INTRODUCTION

The undergraduate program in Computer Engineering at CSUF provides students with a strong theoretical and practical background in the computer hardware and software aspects of computer-based systems, along with the engineering analysis, design and implementation skills necessary to work between the two. The curriculum is based on an engineering philosophy, with emphasis on hardware more than software. Topics integrated into the curriculum include digital systems, computer organization and architecture, processor interfacing techniques, VHDL design, advanced electronics and embedded system design. Elective courses required by the program allow students to specialize in key engineering technology and computer science areas. The program also requires two semesters of multidisciplinary senior design project. The computer engineering program is designed to develop an ability to apply design and analysis knowledge to the practice of computer engineering in an effective and professional manner.

The proliferation of embedded systems in an increasing array of industrial products assures a ready market for graduates in the computer engineering discipline. Computer engineers are employed in a wide range of industries, including VLSI chip design and manufacturing, autonomous systems, consumer electronics, expert systems, smart devices, digital signal processing (DSP) systems, computer manufacturing from PDAs to super computers, and automatic controls. A majority of products, such as airplanes, automobiles, home appliances, consumer electronics, robots etc., use computers and employ computer engineers in their designs. Computer engineers are also needed in the design and implementation of computer networks for business, industrial and governmental institutions.

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

LEARNING GOALS AND STUDENT LEARNING OUTCOMES

The following learning goals and outcomes have been established for students pursuing a degree in Computer Engineering:

Program Educational Objectives

A. Technical Growth – Graduates will be successful in modern engineering practice, integrate into the local and global workforce, and contribute to the economy of California and the nation

B. Professional Skills – Graduates will continue to demonstrate the professional skills necessary to be competent employees, assume leadership roles, and have career success and satisfaction

C. Professional Attitude and Citizenship – Graduates will become productive citizens with high ethical and professional standards, who make sound engineering or managerial decisions, and have enthusiasm for the profession and professional growth
**Student Outcomes**

(a) The ability to apply knowledge of mathematics, science and engineering  
(b) The ability to design and conduct experiments, as well as to analyze and interpret data  
(c) The 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  
(d) The ability to function on multi-disciplinary teams  
(e) The ability to identify, formulate, and solve engineering problems  
(f) An understanding of professional and ethical responsibility  
(g) The ability to communicate effectively  
(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context  
(i) Recognize the need for and an ability to engage in life-long learning  
(j) A knowledge of contemporary issues  
(k) The ability to use the techniques, skills and modern engineering tools necessary for engineering practice

**BACHELOR OF SCIENCE IN COMPUTER ENGINEERING (129 UNITS)**

The Bachelor of Science degree in Computer Engineering includes 56 units of required courses in computer engineering/computer science/electrical engineering/general engineering, nine units of elective courses in computer engineering/computer science/electrical engineering, 34 units of foundation courses in mathematics and science, and 49 units of courses (30 unduplicated units) in General Education.

MATH 150A and MATH 270A must be completed with at least a “C” (2.0). All other mathematics and physical science courses required for the degree must be completed with at least a “C minus” (1.7) to count as prerequisite courses to engineering courses or as credit towards the degree. All core courses in the major must be passed with a “C-” (1.7) or better.

**Placement Examination**

Students with a working knowledge of a high-level programming language such as C++ are encouraged to take the Computer Science placement examination to qualify for a CPSC 120 waiver.

**Computer Engineering Core (56 units)**

- CPSC 120 Introduction to Programming (3)  
- CPSC 121 Programming Concepts (3)  
- CPSC 131 Data Structures Concepts (3)  
- CPSC 253U Workshop in UNIX (1)  
- CPSC 332 File Structures and Database Systems (3)  
- CPSC 351 Operating Systems Concepts (3)  
- EGCP 180 Digital Logic and Computer Structures (3)  
- EGCP/EGEE 280 Microcontrollers (3)  
- EGCP/EGEE 281 Designing with VHDL (2)  
- EGCP 371 Modeling and Simulation of Signals and Systems (3)  
- EGCP 381 Computer Design and Organization (4)  
- EGCP/EGEE/EGCE 401 Engineering Economics and Professionalism (3)  
- EGCP 441 Advanced Electronics for Computer Engineers (4)  
- EGCP 450 Embedded Processor Interfacing (4)  
- EGCP 470 Multidisciplinary Projects in Computer Engineering - I (1)  
- EGCP 471 Multidisciplinary Projects in Computer Engineering - II (2)  
- EGEE 203 Electric Circuits (3)  
- EGEE 203L Electric Circuits Laboratory (1)  
- EGEE 303 Electronics (3)  
- EGEE 303L Electronics Laboratory (1)  
- EGEE 323 Engineering Probability and Statistics (3)

**Technical Electives (9 units)**

The electives shall constitute a coherent body of study consistent with the student’s professional and educational objectives. Students take nine units (12 units if student receives a waiver for CPSC 120) of adviser-approved elective courses. Students may choose the elective courses from a suggested list of courses in computer engineering, computer science and electrical engineering. The electives may also include an adviser-approved free elective.

**Wireless Communication**

CPSC 433, 471  
EGEE 443, 460

**Very Large Scale Integration (VLSI) and Optics**

EGEE 410, 455, 465, 480  
EGCP/EGEE 456, 461

**Microprocessors and Microcomputer Systems**

CPSC 459

**Control Systems and Systems Engineering**

EGEE 416, 424, 425

**Global Positioning Systems (GPS)**

EGEE 483, 483L

**Software Engineering**

CPSC 362, 462, 463, 464, 466

**Database System Design**

CPSC 431, 473, 474

**Multimedia and Digital Game Development**

CPSC 386, 484, 486, 487, 489
Intelligent Systems
CPSC 335, 481, 483
EGEE 430
Current Topics
EGCP 463
Free Elective
Adviser-approved course (3)

Requirements in Related Fields (34 units)
Mathematics Requirement (19 units)
MATH 150A Calculus (4)
MATH 150B Calculus (4)
MATH 250A Multivariate Calculus (4)
MATH 250B Introduction to Linear Algebra and Differential Equations (4)
MATH 270A Mathematical Structures I (3)

Science Requirement (15 units)
PHYS 225 Fundamental Physics: Mechanics (3)
PHYS 226 Fundamental Physics: Electricity and Magnetism (3)
PHYS 227 Fundamental Physics: Waves, Optics, and Modern Physics (3)
PHYS 225L, 226L, 227L Fundamental Physics: Laboratory (1, 1, 1)
BIOL 101 Elements of Biology (3)

General Education Courses

Area A: Core Competencies (9 units)
1. Oral Communication (3)
   HONR 101B, HCOM 100, 102
2. Written Communication (3)
   ENGL 101
3. Critical Thinking (3)
   HONR 101A, HCOM 235, PHIL 105, 106, PSYC 110, READ 290

Area B: Scientific Inquiry and Quantitative Reasoning (18 units)
1. Physical Science (6)
   PHYS 225 and 226
2. Life Science (3)
   BIOL 101
3. Laboratory Experience (2)
   PHYS 225L, 226L
4. Mathematics/Quantitative Reasoning (7)
   MATH 150A, 270A

5. Implications and Explorations in Mathematics and Natural Sciences
   Not applicable for engineering majors

Area C: Arts and Humanities (12 units)
1. Introduction to Arts (3)
   ART 101, 201A, 201B, 311, 312, DANC 101, MUS 100, 101
2. Introduction to the Humanities (3)
   Any lower-division course in this category listed in the current class schedule
3. Explorations in the Arts and Humanities (3)
   Any upper-division course in this category listed in the current class schedule
4. Origins of the World Civilizations (3)
   HIST 110A or 110B, 210A, 210B

Area D: Social Sciences (12 units)
1. Introduction to the Social Sciences (3)
   EGCP/EGCE/EGEE 401
2. World Civilizations and Cultures
   Not applicable for engineering majors
3. American History, Institutions and Values (3)
   AFAM 190, AMST 201, CHIC 190, HIST 180, 190, HONR 201A
4. American Government (3)
   HONR 201B, POSC 100
5. Explorations in Social Sciences (3)
   Any upper-division course in this category listed in the current class schedule

Area E: Lifelong Learning and Self Development (3 units)
Not applicable for engineering majors

Area Z: Cultural (3 Units)
At least one star (*) course in Sections C.3 and D.5

Upper-Division Writing Requirement
Completing both of the following courses fulfills the upper-division English writing requirement:
EGCP 441 Advanced Electronics for Computer Engineers (4)
EGCP 471 Multidisciplinary Projects in Computer Engineering – II (2)

Written work for the two courses must meet professional standards. Both courses must be passed with a “C” (2.0) or better to satisfy the writing requirement.
COMPUTER ENGINEERING COURSES

Computer Engineering Courses are designated as EGCP in the class schedule.

180 Digital Logic and Computer Structures (3)
Prerequisites: CPSC 120. Binary number system and arithmetic, computer codes, Boolean algebra, logic gates, K-map minimization, sequential circuits, memory devices, state diagram and table, computer architecture, memory, Arithmetic Logic Unit, and control unit. (2 hours lecture, 2 hours laboratory)

280 Microcontrollers (3)
Prerequisite: EGEE 245 or EGCP 180. Microcontrollers, microcontroller programming model and instruction set, assembler directives, writing and debugging microcontroller assembly language routines, microcontroller memory system, microcontroller communication systems. (1 hour lecture, 4 hours laboratory) (Same as EGEE 280)

281 Designing with VHDL (2)
Prerequisites: CPSC 120 or 121; and EGEE 245 or EGCP 180. Introduction to various modeling methods, timings, events, propagation delays and concurrency, the language constructs, data representations and formats, and physical attributes. (1 hour lecture, 2 hours laboratory) (Same as EGEE 281)

371 Modeling and Simulation of Signals and Systems (3)
Prerequisite: MATH 250B. Modeling and simulation of physical systems, mathematical description of systems, transfer functions, poles and zeros, frequency response, continuous and discrete-time convolution, continuous and discrete Fourier transforms, Laplace and Z transforms, Fast Fourier Transforms, simulation using Matlab.

381 Computer Design and Organization (4)
Prerequisites: EGCP 281, EGEE 303. Computer system, central processing unit (CPU) organization and design, instruction set and addressing modes, microprogrammed control unit design, cache memory, internal memory, virtual memory, input/output interfacing, parallel processors, superscalar processors (2 hours lecture, 4 hours laboratory).

401 Engineering Economics and Professionalism (3)
(Same as EGCE/EGEE 401)

441 Advanced Electronics for Computer Engineers (4)
Prerequisites: EGCP 281, EGEE 303. High speed CMOS, biCMOS, CPLDs, FPGAs, A/D, D/A, transducers and optics; integration of these devices into complete systems. (2 hours lecture, 4 hours laboratory)

450 Embedded Processor Interfacing (4)
Prerequisites: EGCP 280, 381, 441, EGEE 323, CPSC 351, MATH 270A. Techniques of interfacing based on speed, timings, synchronization, interrupts, protocols, noise and race conditions. Interfacing specifications of the processor data, address and control buses. (2 hours lecture, 4 hours laboratory)

456 Introduction to Logic Design in Nanotechnology (3)
Prerequisites: EGCP 180 or EGEE 245. Promising novel nanoelectronic technologies and logic primitives for such technologies, applicable basic logic design technique, design models for spatial dimensions, applicable world-level data structures, multilevel circuit design, testability and observability, tolerance and reliable computing. (Same as EGCP/EGEE 456)

461 Low Power Digital IC Design (3)
Prerequisite: EGCP 180 or EGEE 245 and EGEE 303. Importance of low power design; analysis of power dissipation in digital integrated circuits; circuit-level low-power techniques, logic-level low-power techniques, and system-level low-power techniques. (Same as EGEE 461)

463 Current Topics in Computer Engineering (3)
Prerequisites: junior/senior standing in computer engineering and consent of instructor. Topics of contemporary interest from the perspective of current research and development in computer engineering. Lectures by guest professionals.

470 Multidisciplinary Projects in Computer Engineering - I (1)
Corequisite: EGCP 450. First course in the two-course senior design sequence. Student teams develop a hardware/software project, from conception through implementation and testing, under an instructor’s supervision. Teams first explore technology issues related to the projects and then prepare complete design proposals. (1 hour lecture)

471 Multidisciplinary Projects in Computer Engineering - II (2)
Prerequisite: EGCP 450, 470. Second course in the two-course senior design course in which student teams develop a hardware/software project under the supervision of the instructor. Emphasizes development of design skill, based upon previous and current courses and laboratory experience. (4 hours laboratory)

499 Independent Study (1-3)
Prerequisite: application for independent study approved by the instructor and the Computer Engineering Program Coordinator. Independent study or research under the direction of a full-time faculty member. May be repeated for a maximum of three units of credit.