

COMPUTER ENGINEERING

Phone: (209) 946-2153

Location: Anderson Hall

Website: Computer Engineering (<http://www.pacific.edu/Academics/Schools-and-Colleges/School-of-Engineering-and-Computer-Science/Academics-/Majors/Computer-Engineering-.html>)

Degrees Offered

Bachelor of Science in Computer Engineering

Computer Engineering Program Educational Objectives

Through their careers in computer engineering or related profession, Pacific graduates are expected to demonstrate the following within a few years of earning their Bachelor's degree in Computer Engineering:

- Competency in the computer engineering profession via promotion to positions of increasing responsibility, publications, and/or conference presentations
- Adaptability to new developments in science and technology by successfully completing or pursuing graduate education in engineering or related fields, participating in professional development and/or industrial training courses, or pursuing professional licensure

Students Graduating with a BS in Computer Engineering 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.

Bachelor of Science in Computer Engineering

Students must complete a minimum of 120 units of academic work and a minimum of 32 units of Cooperative Education in order to earn the bachelor of science in computer engineering.

I. General Education Requirements

For more details, see General Education (<http://catalog.pacific.edu/stocktongeneral/generaleducationprogram/>)

Minimum 28 units and 9 courses that include:

A. CORE Seminars (2 courses)

CORE 001	Problem Solving & Oral Comm	3
CORE 002	Writing and Critical Thinking	4

Note: 1) CORE Seminars cannot be taken for Pass/No Credit. **2)** Transfer students with 28 or more transfer credits taken after high school are exempt from both CORE seminars. Students participating in the First Year Honors Program should complete an honors section of CORE 001 regardless of the number of college transfer units completed.

B. Breadth Requirement (7 courses, at least 3 units each)

At least one course from each of the following areas:

Artistic Process & Creation
Civic & Global Responsibility
Language & Narratives
Quantitative Reasoning
Scientific Inquiry
Social Inquiry
World Perspectives & Ethics

Note: 1) No more than 2 courses from a single discipline can be used to meet the Breadth Requirement.

C. Diversity and Inclusion Requirement

All students must complete Diversity and Inclusion coursework (at least 3 units)

Note: 1) Diversity and Inclusion courses can also be used to meet the breadth category requirements, or major or minor requirements.

D. Fundamental Skills

Students must demonstrate competence in:

Writing
Quantitative Analysis (Math)

Note: 1) Failure to satisfy the fundamental skills requirements by the end of four semesters of full-time study at the University is grounds for academic disqualification.

II. Major Requirements

Mathematics and Science (minimum of 30 units)

MATH 051	Calculus I	4
MATH 053	Calculus II	4
MATH 055	Calculus III	4
MATH 057	Applied Differential Equations I: ODEs	4
PHYS 053	Principles of Physics I	5
PHYS 055	Principles of Physics II	5
Select one of the following Discrete Math electives:		4
COMP 047	Discrete Math for Computer Science	
MATH 074	Discrete and Combinatorial Mathematics	
MATH 174	Graph Theory	

Engineering Science

ENGR 010	Dean's Seminar	1
ENGR 030	Engineering and Computing Ethics in Society	3
ECPE 005	Introduction to Electrical and Computer Engineering **	1

ECPE 041	Circuits	3
ECPE 041L	Circuits Laboratory	1
ECPE 071	Digital Design	3
ECPE 071L	Digital Design Lab	1
Computer Engineering Core		
COMP 051	Introduction to Computer Science	4
COMP 053	Data Structures	4
ECPE 121	Digital Signal Processing	4
ECPE 127	Random Signals	3
ECPE 131	Electronics	3
ECPE 131L	Electronics Lab	1
ECPE 170	Computer Systems and Networks	4
ECPE 172	Microcontrollers	4
ECPE 173	Computer Organization and Arch	3
ECPE 174	Advanced Digital Design	4
ECPE 195	Senior Project I	2
ECPE 196	Senior Project II	2
ENGR 025	Professional Practice Seminar	1
Technical Electives		
Electives: Select four courses from technical elective options		12
COMP Elective		
Select one of the following:		3-4
COMP 127	Web Applications	
COMP 129	Software Engineering	
COMP 135	Human-Computer Interface Design	
COMP 137	Parallel Computing	
COMP 141	Programming Languages	
COMP 147	Computing Theory	
COMP 151	Artificial Intelligence	
COMP 153	Computer Graphics	
COMP 155	Computer Simulation	
COMP 157	Design and Analysis of Algorithms	
COMP 159	Computer Game Technologies	
COMP 163	Database Management Systems	
COMP 173	Operating Systems	
COMP 175	System Administration and Security	
COMP 191	Independent Study	
COMP 197	Undergraduate Research	
ECPE Elective		
Select two of the following:		3-4
ECPE 124	Digital Image Processing	
ECPE 133	Solid State Devices	
ECPE 135	Power Electronics	
ECPE 136	VLSI Design	
ECPE 141	Advanced Circuits	
ECPE 144	Applied Electromagnetics	
ECPE 155	Autonomous Robotics	
ECPE 161	Automatic Control Systems	
ECPE 162	Communication Systems	
ECPE 163	Energy Conversion	
ECPE 165	Power System Analysis	
ECPE 177	Computer Networking	
ECPE 178	Computer Network Security	
ECPE 191	Independent Study	

ECPE 197	Undergraduate Research	
SOECS Elective		
Select one course from BENG, CIVL, COMP, ECPE, ENGR, EMGT, EPHY, 3-4 or MECH ***		
Cooperative Education (Minimum 32 units to include)		
ENGR 181	Professional Practice	1-16
ENGR 182	Professional Practice	1-16
ENGR 183	Professional Practice	1-16

* AP CHEM scores of 4 or 5, or IB CHEM Higher Level scores of 5, 6, or 7, will satisfy the elective

** Students who transfer in with 28 or more units are exempt from taking ECPE 005

*** ECPE, EPHY, or COMP courses must be at 100 or 200 level. Excluding COMP 187, ENGR 010, ENGR 019, ENGR 025, ENGR 030, ENGR 181, ENGR 182, and ENGR 183.

Electrical Computer Engr Courses

ECPE 005. Introduction to Electrical and Computer Engineering. 1 Unit. This course introduces students to various sub-disciplines of Electrical and Computer Engineering and to the tools, both hardware and software, that are used in Electrical & Computer Engineering. Prerequisite that may be taken concurrently: ENGR 010 with a "C-" or better.

ECPE 041. Circuits. 3 Units.

Students study concepts of voltage, current, power, energy. Topics include ideal circuit elements and their I/V characteristics, Kirchhoff's laws, circuit analysis using node voltage and mesh current methods, Thevenin's and Norton's theorems, maximum power transfer, and operational amplifier circuits. The course examines step response of 1st order (RC, RL) and 2nd order (RLC) circuits, phasor analysis, impedance calculations, sinusoidal steady state response, instantaneous, average, and reactive power, frequency response, bandwidth of first order, and lowpass and highpass filters. Prerequisites: PHYS 055; MATH 055; COMP 051 or ENGR 019 with a "C-" or better. Prerequisites that may be taken concurrently: PHYS 55, MATH 55.

ECPE 041L. Circuits Laboratory. 1 Unit.

Students study the use of standard test equipment to make DC and AC measurements and characterize electric circuits. Circuit simulation is taught with software tools, and data analysis is emphasized. Corequisite: ECPE 041.

ECPE 071. Digital Design. 3 Units.

Students study number systems, binary arithmetic, and Boolean logic. Topics include the analysis and synthesis of combinational and sequential circuits and the use of MSI, LSI, FPGA and CPLD devices. Recommended: ECPE 071L. Prerequisites: Fundamental Math Skills requirement; COMP 051, COMP 061, or ENGR 019 with a "C-" or better.

ECPE 071L. Digital Design Lab. 1 Unit.

This course involves laboratory treatment of the concepts discussed in ECPE 071. Prerequisites: Fundamental Math Skills requirement; COMP 051 or ENGR 019 with a "C-" or better. Corequisite: ECPE 071.

ECPE 121. Digital Signal Processing. 4 Units.

Students analyze discrete-time signals and systems using z transforms and Fourier transforms, the fast Fourier transform and its applications, digital filters and their applications and implementation of DSP algorithms using Matlab and Simulink. Prerequisites: ECPE 041 and MATH 057 with a "C-" or better.

ECPE 124. Digital Image Processing. 4 Units.

This course is the analysis and design of algorithms in digital image processing. Topics include: image formation, file format, pixel-based processing, object recognition, filtering and edge detection, image transforms, segmentation, stereo-vision, and motion tracking. Prerequisites: COMP 053, ECPE 121 with a "C-" or better. Prerequisite that may be taken concurrently: ECPE 121.

ECPE 127. Random Signals. 3 Units.

This course is an introduction to probability and statistics in engineering applications. Students will become familiar with discrete and continuous random variables and their probability models. Topics include counting methods, reliability problems, probability mass functions (PMF), probability density functions (PDF), cumulative distribution functions (CDF), conditional PDF's, expected value and variance, joint and marginal PDF's and CDF's, functions of two random variables. Prerequisites: Completion of all Fundamental Skills, MATH 055 with a "C-" or better.

ECPE 131. Electronics. 3 Units.

This course introduces students to semiconductor physics. Topics include modeling, analysis, and simulation of analog and digital circuits containing diodes, bipolar junction transistors, and MOSFETs. Other topics include analysis and design of single stage amplifiers, frequency response of amplifiers, gain, bandwidth, DC biasing, and small signal analysis of amplifiers. Prerequisites: Completion of all Fundamental Skills; ECPE 041, ECPE 041L, ECPE 071, ECPE 071L, MATH 055, PHYS 055, with a "C-" or better; AP CHEM with score of 4 or higher, or IB CHEM Higher Level with score of 5 or higher, one year of high school chemistry with a "B-" or better, appropriate score on the Pacific Diagnostic Chemistry test or CHEM 023 with a "C-" or better. Corequisite: ECPE 131L.

ECPE 131L. Electronics Lab. 1 Unit.

Students examine the use of standard electronic test equipment and simulation tools to analyze, design, and test electronic circuits. Emphasis on analog circuits. Prerequisites: Completion of all Fundamental Skills. Corequisite: ECPE 131.

ECPE 133. Solid State Devices. 4 Units.

This course introduces concepts related to the crystal structure of semiconductors and electronic, optical, and magnetic properties of semiconductors. Dynamics of carriers under equilibrium and non-equilibrium conditions are presented as a frame work for understanding the behavior of a number of devices including Metal-Oxide-Semiconductor (MOS) and Hetero-junction Bipolar (HBT) devices. On such a background, the course builds an understanding of the latest advances in the field. This course is cross listed with EPHY 133 and PHYS 170. Prerequisite: PHYS 055 with a "C-" or better. Prerequisite that may be taken concurrently: MATH 057 with a "C-" or better.

ECPE 135. Power Electronics. 4 Units.

Switch-Mode DC-DC converters, Feedback control of converters, Rectifiers and power factor correction circuits, switch mode DC power supplies, applications to motor control and renewable energy integration to the grid. Includes laboratory. Prerequisites: Completion of all Fundamental Skills; ECPE 131 and ECPE 131L with a "C-" or better. Prerequisite may be taken concurrently: ECPE 121 with a "C-" or better.

ECPE 136. VLSI Design. 4 Units.

Students examine issues in VLSI design. Topics include logic families, sizing, timing models, fabrication, layout, high speed and low power design tradeoffs, circuit simulation and device modeling. Prerequisites: Completion of all Fundamental Skills; ECPE 071, ECPE 071L, ECPE 131, ECPE 131L with a "C-" or better. (Spring odd years).

ECPE 141. Advanced Circuits. 4 Units.

Analysis and design of circuits in the continuous time domain. Topics include: frequency response, Laplace transforms, Fourier transforms, stability and feedback. Applications include high-order filter design and controls. Prerequisites: ECPE 041, ECPE 041L, and MATH 057 with a "C-" or better.

ECPE 144. Applied Electromagnetics. 4 Units.

The purpose of this course is for students to gain an understanding of transmission lines and field theory as it applies to communication circuits and systems. Electromagnetic wave propagation, reflection, and transmission through common materials are examined. This course is cross listed with EPHY 144. Prerequisites: Completion of all Fundamental Skills; PHYS 055, MATH 057, with a "C-" or better.

ECPE 155. Autonomous Robotics. 4 Units.

This course is an overview of the design of autonomous robotics. Students study architectures for robot organization and control, configurations of fixed and mobile robots, sensors and actuators. Students also study the design of algorithms and knowledge representations. Prerequisites: Completion of all Fundamental Skills; COMP 053 and ECPE 172 with a "C-" or better or permission of instructor.

ECPE 161. Automatic Control Systems. 4 Units.

Students study component and system transfer functions, open and closed loop response; stability criteria; applications to engineering systems. this course include a laboratory. Prerequisites: Completion of all Fundamental Skills; Prerequisite that may be taken concurrently: ECPE 121 or ECPE 141.

ECPE 162. Communication Systems. 4 Units.

Students examine signal characterization in time and frequency domains. Topics include baseband communication, pulse code modulation, multiplexing, complex envelope representation of bandpass signals. AM, FM, and digital modulations. Students also examine applications to radio, television, telephone, and cellular phone systems. A laboratory is included. Prerequisites: Completion of all Fundamental Skills and ECPE 121 with a "C-" or better. (Spring).

ECPE 163. Energy Conversion. 4 Units.

Students study three phase power systems. Topics include magnetic circuits, transformers, rotating machines: DC, induction, and synchronous machines as well as equivalent circuits and characteristic curves of transformers and rotating machines, renewable energy sources and technologies. the course includes a laboratory. Prerequisites: Completion of all Fundamental Skills; ECPE 041 and ECPE 041L; PHYS 055 with a "C-" or better.

ECPE 165. Power System Analysis. 3 Units.

Students study electrical power generation and transmission, Three-phase systems, power system component models, per-unit system and single line diagrams, power flow analysis. Prerequisites: Completion of all Fundamental Skills and ECPE 041 with a "C-" or better. Junior standing.

ECPE 170. Computer Systems and Networks. 4 Units.

This course is a comprehensive and holistic examination of the modern computing environment. Students gain an understanding of the various hardware and software components that enable computers and networks to process information and execute applications. Students learn to apply this knowledge in the development of efficient and robust software applications. Prerequisites: Completion of all Fundamental Skills; ECPE 071, COMP 053 with a "C-" or better.

ECPE 172. Microcontrollers. 4 Units.

Students study the design and implementation of digital monitoring and control systems that use micro-controllers. Topics include hardware and software development, interfacing input and output devices, assembly and C programming as well as representative applications. The course includes a laboratory. Prerequisites: Completion of all Fundamental Skills; COMP 051, ECPE 071, and ECPE 071L with a "C-" or better.

ECPE 173. Computer Organization and Arch. 3 Units.

The objective of this course is to give students an understanding of how a complete modern computer system operates. Students learn about design of control, datapath and arithmetic-logic units. Other topics include pipelining, memory hierarchy and assembly language programming. Prerequisites: Completion of all Fundamental Skills; ECPE 170; ECPE 172 or ECPE 174 with a "C-" or better.

ECPE 174. Advanced Digital Design. 4 Units.

Students learn how to analysis, design, and implement synchronous state machines using programmable logic devices. Topics include CAD-based simulation and development that use schematic capture and hardware description languages, and representative applications. The course includes a laboratory. Prerequisites: Completion of all Fundamental Skills; ECPE 071 and ECPE 071L with a "C-" or better.

ECPE 177. Computer Networking. 4 Units.

Students study computer networks and the Internet. Topics include LAN and WAN architectures, packet switched networks and routing, the 7-layer OSI model and Internet protocol stack, socket programming and client/server systems as well as wireless security. The course includes a laboratory. Also listed as COMP 177. Prerequisites: Completion of all Fundamental Skills; COMP 053 and ECPE 170 with a "C-" or better. Junior or Senior standing.

ECPE 178. Computer Network Security. 3 Units.

This course is an examination of the pervasive security threats related to the Internet, data communications and networking. Topics include TCP/IP protocols, authentication, encryption, malware, cybercrime, and social engineering. Emphasis is on computer and network attack methods, their detection, prevention and analysis, and the integration of the tools and techniques employed in this effort. Includes lab. Prerequisites: Completion of all Fundamental Skills and ECPE 170 or COMP 175 with a "C-" or better.

ECPE 191. Independent Study. 1-4 Units.

Special individual projects are undertaken under the direction of one or more faculty members knowledgeable in the particular field of study. Permission of department chairperson and faculty members involved.

ECPE 195. Senior Project I. 2 Units.

This first semester capstone design course instructs students in the application of design processes and interdisciplinary teamwork. Student teams select a project and develop requirements, test, and design documents. Projects incorporate consideration of engineering standards and realistic constraints such as economics, the environment, sustainability, manufacturability, or safety. Components are evaluated and selected. Feasibility is analyzed through prototyping or simulation and results are presented via oral and written reports. This course is cross listed with EPHY 195. Prerequisites: Completion of all Fundamental Skills; ECPE 131 and ECPE 131L; ECPE 121, ECPE 141, ECPE 172 or ECPE 174 with a "C-" or better.

ECPE 196. Senior Project II. 2 Units.

This second-semester capstone design course, interdisciplinary teams complete the design of their projects. Full implementation is completed, including iteration, optimization, and refinement; justifications for design decisions are analyzed. Testing is performed and results are evaluated to demonstrate satisfaction of specifications. Final oral and written reports, complete documentation, and a project demonstration are required. This course is cross listed with EPHY 196. Prerequisites: Completion of all Fundamental Skills; ECPE 195 with a "C-" or better.

ECPE 197. Undergraduate Research. 1-4 Units.

This course offers applied or basic research in electrical and/or computer engineering under faculty supervision. Permission of faculty supervisor and department chair. The student must be in good academic standing.