Computer Engineering

Nature of 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 computer engineering program is accredited by the Engineering Accreditation Commission (EAC) of ABET, http://www.abet.org.

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.

Student Outcomes

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

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to design and conduct experiments, as well as to analyze and interpret data
- An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- An ability to function on multidisciplinary teams
- An ability to identify, formulate, and solve engineering problems
- An understanding of professional and ethical responsibility
- An ability to communicate effectively
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- A recognition of the need for, and an ability to engage in life-long learning
- A knowledge of contemporary issues
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

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.

The computer engineering technical electives must be taken from 400-level CPE regular courses. The other technical electives should be selected from upper division regular courses in biometric systems, computer engineering, computer science, or electrical engineering. However, students with special career objectives can petition the department through their advisors for prior written permission to select technical electives from upper-division courses in mathematics, the sciences, or other areas of engineering.

A total of five humanities and social science electives (GEF electives) must be selected. The humanities and social science electives must be chosen so as to meet the University General Education Foundations requirements and Accreditation Board for Engineering and Technology accreditation guidelines.

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.

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 Skills		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.

Curriculum Requirements

To receive a bachelor of science in computer engineering, a student must meet the University's undergraduate degree requirements, take all the courses indicated below, and attain a grade point average of 2.0 or better for all Lane Department of Computer Science and Electrical Engineering courses. If a Lane Department of Computer Science and Electrical Engineering is repeated, only the last grade received is used to compute the major grade point average, and the course credit hours are counted only once. This requirement assures that the student has demonstrated overall competence in the major.

Freshman Engineering Requirements		
ENGR 101	Engineering Problem Solving 1	2
Engineering Problem Solving:		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	
ENGR 199	Orientation to Engineering	1
Non-Computer Engineering Core		
CHEM 115	Fundamentals of Chemistry (GEF 2B)	4
ECON 201	Principles of Microeconomics (GEF 4)	3
ECON 202	Principles of Macroeconomics	3
Calculus I (GEF 3):		4
MATH 155	Calculus 1 (Minimum grade of C- is required)	
MATH 153 & MATH 154	Calculus 1a with Precalculus and Calculus 1b with Precalculus (Minimum grade of C- is required)	
MATH 156	Calculus 2 (GEF 8 - Minimum grade of C- is required)	4
MATH 251	Multivariable Calculus (Minimum grade of C- is required)	4
MATH 261	Elementary Differential Equations	4
MATH 375	Applied Modern Algebra	3
PHYS 111	General Physics (GEF 8)	4
PHYS 112	General Physics (GEF 8)	4
STAT 215	Introduction to Probability and Statistics	3
Engineering Science Elective (Choose one)		3
CHE 201	Material and Energy Balances 1	
CHE 366	Materials Science	
IENG 377	Engineering Economy	
MAE 241	Statics	
MAE 320	Thermodynamics	
Computer Engineering Core Requirements (Minimum GPA of 2.0 required in BIOM, CPE, CS, and EE courses)		
CPE 271	Introduction to Digital Logic Design	3
CPE 272	Digital Logic Laboratory	1

CPE 310	Microprocessor Systems	3
CPE 311	Microprocessor Laboratory	1
CPE 312	Microcomputer Structures and Interfacing	3
CPE 313	Microcomputer Structures and Interfacing Laboratory	1
CPE 480	Senior Design Seminar (Fulfills Writing and Communications Skills Requirement)	2
CPE 481	Senior Design Project	3
CS 110	Introduction to Computer Science	4
CS 111	Introduction to Data Structures	4
CS 230	Introduction to Software Engineering	4
CS 350	Computer System Concepts	3
CS 450	Operating Systems Structure	3
EE 221	Introduction to Electrical Engineering	3
EE 222	Introduction to Electrical Engineering Laboratory	1
EE 223	Electrical Circuits	3
EE 224	Electrical Circuits Laboratory	1
EE 251	Digital Electronics	3
EE 252	Digital Electronics Laboratory	1
EE 327	Signals and Systems 1	3
EE 355	Analog Electronics	3
EE 356	Analog Electronics Laboratory	1
CPE Technical Elective (400-level course in Computer Engineering)		3
Technical Electives (300 level or higher course in Biometric Systems, Computer Engineering, Computer Science, or Electrical Engineering)		6
Free Elective		3
GEF Electives 1, 5, 6, 7		15
Total Hours		130

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
MATH 155 (GEF 3)	4	MATH 156 (GEF 8)	4
ENGR 101	2	ENGR 102	3
ENGR 199	1	PHYS 111 (GEF 8)	4
CHEM 115 (GEF 2)	4	GEF 6	3
ENGL 101 (GEF 1)	3	GEF 7	3
GEF 5	3		
	17		17

Second Year

Fall	Hours	Spring	Hours
CPE 271	3	CS 110	4
CPE 272	1	EE 223*	3
EE 221	3	EE 224*	1
EE 222	1	EE 251	3
MATH 251	4	EE 252*	1
PHYS 112 (GEF 8)	4	ENGL 102 (GEF 1)	3
		MATH 261	4
	16		19

Third Year

Fall	Hours	Spring	Hours
CPE 310	3	CPE 312*	3

CPE 311		1 CPE 313*	1
CS 111		4 CS 230	4
EE 327*		3 CS 350	3
EE 355*		3 ECON 201 (GEF 4)	3
EE 356*		1 STAT 215	3
MATH 375		3	
		18	17

Fourth Year

Fall	**Hours**	**Spring**	**Hours**
CPE 480		2 CPE 481	3
CS 450		3 Engr. Science Elective	3
ECON 202		3 CPE Tech. Elective	3
Free Elective		3 Tech. Elective	3
Tech. Elective		3	
		14	12

Total credit hours: 130

* Offered once per year in the semester shown.

Major Learning Goals

COMPUTER ENGINEERING

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- An ability to function on multidisciplinary teams
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- An ability to communicate effectively
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
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CPE 271. Introduction to Digital Logic Design. 3 Hours.
PR: MATH 156 or consent. Introduction to the design of digital systems. Topics include number systems, coding, Boolean and switching algebra, minimization of logic, analysis and design of combinational and sequential logic circuits.

CPE 272. Digital Logic Laboratory. 1 Hour.
CoReq: CPE 271. Experiments with digital electronic circuits including number systems, design and application of modern digital circuitry for both combinational and sequential logic circuits. (3 hr. lab.).

CPE 293. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

CPE 310. Microprocessor Systems. 3 Hours.
PR: CPE 271 and CPE 272 and PR or CONC: CPE 311. Theory and design of microprocessors: organization and architecture of modern processors; integration of microprocessors with RAM, ROM, and I/O devices; machine language, assembly language and software development. (3 hr. lec.).

CPE 311. Microprocessor Laboratory. 1 Hour.
CoReq: CPE 310. Machine language, assembly language and hardware and software interfacing. (This includes editing, linking, and debugging.) Memory, I/O and basic techniques of microprocessor interfacing. (3 hr. lab.).

CPE 312. Microcomputer Structures and Interfacing. 3 Hours.
PR: CPE 310 and CPE 311 and EE 251 and EE 252 and CoReg: CPE 313 and CS 350. Design of computer systems with emphasis on interface hardware including communications, high power interface devices, line driver/receiver circuits, A/D and D/A devices, and utilization of software techniques for programmed, interrupt, and direct memory access. (3 hr. lec.).

CPE 313. Microcomputer Structures and Interfacing Laboratory. 1 Hour.
PR: CPE 310 and CPE 311 and CoReq: CPE 312. A microprocessor based single-board computer is designed and built. A semester project is required using standard I/O techniques. (3 hr. lab.).

CPE 435. Computer Incident Response. 3 Hours.
PR: CPE 310 and CPE 311 and (CS 350 or CS 355) or consent. Introduction to computer incident response, forensics, and computer security. Legal basis, proper procedures, and multiple operating systems application.

CPE 442. Introduction to Digital Computer Architecture. 3 Hours.
PR: (MATH 375 or MATH 378) and (CPE 310 or CPE 320). Control, data, and demand-driven computer architecture; parallel processing, pipelining, and vector processing; structures and algorithms for array processors, systolic architectures, design of architectures. (3 hr. lec.).

CPE 462. Wireless Networking. 3 Hours.
PR: EE 327 and (STAT 215 or MATH 448). Design and analysis of modern wireless data networks. Digital modulation techniques, wireless channel models, design of cellular networks, spread spectrum, carrier sense multiple access, ad-hoc networks routing, error control coding, automatic request strategies.

CPE 480. Senior Design Seminar. 2 Hours.
PR: ENGL 102 and consent. Penultimate semester group senior design projects with individual design assignments appropriate to student's discipline. Complete system-level designs of the subsequent semester's project presented in written proposals and oral presentations. (Equivalent to BIOM 480, CS 480, and EE 480). (2 hr. lec., 1 hr. conf.).

CPE 481. Senior Design Project. 3 Hours.
PR: CPE 480. Continuation of CPE 480. Detailed design and implementation of the system including choice of components, algorithm development, interfacing troubleshooting, working in groups, and project management. Also covers professional topics, including ethics, liability, safety, socio-legal issues, risks and employment agreements. (1 hr. lec., 1 hr. conf., 2 hr. lab.).

CPE 484. Real-Time Systems Development. 3 Hours.
PR: CS 350 or working knowledge of C programming language and UNIX. Characteristics of real-time systems, system and software development standards, structured and object oriented development methods for real-time systems, using a computer aided software engineering (CASE) tool in the development of a large engineering project. Emphasis is on real-time systems requirements analysis and design. This is a project based course. (3 hr. lec.).

CPE 490. Teaching Practicum. 1-3 Hours.
PR: Consent. Teaching practice as a tutor or assistant.

CPE 491. Professional Field Experience. 1-18 Hours.
PR: Consent. (May be repeated up to a maximum of 18 hours.) Prearranged experiential learning program, to be planned, supervised, and evaluated for credit by faculty and field supervisors. Involves temporary placement with public or private enterprise for professional competence development.

CPE 493. Special Topics. 1-6 Hours.
PR: Consent. Investigation of topics not covered in regularly scheduled courses.

CPE 494. Seminar. 1-3 Hours.
PR: Consent. Presentation and discussion of topics of mutual concern to students and faculty.

CPE 495. Independent Study. 1-6 Hours.
Faculty supervised study of topics not available through regular course offerings.

CPE 496. Senior Thesis. 1-3 Hours.
PR: Consent.

CPE 498. Honors. 1-3 Hours.
PR: Students in Honors Program and consent by the honors director. Independent reading, study or research.