Computer Engineering

In the College of Engineering

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The undergraduate degree in Computer Engineering is accredited by the Engineering Accreditation Commission (EAC) of ABET, http://www.abet.org.

Faculty

Emeritus: Harris, J., Iosupovici, Lee, G., Marino, Panos, Tummala
Chair: Mi
Coordinator for Computer Engineering: Ozturk
Professors: Gupta, harris, f., Kumar, Ozturk
Associate Professors: Alimohammad, Sarkar
Assistant Professors: Aksanli, Huang

Offered by the Department of Electrical and Computer Engineering

Doctor of Philosophy degree in engineering sciences: (bioengineering), (electrical and computer engineering), (mechanical and aerospace engineering), (structural engineering).
Master of Engineering.
Master of Science degree in electrical engineering.
Major in computer engineering with the B.S. degree.
Major in electrical engineering with the B.S. degree.
Certificate in rehabilitation technology (refer to the *Graduate Bulletin*).

Research Laboratories

Embedded Systems Laboratory
Multimedia Communication Laboratory
Pervasive Computing and Smart Health Laboratory
Reconfigurable Computing Laboratory
VLSI Design and Test Laboratory
Wireless Networks Laboratory

Transfer Credit

No credit will be given for upper division engineering coursework taken at an institution having an engineering program which has not been accredited by the Engineering Accreditation Commission (EAC) of ABET, unless the student successfully completes the first 12 units of engineering work attempted at this university. At that time, and upon recommendation of the department, credit will be given for the unaccredited work.

General Education

Students will complete a minimum of 50 units in General Education, to include a minimum of nine upper division units taken after attaining junior class standing. No more than 12 units may be used for General Education credit from any one department or academic unit. No more than 7 units from one department can be used in Sections II and IV combined (Foundations of Learning and Explorations of Human Experience), nor more than 10 units from one department in Sections II, III, and IV combined (Foundations of Learning, American Institutions, and Explorations of Human Experience).

I. Communication and Critical Thinking: 9 units
You may ***not*** use Credit/No Credit grades in this section. A grade of C- (1.7) or better is required.
1. Oral Communication (3 units)
2. Composition (3 units)
3. Intermediate Composition and Critical Thinking (3 units)

II. Foundations of Learning: 29 units

A. Natural Sciences and Quantitative Reasoning (17 units):
1. Physical Sciences (7 units)
Physics 195 (3 units)
Physics 196 and 196L (4 units)
2. Life Sciences (3 units)
Engineering students will take Biology 100 or 101.
3. Laboratory (satisfied under A.1. above)
4. Mathematics/Quantitative Reasoning
You may ***not*** use Credit/No Credit grades. A grade of C- (1.7) or better is required. (NOTE: preparation for the major requires a grade of C (2.0) or better.)
Mathematics 150 (3 units applicable to General Education)
Mathematics 151 (4 units)

B. Social and Behavioral Sciences (3 units)

C. Humanities (9 units)
Complete three courses in three different areas. One of these courses and the one under IV.A. below must be taken in the same department.

III. American Institutions: Three units of the six units of coursework which meet the American Institutions graduation requirement may be used to satisfy this section, excluding courses numbered 500 and above.

IV. Explorations of Human Experience: Courses in this area must not be taken sooner than the semester in which you achieve upper division standing (60 units passed). Upper division courses in the major department may not be used to satisfy General Education. Total 9 units; must include one course of cultural diversity.

A. Upper division Humanities (3 units)
Three units must be taken from the same department as one of the Humanities courses selected in Foundations of Learning.
B. Upper division Social and Behavioral Sciences (3 units).
C. Upper division Social and Behavioral Sciences (Engineering majors may satisfy this area with an additional American Institutions course (excluding 500-level) to complete the American Institutions requirement if this requirement was not completely satisfied with lower division coursework) (3 units).

The Major

Computers are machines that store and process information. Desktop computers, portables, workstations, and mainframe computers are the most readily recognized examples of such devices. Equally important, however, are the millions of tiny computers (microprocessors) that are embedded in machines, instruments, and products of all sorts. For example, there are embedded computers in VCRs, cameras, telephones, CD/DVD players, televisions, washing machines, ovens, robots, automobiles, airplanes, medical instruments, toys, and many other devices, both familiar and exotic.

Computer Engineers are involved in the design, development, manufacture, installation, and operation of general purpose and embedded computers of all sorts. They are both concerned with hardware (i.e., the electronic circuits and devices that actually store and process information) and software (i.e., the programs that control the operation of the hardware). The B.S. degree program in Computer Engineering provides a solid foundation in the fundamentals of mathematics, science, computer hardware, computer software, and engineering design that are needed to practice the profession or to pursue a graduate degree in the field.

In addition to fundamentals, the curriculum also includes training in the areas of rapid growth that are important to modern practice of computer engineering. These include: Very Large Scale Integrated Circuits design (i.e., the design of electronic circuits implemented on silicon chips); Multimedia Systems (i.e., systems that process audio and visual information as well as text and numbers); Embedded Systems; Digital Signal Processing (DSP), which plays a vital role both in processing the continuous signals that are common in embedded system applications and in compressing and processing the large volumes of information that are common in multimedia systems; Computer Networks, which have become vital for connecting multiple computers in distributed control applications, and connecting users of general purpose computers who wish to share information and computing resources (e.g., Local Area Networks, the Internet); Graphical User Interfaces (GUIs), which are rapidly replacing text-based interfaces in nearly all applications; and Object Oriented Programming (OOP), a technique for designing more reliable and maintainable software.

The computer engineering curriculum provides a balance between theory and practice that prepares the graduate both for immediate employment and for continued study. The process of engineering design is emphasized throughout the curriculum by including open-ended problems with realistic design constraints. The design experience culminates in a capstone design course required of all students. Creativity, consideration of economic and social factors, and the application of systematic design procedures are required in major design projects during the senior year.

Educational Objectives

The overall objective of the undergraduate program in computer engineering is to produce the best skilled, hands on practicing computer engineer. More specifically the objectives are:

A. To provide students with the technical knowledge and skills that will enable them to have a successful career in the computer engineering profession;

B. To provide students with a general education that will enable them to appreciate the social, ethical, economic, and environmental dimensions of problems they may face;

C. To develop in students the communication skills and social skills that are necessary to work effectively with others;

D. To develop the ability of students to solve problems by learning what is already known, and then applying logic and creativity to find a solution;

E. To provide students with the intellectual skills necessary to continue learning and to stay current with the profession as it changes.

Impacted Program

The computer engineering major is an impacted program. To be admitted to the computer engineering major, students must meet the following criteria:

a. Complete with a grade of C (2.0) or better: Computer Engineering 160; Electrical Engineering 210; Mathematics 150, 151; Physics 195, 196. These courses cannot be taken for credit/no credit (Cr/NC);

b. Have an overall cumulative GPA of 2.7.

To complete the major, students must fulfill the degree requirements for the major described in the catalog in effect at the time they are accepted into the premajor at SDSU (assuming continuous enrollment).

Major Academic Plans (MAPs)

Visit http://www.sdsu.edu/mymap for the recommended courses needed to fulfill your major requirements. The MAPs website was created to help students navigate the course requirements for their majors and to identify which General Education course will also fulfill a major preparation course requirement.

Computer Engineering Major

With the B.S. Degree
(Major Code: 09094) (SIMS Code: 445001)
(SIMS Code: 445002 - Georgia)

The program below describes the 129 units required for the degree.

Preparation for the Major. Computer Engineering 160, 260, 270, 271; Aerospace Engineering 280; Biology 100 or 101; Electrical Engineering 210; Mathematics 150, 151, 245, 254; Physics 195, 196, 196L. (42 units)

Computer Engineering 160; Electrical Engineering 210; Mathematics 150, 151; Physics 195, 196 must be completed with a grade of C (2.0) or better. Computer Engineering 260, 270, 271; Aerospace Engineering 280; Mathematics 245, 254 must be completed with a grade C- (1.7) or better. These courses cannot be taken for credit/no credit (Cr/NC).

General Education. Engineering students must follow the specific General Education program outlined in this section of the catalog. Other general education requirements and limitations, as well as listings of specific General Education course electives are presented in the General Education section of Graduation Requirements for the Bachelor's Degree. (Fifty units, including 17 units from preparation for the major which count toward General Education credit, and three units of American institutions which count toward General Education credit.)

Graduation Writing Assessment Requirement. Passing the Writing Placement Assessment with a score of 10 or completing one of the approved upper division writing courses (W) with a grade of C (2.0) or better. See "Graduation Requirements" section for a complete listing of requirements.

Major. A minimum of 51 upper division units to include Computer Engineering 361, 375, 470, 470L, 475, 490, 560; Electrical Engineering 300, 310, 330, 330L, 410; one approved elective course in mathematics (3 units); three approved elective courses selected from computer engineering, electrical engineering, or other approved elective (9 units); two approved technical elective courses in computer engineering, computer science, or electrical engineering (6 units). After enrollment in Computer Engineering at SDSU, the Computer Engineering major must take all upper division computer science and engineering courses at SDSU unless prior approval is obtained from the department.

Master Plan. The master plan provides an advising record for computer engineering majors and should be initiated by the student with their faculty adviser during the first semester of the junior year. All students must have a master plan on file in the department prior to enrollment in Electrical Engineering 410. Changes to the master plan are permitted with the approval of the faculty adviser and the department chair.

Courses (COMPE)

Refer to Courses and Curricula and University Policies sections of this catalog for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

NOTE: Prerequisites will be enforced in all undergraduate computer engineering and electrical engineering courses numbered 100 through 599. A copy of an official transcript will be accepted as proof. For corequisites, an enrollment confirmation form will be accepted.

LOWER DIVISION COURSES

COMPE 160. Introduction to Computer Programming (3)
Two lectures and three hours of laboratory.
Prerequisite: Mathematics 150 with a grade of C (2.0) or better.
Computer organization and operation. Binary representation of information. Fundamentals of computer programming using a C family language: data types, selection and iteration structures, functions, arrays, pointers, scope and duration of variables. Systematic design and development of computer programs.

COMPE 260. Data Structures and Object-Oriented Programming (3)
Prerequisites: Computer Engineering 160 with a grade of C (2.0) or better. Grade of C- (1.7) or better in Mathematics 245.
Data structures using object-oriented programming. Disciplined approach to design, coding, and testing using OOP, teach use and implementation of data abstractions using data structures. Arrays, linked lists, stacks, queues, trees. Sorting, searching, recursive algorithms.

COMPE 270. Digital Systems (3)
Prerequisite: Mathematics 151 with a grade of C (2.0) or better.
Modelling, analysis and design of digital systems, primarily at the Logic Design level. Combinational and sequential networks. Not open to students with credit in Electrical Engineering 370.

COMPE 271. Computer Organization (3)
Prerequisites: Computer Engineering 160 with a grade of C (2.0) or better. Grade of C- (1.7) or better in Computer Engineering 270.
Organization and operation of computer hardware and software. Operating system shell and services. Program design and development. Input-output programming. Multi-module and mixed-language programming. Assembler and C language.

UPPER DIVISION COURSES
(Intended for Undergraduates)

COMPE 361. Windows Programming (3)
Prerequisites: Computer Engineering 260 and 271 with a grade of C- (1.7) or better in each course.
Object Oriented Programming (OOP) using C# and .NET Framework. Graphical User Interface (GUI) and event-driven programming. Visual Studio Integrated Development Environment (IDE). Graphics programming.

COMPE 375. Embedded Systems Programming (3)
Two lectures and three hours of laboratory.
Prerequisite: Computer Engineering 271 with a grade of C- (1.7) or better.
Embedded system architecture; IO programming using parallel ports, serial ports, timers, and D/A and A/D converters; interrupts and real-time programming; program development and debugging tools; C language and assembler.

COMPE 470. Digital Circuits (3)
Prerequisite: Computer Engineering 270 with a grade of C- (1.7) or better.
Design of digital electronic systems using commercially available high-speed digital devices and circuits.

COMPE 470L. Digital Logic Laboratory (1)
Three hours of laboratory.
Prerequisites: Computer Engineering 470 and Electrical Engineering 330L.
Hands-on experience in characterization and application of standard digital integrated circuit devices.

COMPE 475. Microprocessors (3)
Prerequisites: Computer Engineering 375 with a grade of C- (1.7) or better. Computer Engineering 470.
Bus design, memory design, interrupt structure, and input/output for microprocessor-based systems.

COMPE 490. Senior Design Project (4)
Two lectures and six hours of laboratory.
Prerequisites: Computer Engineering 375 with a grade of C- (1.7) or better. Electrical Engineering 330L and credit or concurrent registration in Computer Engineering 470L.
Supervised capstone design projects to provide an integrative design experience for seniors to include ethics, professionalism, cost-effectiveness, and project management.

COMPE 496. Advanced Computer Engineering Topics (1-3)
Prerequisite: Consent of instructor.
Modern developments in computer engineering. See *Class Schedule* for specific content. Maximum credit nine units for any combination of Computer Engineering 496 and 596 applicable to a bachelor's degree.

COMPE 499. Special Study (1-3)
Prerequisites: Approval of project adviser and department chair.
Individual study. Maximum credit six units.

UPPER DIVISION COURSES
(Also Acceptable for Advanced Degrees)

COMPE 560. Computer and Data Networks (3)
Prerequisites: Computer Engineering 271 and Electrical Engineering 410 with a grade of C- (1.7) or better in each course.
Wide area and local area networks, multi-layered protocols, telephone systems, modems, and network applications.

COMPE 561. Windows Database and Web Programming (3)
Prerequisite: Computer Engineering 361 with a grade of C- (1.7) or better.
Programming applications involving file systems, relational databases, Structured Query Language (SQL), ADO.NET, client-server architecture, multithreading sockets, web servers, web browsers, web services, ASP.NET, Hypertext Markup Language (HTML), and Extensible Markup Language (XML).

COMPE 565. Multimedia Communication Systems (3)
Prerequisite: Credit or concurrent registration in Computer Engineering 560.
Design and implementation of multimedia communication systems. Image compression, JPEG, VQ, cell-B standards. Video and audio compression standards, MPEG, MPEG-2, H.26X, G.72X. Data storage systems and multimedia requirements. Networking requirements and networks as multimedia carriers. Transport and network protocols for carrying multimedia over data networks. Multimedia system design, scheduling, congestion control, traffic shaping, buffer management.

COMPE 571. Embedded Operating Systems (3)
Prerequisites: Computer Engineering 260 with a grade of C- (1.7) or better. Computer Engineering 475.
Real-time kernel, basic kernel services, threading and synchronization, preemptive multithreading, mutexes, spin locks, critical sections, priority scheduling, interrupts, RTOS implementation, memory management, task management, intertask communications.

COMPE 572. VLSI Circuit Design (3)
Prerequisites: Computer Engineering 271 with a grade of C- (1.7) or better. Electrical Engineering 330.
Design of digital integrated circuits based on CMOS technology; characterization of field effect transistors, transistor level design and simulation of logic gates and subsystems; chip layout, design rules, introduction to processing; ALU architecture.

COMPE 596. Advanced Computer Engineering Topics (1-3)
Prerequisite: Consent of instructor.
Modern developments in computer engineering. May be repeated with new content. See *Class Schedule* for specific content. Maximum credit of nine units for any combination of Computer Engineering 496 and 596 applicable to a bachelor's degree. Credit for 596 and 696 applicable to a master's degree with approval of the graduate adviser.

GRADUATE COURSES
Refer to the *Graduate Bulletin*.