ENGINEERING SCIENCE

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** Faculty Early Retirement Program*

Programs Offered

Bachelor of Science in Electrical Engineering
(Electrical Engineering with minor in Mathematics)

Minor in Electrical Engineering for non-EE majors

Professional Science Masters (PSM) programs:
Master of Science in Computer and Engineering Science
(Three tracks: Bioengineering, Communications and Photonics, and Computer Hardware and Software Systems)

As defined in *Webster's Unabridged Dictionary*, "Engineering is the science by which the properties of matter and the sources of energy in nature are made useful to [humankind]." The study of Electrical Engineering, with focus in Electronics and Communications deals with the processing of information and energy in electrical and magnetic forms involving conceptualization and formulation of the ideas, design to manufacturing to application of many diverse electrical, electronic, and magnetic devices and systems.

The Bachelor of Science in Electrical Engineering (BSEE) program has been designed to prepare students for an exciting career in designing and manufacturing of electronic systems, communications systems and networks, microprocessors and computers, microwave and lightwave communications, and integrated circuits. The graduates of the proposed program will be well grounded in the rigorous scientific and theoretical foundations of the discipline. This will prepare them not only to have a successful career in the industry in the region and beyond, but also to enter and be successful in any advanced level graduate program of their choosing. The technical and liberal arts components of the curriculum provide students with the opportunity for gaining self-development, technical competence, and awareness of economic and ethical responsibilities.

The MS-CES curriculum, recognized as Professional Science Masters (PSM) programs by the Council of Graduate Schools (CGS), is designed to further the working skills and practical knowledge of engineers, computer scientists and similar professionals and prepares them to be successful in the real world, exposing students to management training and providing practical real world experience through internships and graduate seminars. The firm base in mathematics, computer science and physics is augmented with a selection of engineering course options, which prepares the students for tackling real-world problems.

Bachelor of Science in Electrical Engineering (Electrical Engineering with focus in Electronics and Communications)

(See page 130 for a sample four-year program.)

Consistent with the mission of the University, the mission of the BSEE Program is to prepare students to be learned men and women who are capable of pursuing fulfilling careers in a changing world, and to fulfill the undergraduate technical education needs of the community, business, and industry of the North Bay region. A broader mission is to enable graduating engineers to acquire knowledge and experiences to prepare them to pursue lifelong learning, advanced study, and leadership roles in business and community.

The Electrical Engineering (EE) Program at Sonoma State University is an innovative program in which the curriculum has been designed to provide students with education in electrical engineering with electronics and communications.

The curriculum includes 50 units of General Education courses (9 units overlap with the required Physics, Computer Science, and Mathematics courses); a 33-unit core in mathematics, computer science, and basic sciences; a 48-unit core in Electrical Engineering which includes electrical, computer, electronics, and communications engineering subjects such as circuits, analog/digital electronics, electromagnetic fields, microprocessors, analog and digital communications, and networking; and 6 units of Electrical Engineering electives which provides senior-level choices for more depth in students' areas of interest. Theoretical and practical learning experiences are an important part of all course work. The senior year also gives students the opportunity to consolidate their educational

experiences with a capstone design project. The curriculum develops students' abilities to formulate problems, analyze alternatives, make decisions, and solve problems. Internship and co-op experiences will be encouraged to provide the students a real-world experience and to enhance students' communication and interpersonal skills.

BSEE Educational Objectives

1. Educate and prepare students to be successful in the profession of electrical engineering.
2. Educate students to successfully pursue graduate degrees.
3. Provide a strong foundation to the students for lifelong learning and being responsible citizens.

BSEE Program Outcomes

The students will attain:

1. An ability to apply knowledge of mathematics, science, and engineering.
2. An ability to design and conduct experiments, as well as to analyze and interpret data.
3. 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.
4. An ability to function on multidisciplinary teams.
5. An ability to identify, formulate, and solve engineering problems.
6. An understanding of professional and ethical responsibility.
7. An ability to communicate effectively.
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
9. A recognition of the need for, and an ability to engage in lifelong learning.
10. A knowledge of contemporary issues.
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
12. Knowledge of basic sciences, advanced mathematics and engineering and ability to apply that knowledge to analyze and solve practical problems in the field of electronics and communications.
13. Expertise to design and conduct scientific and engineering experiments, analyze data and interpret results.

Career Paths and Opportunities

The BSEE Program has been designed to prepare students for an exciting career in industries or to pursue graduate degrees. The graduates will find opportunities in industry in areas such as:

1. Designing and manufacturing of electronic systems;
2. Communications systems;
3. Networking;
4. Computer engineering;
5. Telecommunications;
6. Optical fiber communications;
7. Integrated circuits;
8. Research and development in the areas above; and/or
9. Sales, marketing, and management in the areas above.

Some examples of the corresponding job titles are electronics engineer, computer engineer, hardware designer, systems engineer, communications engineer, communications analyst, telecommunications engineer, network engineer, network analyst, sales engineer, applications engineer, and field engineer.

Graduate degrees can be pursued in any one of the many fields such as electronics, communications, networking, computer engineering, and computer science.

Program Requirements

Degree Requirements	Units
Major requirements (including technical electives)	54
Support courses (physics, computer science, and mathematics*)	33
GE courses (including 9 units in support courses)	50
Total units needed for graduation	**128****

** 9 units overlap with GE units.*

*** Under revision.*

Electrical Engineering

ES 110 Introduction to Engineering & Lab Experience	2
ES 112 Fundamentals of Digital Logic Design	1
ES 210 Digital Circuits & Logic Design	4
ES 220 Electric Circuits	3
ES 221 Electric Circuits Laboratory	1
ES 230 Electronics I	3
ES 231 Electronics I Lab	1
ES 310 Microprocessors & System Design	4
ES 314 Advanced Programing, Modeling and Simulation	4
ES 330 Electronics II	2
ES 345E Engineering Applications of Probability Theory	1
ES 400 Linear Systems Theory	3
ES 442 Analog and Digital Communications	4
ES 443 Introduction to Optical Fiber Communication	3
ES 465 Introduction to Networking and Network Management	3
ES 430 Electromagnetic Theory & Applications	3

Approved Technical Elective I		3
Approved Technical Elective II		3
ES 492 Senior Design Project Planning		2
ES 493 Senior Design Project		3
ES 497 Engineering Science Colloquium		1
	Subtotal	54
Computer Science		
CS 115 Programming I		4
	Subtotal	4
Physics		
PHYS 114 Introduction to Physics I		4
PHYS 116 Introductory Lab Experience		1
PHYS 214 Introduction to Physics II		4
	Subtotal	9
Mathematics		
MATH 142E Discrete Mathematics for Engineering		2
MATH 161 Calculus I		4
MATH 211 Calculus II		4
MATH 241 Calculus III		4
MATH 261 Calculus IV		4
MATH 345E Probability Theory for Engineering		2
	Subtotal	20
General Education		
(Excluding math, physics, and CS courses)		
ENGL 101 Expository Writing & Analytical Reading		4
Remaining GE courses*		37
	Subtotal	41
	Total Units for Graduation	128**

** A list of recommended GE courses for BSEE major can be found at the department website or obtained from the department office.*

*** Under revision.*

Minor in Mathematics

The course ES 400 Linear Systems Theory is crosslisted with MATH 430 and ES 435E is recognized as equivalent of an upper division math course. As such, the BSEE curriculum includes 24 units of Mathematics including 6 units in upper-division (MATH 345E, ES 345E, and MATH 430) required to minor in mathematics. Therefore, a student satisfying BSEE degree requirement is automatically completing a minor in mathematics, and can obtain such a certification from the math department.

Minor in Electrical Engineering (EE)

The Department offers a minor program in EE to provide an opportunity to any non-EE major student interested in gaining ability and training in the field of Electrical Engineering. Students interested in receiving a minor in Electrical Engineering require 10 units to 43 units depending upon the student's major field of study and the units available as free electives in the major that can be used by the EE minor program. The EE minor requirements are as follows.

I. Course Requirements

To minor in Electrical Engineering, students must complete 24 units of Electrical Engineering courses: 15 units of core courses and 9 units of electives and 19 units of support courses in Mathematics, Physics as follows:

Core Courses (15 Units):	
ES 110 Introduction. to Engineering & Lab Experience	2
ES 112 Fundamentals of Digital Logic Design	1
ES 210 Digital Circuits & Logic Design	4
ES 220 Electric Circuits	3
ES 221 Electric Circuits Laboratory	1
ES 230 Electronics I	3
ES 231 Electronics I Lab	1
Electives From The Following List (9 units):	
ES 314 Adv. Program., Modeling and Simulation	4
ES 310 Microprocessors & System Design	4
ES 330 Electronics II	3
ES 400 Linear Systems Theory	3
ES 430 Electromagnetic Theory & Applications	3
ES 432 Physical Electronics	3
ES 440 Analog & Digital Communications I	3
ES 445 Photonics	3
ES 465 Introduction. to Networking	3
Support Courses:	
PHYS 114 Introduction to Physics I	4
PHYS 214 Introduction to Phys II	4
PHYS 116 Introductory Physics lab	1
MATH 142E Discrete Structures I	2
MATH 161 Calculus I	4
MATH 211 Calculus II	4
Total units without support courses	24
Total units including support courses	43

Additional support courses may be needed depending upon the electives chosen. For example, ES 400: Linear Systems Theory requires a prerequisite of Math 241: Differential Equations with Linear Algebra and ES 314 requires a prerequisite of CS 115.

II. Grade Requirement

The student must complete each course applied towards minor or major in Electrical Engineering with a grade of C or higher.

III. Pathway Examples

Examples of the pathways to minor in EE by the students majoring in Chemistry, Computer Science, Mathematics, and Physics disciplines are posted on the department website at url http://www.sonoma.edu/engineering/bses/ee_minor_pathway_examples.pdf. The interested students should contact ES Department for advising and developing a plan of study.

The Professional Science Masters (PSM) Programs, Master of Science in Computer and Engineering Science

- **Bioengineering (to be launched);**
- **Communications and Photonics; and**
- **Computer Hardware and Software Systems.**

The Master of Science degree in Computer and Engineering Science (MS-CES) at Sonoma State University is a multidisciplinary degree built on a strong foundation of Physics, Mathematics, Computer Science and/or Electrical Sciences and recognized as PSM programs by the Council of Graduate Schools. The Professional Science Masters (PSM) degree is a unique professional degree grounded in science and/or mathematics and designed to prepare students for a variety of career options. The degree combines advanced coursework in science and/or math with an appropriate array of professional skill-development activities to produce graduates highly valued by employers and fully prepared to progress toward leadership roles.

The MSCES program emphasizes the application of Physics, Mathematics, Computer Science and/or Electrical Sciences fields to the design, analysis and synthesis of engineering problem solutions, exposes the student to management training and provides practical real world experience through internships and graduate seminars. The MS-CES faculty is composed of professors from Sonoma State University, whose interests traverse the fields of science and engineering, as well as professionals from the local community who have cutting-edge expertise in the various engineering disciplines of interest and are qualified to be adjunct faculty in SSU. A linkage with local industry in the form of an Industry Advisory Board (IAB) is an integral part of the program. Such an advisory board is critical to ensure the Program meets local community needs. The IAB provides the Program with valuable input regarding the new scientific and technological developments and educational needs of the industry. It also facilitates internship opportunities for students, joint student research/project development and supervision, faculty-scientists/engineers joint project opportunities, equipment and financial support from the industries. Through this linkage of academic learning and practical application, students obtain a solid education indispensable for working in a professional environment. The MS-CES is a self-supported program that is underwritten by local industry as well as student tuition revenue. Therefore, as of this writing, tuition fee for this Program is $500 per unit for all students, resident and non-resident. The MS-CES is 32-35 unit program, not including any prerequisite work.

MSCES Program Educational Objectives

- Educate and prepare students to be independent investigators;
- Educate students to be leaders in their professions; and
- Educate students to be socially responsible engineers, committed to community service.

MSCES Program Outcomes

The students of this program will acquire:

- Knowledge of the theory of high performance computing, communications and/or networking (and bioengineering in case of Bioengineering Track);
- Critical thinking ability and analytical and simulation tools to do system performance evaluation;
- Ability to model and analyze scientific and engineering problems (particularly in biological environment in case of Bioengineering Track);
- Ability to apply theory to design and to implement efficient computing and/or communications systems (ability to apply theory to design and develop solutions for health-related products and techniques in case of Bioengineering Track);
- Ability to integrate knowledge from multiple interrelated disciplines to formulate, design, and/or implement interdisciplinary projects;
- Ability to investigate and formulate research problems and/or design projects independently; and
- Ability for effective written and oral communication skills.

Admission to the Program

For admission, the applicant must have:

1. A baccalaureate degree in a scientific or technical discipline from an U.S. institution accredited by an appropriate accreditation body, or an equivalent baccalaureate degree from a foreign institution of high reputation;
2. Attained grade point average of at least 3.00 (A=4.00) in the last 60 semester (90 quarter) units attempted;
3. TOEFL-Test of English as a Foreign Language with a minimum paper based score of 550, minimum computer based score of 213 or minimum internet based score of 79. Sonoma State's ETS code is 4723. (This requirement does not apply to those applicants who have studied in the U.S. for at least three consecutive years.)
4. Demonstrate competency in writing by one of the Written English Proficiency Test criteria for MS-CES students given below. If this requirement is to be met by writing an essay, it should be submitted with the application for admission; and
5. Completed the following SSU courses or equivalent at the undergraduate level with a GPA of 3.0 or higher:
    - 3 semesters of Calculus (MATH 161, 211, 241) and one semester of Probability Theory (MATH 345);
    - 1 semester of each of the following subjects: Electric Circuits with lab, Electronics with lab and Digital Circuits and Logic Design with lab (ES 220/221, ES 230/231 and ES 210);
    - 2 semesters of Programming in an approved high level Procedural Language, modeling and simulation (CS 115 and ES 314); and

- Biology prerequisite (for Bioengineering Track) or ES 310: Microprocessors and System Design (for the other tracks).

Whenever possible, the department offers highly intense and compressed courses such as CES 490 which cover the material necessary to satisfy the prerequisite requirements in an expeditious manner.

Please contact department office for more information regarding such offerings.

Conditional Admission

The applicants whose GPA is less than 3.0 but greater than 2.5, or who lack not more than 18 units of prerequisite work (generally, 6 courses), may be accepted conditionally and must complete a program of study specified by the graduate coordinator at the time of admission before being given full admission.

Written English Proficiency Test Requirement

All students are required to demonstrate competency in written English. A student can satisfy the Written English Proficiency Test (WEPT) requirement by meeting any one of the following five criteria:

1. A student who has obtained his/her bachelor's degree from a CSU institution will be deemed to have satisfied WEPT requirement.
2. A student who has obtained a bachelor's degree and a master's degree from an accredited institution(s) with English as the medium of instruction for both the degree programs will be deemed to have satisfied WEPT requirement.
3. A student who scores at least 3.5 in the analytical writing portion of the GRE test will be deemed to have satisfied the WEPT requirement.
4. A student who takes and passes the campus WEPT test.
5. A student may write and submit an article of at least 500 words in length to demonstrate his/her writing proficiency in English. It will be evaluated by the MS-CES curriculum committee for (i) competent analysis of complex ideas, (ii) development and support of main points with the relevant reasons and/or examples, (iii) organization of ideas, (iv) ease in conveying meaning with reasonable clarity, and, (v) demonstration of satisfactory control of sentence structure and language (including spelling, punctuation, and proper use of grammar). If accepted by the curriculum committee, the student will be deemed to have satisfied the WEPT requirement.

Degree Requirements

The program requires completion of a total number of thirty-two OR thirty-five semester hours, depending upon the culminating experience path chosen, of work as follows:

- 24 (Plan A and Plan B) to 27 units (Plan C) in technical courses;
- 3 units in a business and management course;
- 3 units in Culminating Experience;
- 1 unit in internship; and
- 1 unit in graduate seminar.

The Culminating Experience requirement can be completed in one of three different ways, referred above as Plan A (thesis), Plan B (design project) and Plan C (Lab and Technical Report Experience). In addition, a student must also demonstrate that he/she has acquired proficiency in written English.

Program of Study

The program offers three tracks or areas of specialization:

- Track 1: Bioengineering - This area of specialization prepares students to apply engineering principles in the areas of communications, photonics and computer hardware and software systems to develop solutions for health-related products and techniques that improve the quality of life. This specialization includes topics such as computational techniques for biomolecules, biomedical instrumentation, biophotonics, and medical image processing.
- Track 2: Communications & Photonics - This area of specialization provides students with expertise in the areas of (i) analog and digital electronics, (ii) semiconductor and photonics components and devices, (iii) communications techniques (wireless, wireline, and optical fiber media), (iv) local and wide area networking, and (v) broadband access technology.
- Track 3: Computer Hardware & Software Systems - This area of specialization is intended to deepen students' ability to analyze and design computer systems. This specialization includes topics such as embedded systems, digital data compression, software engineering, and computer networks.

A student chooses one of the three tracks at the time of admission but can change it during their course of study. However, that may mean taking additional courses to meet the requirements of the new track. A student's program of study consists of the following four components: a common core, a track core, culminating experience, and technical electives. Details of these components are as follows.

I. Common Core Curriculum (11 units)

CES 400 Linear Systems Theory	3
CES 440 Introduction. Networking & Network Management	3
CES 506 Operations Management	3
CES 591 Internship	1
CES 597 Graduate Seminar	1

II. Discipline-Specific Curriculum Group 1 (9 units from the list of selected discipline)

(a) Computer Hardware and Software Systems program

CES 432 Physics of Semiconductor devices	3
CES 530 Analog and Digital Microelectronics	3
CES 512 Theory of Software Systems	3
CES 514 Data Mining	3

(b) Communications and Photonics program

CES 430 Photonics	3
CES 530 Analog and Digital Microelectronics	3
CES 540 Digital Data Transmission	3
CES 543 Optical Fiber Communications	3
CES 544 Wireless Communications	3

(c) Bioengineering program

CES 561 Computational Techniques for Biomolecules	3
CES 562 Biomedical Instrumentation	3
CES 563 Biophotonics	3
CES 564 Medical Image Processing	3
CES 592B Selected Topics in Bioengineering	3

III. Discipline-Specific Curriculum Group 2 (3 units from the list of selected discipline)

(a) Computer Hardware and Software Systems program

CES 500 Queuing and Transform Theory	3
CES 510 Intelligent Systems Design	3
CES 516 High Performance Computing	3
CES 520 Embedded Systems	3
CES 522 VLSI Design	3

(b) Communications and Photonics program

CES 500 Queuing and Transform Theory	3
CES 542 Digital Signal Processing	3
CES 546 Data Compression	3
CES 547 Digital Switching: Techniques and Arch.	3
CES 552 Network Architecture and Protocols	3
CES 554 Broadband Access Technology	3

(c) Bioengineering program

CES 561 Theory of Software Systems	3
CES 562 Data Mining	3
CES 563 High Performance Computing	3
CES 564 Data Compression	3

IV. Culminating Experience

Thesis (Plan A), Project (Plan B) or Lab and Technical Report Experience (Plan C)	3

V. Approved Technical Electives

(Plan A: 6 units; Plan B: 6 units; Plan C: 9 units)

Choose from the following list of courses:

Course Description	Units
CES 430: Photonics	3
CES 432 Semiconductor Devices	3
CES 500: Queuing and Transform Theory	3
CES 510: Intelligent Systems Design	3
CES 512: Theory of Software Systems	3
CES 514: Data Mining	3
CES 516: High Performance Computing	3
CES 520: Embedded Systems	3
CES 522: VLSI Design	3
CES 524: Advanced Computer Architecture	3
CES 530: Analog and Digital Microelectronics	3
CES 532: Advanced Semiconductor & Photonics Devices	3
CES 540: Digital Data Transmission	3
CES 542: Digital Signal Processing	3
CES 543: Optical Fiber Communications	3
CES 544: Wireless Communications	3
CES 546: Data Compression	3
CES 547: Digital Switching: Techniques and Architectures	3
CES 552: Network Architecture and Protocols	3
CES: 554: Broadband Access Technology	3
CES 561: Computational Techniques for Biomolecules	3
CES 562: Biomedical Instrumentation	3
CES 563: Biophotonics	3
CES 564: Medical Image Processing	3
CES 590: Selected Topics in Communications and Photonics	3
CES 592: Selected Topics in Hardware & Software Systems	3
CES 592B: Selected Topics in Bioengineering	3

Duration of Program Completion

Courses for these programs are offered in the evening hours to facilitate joining these programs by working professionals. The entire Program requires 32 (Plan A and B) or 35 (Plan C) semester hours to complete. A full time student taking 9 semester hours of average load per semester can complete the 35-unit Program in four semesters and a working professional taking 6 semester hours of average load per semester is likely to complete this program in 6 semesters.

Student Mentoring Plan

Each student in a program is assigned a faculty advisor who helps the student develop a plan of study based his/her interest. The faculty advisor monitors the student's progress and address any difficulties that the student may be having in making satisfactory progress in the program. At an appropriate time, generally midway through the completion of the coursework, the student is advised to choose a master's project guide, who then takes over as the student's mentor. The mentor helps the student find an Industry mentor who can help the student in his/her master's project and internship placement in an industry. Roles of the two mentors are to guide and prepare the student to succeed in the real world and be a leader in his/her field of work.

Culminating Experience through Thesis/Design Project/Lab and Technical Report Experience

All students are required to complete a culminating experience which may take one of the following three forms:

- Research and Thesis (Plan A)
- Design Project (Plan B)
- Lab and Technical Report Experience (Plan C)

A supervisory committee is appointed for the students who choose Plan A or Plan B. A supervisory committee consists of three faculty members. One of the three members can be an adjunct faculty. A

student interested in choosing Plan A or B chooses a faculty member to be his/her thesis/project supervisor. Subsequently, the faculty supervisor becomes chairman of the student's supervisory committee. In consultation with the faculty supervisor, two other members of the committee are selected. For a student choosing Plan C, an advisor is appointed by the Program Director to guide the student through this plan.

Under Plan A, a student chooses to do thesis research and write a thesis under the guidance of the faculty supervisor and members of the supervisory committee.

Under Plan B, a student chooses to prepare a design project focused on the design of devices, instruments, or systems. As in the case of Plan A, the project is mentored by the student's faculty supervisor and members of the supervisory committee.

Upon approval by the student's supervisory committee, the thesis research or design project may be carried out at the student's company's site (if the student is working) under the supervision of an approved senior scientist/engineer of the company. However, a SSU faculty supervisor must oversee the research/project and regularly examine the student's progress. While not a requirement for graduation, it is expected that the results of the research/project will be presented in an appropriate technical conference and/or published in a relevant professional journal.

Plan C, Lab and Technical Report Experience (LTR Experience), provides students with the opportunity to take more courses to develop a deeper knowledge in their areas of interest instead of carrying out research or design projects, gives extensive exposure of the state-of-the art equipment in various laboratories, and develops technical report writing skills.

Internship Requirement

As a part of culminating experience, each MS-CES student is required to do an internship in an industry, university, laboratory, utility company, government organization, etc. The objectives of the internship must be to gain hands-on training in dealing with and solving real world engineering problems within the scope of the student's plan of study, develop teamwork and presentation skills and develop an understanding of the differences in ideal and real world situations. The internship must be completed within one semester or semester term. The number of hours worked as an intern should be at least 45, preferably much more. The supervisory committee's and graduate coordinator's approval must be obtained before starting the internship. After completion of the internship, a report of the work done and achievements certified by the intern-supervisor must be submitted to the supervisory committee and department for its acceptance.

Students with industrial experience can petition for a waiver of the internship requirement. However, the petition may be considered by the student's supervisory committee and the graduate coordinator of the MS-CES program only if the student can support the petition with proper supporting evidence that he/she fulfills this requirement based on his/her past industrial experience.

GPA Requirements

Please refer to this catalog and the department office for various general academic regulations and specific requirements for graduate students such as grade point average requirement, course repeat policy, continuation in the program, etc.

Laboratories

The program has the following eight state-of-the art laboratories in various areas of interest located in the Cerent Engineering Sciences Complex in Salazar Hall.

- AFC Access Technologies Laboratory
- Agilent Technologies Communications Laboratory
- Rolf Illsley Photonics Laboratory
- William Keck Microanalysis Laboratory
- Networking Laboratory
- Human-Computer Interaction and Systems Laboratory
- Software Engineering Laboratory
- Electronics Laboratory

These labs provide excellent facilities to our students and faculty for hands-on experience, research, project development, implementation, and testing. Many of these labs are sponsored by the high-tech industries in the North Bay region of the San Francisco area.

Sample Four-year Program for Bachelor of Science in Electrical Engineering

SEMESTER 1: 16 Units	
ES 110 Introduction to Engineering & Lab Experience	2
CS 115 Programming I	4
MATH 142E Discrete Mathematics for Engineering	2
MATH 161 Calculus 1	4
ENGL 101 Expository Writing & Analytical Reading (GE)	4
SEMESTER 2: 16 Units	
ES 112 Fundamentals of Digital Logic Design	1
PHYS 114 Introduction to Physics I	4
PHYS 116 Introductory Lab Experience	1
MATH 211 Calculus II	4
GE	6
SEMESTER 3: 16 Units	
PHYS 214 Introduction to Physics II	4
MATH 241 Calculus III	4
ES 220 Electric Circuits	3
ES 221 Electric Circuits Lab	1
GE	4
SEMESTER 4: 18 Units	
ES 210 Digital Circuits & Logic Design	4
ES 230 Electronics I	3
ES 231 Electronics I Laboratory	1
MATH 261 Calculus IV	4
GE	6
SEMESTER 5: 15 Units	
ES 314 Adv. Program., Modeling and Simulation	4
ES 330 Electronics II	2
ES 345E Engineering Applications of Probability Theory	1
MATH 345E Probability Theory for Engineering	2
ES 400 Linear Systems Theory	3
GE	3
SEMESTER 6: 17 Units	
ES 310 Microprocessors and System Design	4
ES 442 Analog & Digital Communications	4
ES 430 Electromagnetic Theory & Applications	3
GE	6
SEMESTER 7: 15 Units	
ES 443 Introduction to Optical Fiber Communications	3
ES 465 Introduction to Networking and Network Management	3
ES 492 Senior Design Project Planning	2
ES 497 Eng. Science Colloquium	1
GE	6
SEMESTER 8: 15 Units	
ES 493 Senior Design Project	3
Approved Technical Elective I	3
Approved Technical Elective II	3
GE	6
TOTAL UNITS: 128	