
ENGR 191	1	PHYS 111 & 111L	4
MATH 155	4		
GEF 5, 6, or 7	3		
	17		15

Second Year

Fall	Hours	Spring	Hours
EE 221 & 221L	4	CPE 271 & 271L	4
MAE 202	1	ENGL 102	3
MAE 241	3	MAE 212L	1
MATH 251	4	MAE 242	3
PHYS 112 & 112L	4	MATH 261	4
	16		15

Third Year

Fall	Hours	Spring	Hours
CPE 310 & 310L	4	CS 350	3
MAE 211 & 211L	3	EE 223 & 223L	4
MAE 243	3	EE 251 & 251L	4
ROBE 313	3	MAE 316	3
STAT 215	3		
	16		14

Fourth Year

Fall	Hours	Spring	Hours
EE 355 & 355L	4	CS 330 & 330L	4
MAE 342	3	ECON 201 (GEF 4)	3
MATH 375	3	EE 327	3
ROBE 412*	3	ROBE 413*	3
GEF 5, 6, or 7	3	GEF 5, 6, or 7	3
	16		16

Fifth Year

Fall	Hours	Spring	Hours
CPE 453	3	CPE 410S, 442, or 484	3
CS 450	4	MAE 460	3
MAE 411 & 411L	3	ROBE 472S or CSEE 481S*	3
ROBE 414*	3	Technical Elective	3
ROBE 471S or CSEE 480S*	3		
	16		12

Total credit hours: 153

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Courses only taught in given semester.

Student Outcomes

Upon graduation, all Bachelor of Science in Computer Engineering students will have:

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.