

**Requirements for the Bachelor of Science Degree  
with a Major in Computer Engineering**

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**Program Description**

Computer engineering is a field which, in some sense, resides between the long-established fields of computer science and electrical engineering. It is concerned with topics such as analog and digital circuit design, embedded controllers, computer hardware, system software, computer system design, data communication, signal processing, computer networks, robotics, computer vision, graphics and image processing, and other topics in computing where hardware plays an important role. Computer engineers often work with other engineers, physical scientists, and software engineers.

**Requirements for the Bachelor of Science Degree in Computer Engineering**

Total Units Required to Graduate	199–206
Major Requirements	134
CENG/CMPS Courses	76
Cognates	48
Other University Requirements	65–72
CSUB 101	0–2
American Institutions	5
Area A1,2	10*
Area B2	5*
Area C	15
Area D	15
Theme I	0*
Theme II	5**
Theme III	5
GRE	5
GWAR (test or class)	0–5

\*A3,B1,B3,B4,Theme 1 satisfied in major or cognate

\*\*PHIL 316 is required

**Major Requirements for the Bachelor of Science Degree in Computer Engineering**

Lower Division (21 units)

- CMPS 150 Introduction to Unix (1)
- CMPS 221 Programming Fundamentals
- CMPS 223 Data Structures and Algorithms
- CMPS 224 Assembly Language Programming
- CMPS 295 Discrete Structures

Upper Division required (40 units)

- CENG 304 Linear Systems

CENG 307 Analog Circuits  
 CENG/CMPS 320 Digital Circuits  
 CMPS 321 Computer Architecture  
 CENG/CMPS 322 Digital Design with VHDL  
 CMPS 360 Operating Systems  
 CENG/CMPS 420 Embedded Systems  
 CENG 490 Senior Project in Computer Engineering

Upper Division Electives CENG (3 courses) (15 units)

Choose one course from each of the three areas:

Communications, Signal Processing, Networking:

CENG/CMPS 422 Digital Signal Processing  
 CENG 423 Digital Communications

Embedded Systems, Computer Control, Robotics

CENG/CMPS 457 Robotics  
 CENG 432 Instrumentation, Control and Data Acquisition

Computer Vision and Image Processing

CENG 446 Image Processing  
 CENG 447 Computer Vision

Upper Division electives CMPS (2 courses) (10 units)

Select two courses from:

CMPS 335 Software Engineering, CMPS 435 Advanced Software Eng.  
 CMPS 342 Database Systems, CMPS 442 Advanced Database Systems  
 CMPS 356 Artificial Intelligence, CMPS 456 Advanced Artificial Intelligence  
 CMPS 371 Computer Graphics, CMPS 471 Advanced Computer Graphics  
 CMPS 376 Computer Networks, CMPS 476 Advanced Computer Networks

Cognate Requirements (48 units)

MATH 201 Calculus I  
 MATH 202 Calculus II  
 MATH 203 Calculus III  
 MATH 204 Calculus IV  
 MATH 330 Linear Algebra  
 PHYS 221 Basic Principles of Newtonian Physics (6)  
 PHYS 222 Basic Principles of Maxwellian Physics (6)  
 PHYS 223 Modern Physics (6)  
 PHYS/ENGR 207 Electric Circuits

Information on General Education Courses

CSUB 101 is required for entering Freshman with no transfer credit.  
 PHYS 221 will satisfy Areas B1 and B3.  
 Any of the Calculus courses (MATH 201, 202, 203, 204) will satisfy Area B4.  
 Theme I is waived for Computer Engineering.  
 Area A3 is waived for Computer Engineering.  
 PHIL 316 (Professional Ethics) must be taken and will satisfy Theme II.

## COURSE DESCRIPTIONS

Note that most of the courses required for Computer Engineering are listed under the Computer Science Program. Additional upper division engineering courses are as follows:

**CENG/CMPS 304 Linear Systems (5)** Time and frequency domain techniques for signal and system analysis. Fourier series and transforms, and Laplace transforms. Topics in differential equations and probability. Use of a numerical computing environment such as MATLAB. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: MATH 204 or consent of the instructor.

**CENG/CMPS 307 Analog Circuits (5)** Design, construction, and debugging of analog electronic circuits. Diodes, filters, oscillators, transistors, JFETs, op-amps, and basic analog circuit design. Broadband applications in networking and communications. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisite: PHYS/ENGR 207 or consent of the instructor.

**CENG/CMPS 423 Digital Communications (5)** Principles and techniques fundamental to the analysis and design of digital communication systems. The basic building blocks of a digital communication system including channel encoder/decoder, digital modulator/demodulator and channel characteristics. Channel impairments such as signal-to-noise ratios, distortion, interference, transmission errors and fading. Wired and wireless systems. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: CMPS 320.

**CENG/CMPS 446 Image Processing (5)** Digital image acquisition, image enhancement and restoration, image compression, computer implementation and testing of image processing techniques. Students gain hands-on experience of complete image processing systems, including image acquisition, processing, and display through laboratory experiments. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: CMPS 223 and CMPS 304.

**CENG/CMPS 447 Computer Vision (5)** Imaging formation, early vision processing, boundary detection, region growing, two-dimensional and three-dimensional object representation and recognition techniques. Each week lecture meets for 200 minutes and lab meets for 150 minutes. Prerequisites: CMPS 223.

**CENG 490 Senior Project (5)** After consultation with the instructor and investigation of relevant literature, the student shall prepare a substantial project with significance in Computer Engineering. In addition, an oral presentation and a written report of the project will be required. Prerequisites: major in Computer Engineering and upper division standing.