

## **New Industry-Sponsored Laboratories**

The construction of two labs in the Industrial and Manufacturing Engineering Department was recently made possible with generous and on-going contributions from several industry partners.

The first lab, the Solectron Lab, equipped with 13 Gateway Pentium computers with industry-current software, allows students to design their own circuits and circuit boards.

### **Solectron Electronics Manufacturing CAD/CAM Laboratory**

*Photo courtesy of College of Engineering*

The Stanford Telecom Lab allows the designs created in the first lab to be manufactured. Real automation tools, including a circuit board assembly line, solder paste stencil printer, and reflow oven, allow students to perform all the steps necessary – such as screen printing, chip mounting, and soldering – for creating their own circuit products.

Students from all majors who take IME 157 Electronic Manufacturing create working prototypes of their choice, from start to finish – from power supplies, phone answering equipment, or car burglar alarms, to signal generators.

Use of these labs by freshmen as well as seniors and graduate students has generated an increased appreciation by all students for the real industrial applications of the science and the art of engineering.

### **Stanford Telecom Electronics Automation Laboratory**

*Photo by Ken Chen, courtesy of Communications Office*

# College of *Engineering*

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## ACADEMIC PROGRAMS

Aeronautical Engineering .....	BS, * MS
Bioresource & Agricultural Engineering .....	BS*
(College of Agriculture)	
Civil and Environmental Engineering.....	MS
Civil Engineering .....	BS*
Computer Engineering .....	BS*
Computer Science .....	BS**, MS,
	Minor
Electrical Engineering .....	BS*, MS
Engineering.....	MS
Engineering Management .....	MBA/MS
Environmental Engineering .....	BS*
General Engineering .....	BS
Industrial Engineering.....	BS*
Manufacturing Engineering .....	BS*
Materials Engineering.....	BS*
Mechanical Engineering .....	BS*
Transportation Planning .....	MCRP/MS

\* Engineering programs accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

\*\* BS Computer Science program accredited by the Computing Sciences Accreditation Commission of the Computer Science Accreditation Board.

Engineering and computer science at Cal Poly are strongly oriented toward preparing students for immediate entry into professional practice upon graduation from one of the bachelor's degree programs. Each student selects a major at entrance and generally takes at least one course in that major each quarter. This early introduction increases motivation to master the mathematics, basic science, and engineering science or computer science which constitute a very important portion of each curriculum.

The undergraduate engineering disciplines listed above provide the education for entry to the engineering profession and for continued academic work toward advanced degrees. Many of our graduates enter graduate programs at Cal Poly or other institutions. Cal Poly engineering and computer science graduates are in great demand and find a large variety of challenges awaiting them. They enter professional occupations such as engineering design, computer hardware and software engineering, test and evaluation, systems analysis, modeling

and simulation, manufacturing, applied research, development, sales, and field engineering. Graduates pursue careers in a broad cross-section of industry, government agencies, public utilities, marketing groups, and educational institutions.

The main focus of the engineering and computer science programs at Cal Poly is to prepare graduates for practice in professional engineering and computer science. Our "learn by doing" philosophy is reflected in the curricula by the numerous design-centered laboratories, integrating design throughout the curricula, and the senior project capstone design experience.

The Accreditation Board for Engineering and Technology (ABET) defines engineering as "the profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize economically the materials and forces of nature for the benefit of mankind."

The Bachelor of Science degree in Computer Science is designed in accordance with the Report of the ACM/IEEE-CS Joint Curriculum Task Force, Computing Curricula 1991. Numerous laboratory and project experiences enhance the practical skills of the graduate. They are equally prepared for the practice of computer science and graduate study.

The master's degree programs in the College of Engineering are built upon the excellence of Cal Poly's undergraduate engineering and computer science programs. Industry most often considers the master's degree as an important requirement for the design, development, applied research and analysis occupations in engineering and computer science. The master's degree allows entry into these occupations at higher levels of technical skills and responsibilities.

The MS in Computer Science has special provisions for students whose undergraduate degree is in a field other than computer science. Students from a wide variety of fields have earned the MS in Computer Science by following a carefully designed remedial curriculum prior to enrolling in graduate courses. A similar program is available in the engineering master's degree program for students whose undergraduate degree is in a closely related field of science.

## STUDENT SERVICES CENTER

The College of Engineering Student Services Center, located in the Engineering South Building (40), houses the Advising Center, the MESA Engineering Program, and the Women's Engineering Program. These offices provide centralized services to undergraduate engineering students.

### Advising Center

**Stacey Breitenbach, Director**  
**Engineering South (40), Room 115**  
**(805) 756-1461**

[www.ee.calpoly.edu/CENGAC/](http://www.ee.calpoly.edu/CENGAC/)

The College of Engineering Advising Center provides academic advising services to all majors within the College in conjunction with each student's faculty adviser. The Advising Center is open five days a week, nine hours per day during the quarter.

Tracking of academic and administrative progress of all engineering students is done within the Advising Center. Current academic and administrative probation policies are posted on our web site, as well as other information that pertains to new and continuing students. Students should be aware that all full-time engineering students are expected to complete (with passing grades) a minimum of two major and/or support courses per quarter with no more than one course per quarter that does not count toward their stated degree.

Most student-related forms (such as curriculum substitution and change of major) are processed in the Advising Center. The majority of the general education questions and interpretation of transfer credit questions are handled in the Advising Center after the Evaluations Office has provided the initial evaluation.

The Advising Center maintains working folders on each student. These folders are used for general advising purposes. The Advising Center has past and present flowcharts and curriculum sheets for all engineering majors, major specific technical elective forms, FE (EIT) information packets, articulation agreements, and engineering-related pamphlets for student perusal.

While the Advising Center is responsible for providing procedural advice, faculty advisers are responsible for providing academic content and technical advice. Student course scheduling, course content questions, and career planning are usually done by the faculty advisers. Depending on the form and the student's major, the director of the Advising Center has signature authority to sign for the adviser, department chair, and associate dean with strict adherence to procedures developed with the Department Heads/Chairs and the Dean and Associate Deans.

## MESA Engineering Program (MEP)

**David Cantu, Director**  
**Engineering South (40), Room 117**  
**(805) 756-1433**

[www.calpoly.edu/~mep](http://www.calpoly.edu/~mep)

The MESA Engineering Program (MEP) is an academic support program designed to recruit, retain, and graduate educationally disadvantaged students in engineering and computer science disciplines. This purpose is accomplished by building an academic support community among students and providing the necessary bridges for students' academic and professional success.

MEP offers an orientation class to teach effective learning techniques. A study center is available for students so that they can overcome feelings of isolation, develop supportive academic peer groups, and share information about classes and scholarship opportunities.. Tutoring is available for undergraduate technical courses. Group study workshops teach students complex technical concepts through group study and support. In pursuit of professional development, students are offered summer jobs, internship and scholarship opportunities by companies who recognize the MEP as a valuable source for skilled future employees.

## Women's Engineering Program

**Lizabeth T. Schlemmer, Director**  
**Engineering South (40), Room 119**  
**(805) 756-2350**

[www.csc.calpoly.edu/~swe](http://www.csc.calpoly.edu/~swe)

The Women's Engineering Program provides support services to encourage women to pursue technical degrees. Retention activities focus on supporting women in social, academic, and financial environments. Socially, the Women's Engineering program joins with the Society of Women Engineers (SWE) to host bi-monthly meetings, socials, and community service activities all aimed at building a network for female students. The program also provides information on financial aid opportunities.

Professional job placement activities are coordinated in conjunction with SWE. Activities include an annual banquet with industry representatives, resume seminars, professional speakers, and discussion of special issues women encounter.

A variety of outreach activities are sponsored by the Women's Engineering Program. Each activity exposes pre-college students to women role models and fun activities to introduce engineering as a career choice.

## TRANSFER STUDENTS

The following chart should be studied and followed in order to prevent loss of time in completing an engineering program after transferring to Cal Poly.

**TRANSFER STUDENTS: Recommended Community College Preparation for  
Engineering and Computer Science Curricula**

Recommended C.C. Preparation in Terms of Cal Poly Courses	Qtr. Units	Aero	BRAE	CE	CpE	CSc	EE	GENE	EnvE	IE	MfgE	MatE	ME
<b>Maximum Transfer Units</b>		105	105	105	105	105	105	105	105	105	105	105	105
<b>Mathematics</b>													
MATH 141 Calculus I	4	X	X	X	X	X	X	X	X	X	X	X	X
MATH 142 Calculus II	4	X	X	X	X	X	X	X	X	X	X	X	X
MATH 143 Calculus III	4	X	X	X	X	X	X	X	X	X	X	X	X
MATH 206 Linear Algebra I	4					X							
MATH 241 Calculus IV	4	X	X	X	X		X	X	X	X	X	X	X
MATH 242 Differ. Equations	4	X	X	X	X		X	X	X	X	X	X	X
<b>Physics</b>													
PHYS 131 General Physics	4	X	X	X	X	X	X	X	X	X	X	X	X
PHYS 132 General Physics	4	X	X	X	X	X	X	X	X	X	X	X	X
PHYS 133 General Physics	4	X	X	X	X	X	X	X	X	X	X	X	X
PHYS 211 Modern Physics	4				X		X						
<b>Chemistry</b>													
CHEM 124 General Chemistry	4	X	X	X	X	X	X	X	X	X	X	X	X
CHEM 125 General Chemistry	4		X	X			X	X	X	X	X	X	X
CHEM 129 General Chemistry	4								X				
<b>Engineering, Computer Science</b>													
Engineering Graphics, CAD/CAM, Design	–	4	4	4	0	0	0	2	4	4	4	2	4
Digital Computer Science	–	2	2	2	10	10	3	3	2	3	3	2	2
Manufacturing Processes	–	0	0	0	0	0	0	4	0	4	5	2	5
Engineering Strength of Materials	–	6	6	6	0	0	0	6	5	3	6	6	6
Engineering Statics & Dynamics	–	6	6	6	3	0	6	6	6	6	6	6	6
Engineering Circuits and Electronics		4	4	4	8	0	8	4	4	4	4	4	4
Materials Engineering	–	3	0	4	0	0	3	4	0	3	4	4	4
Surveying	–	0	2	4	0	0	0	0	0	0	0	0	0
<b>General Education</b>													
Courses vary. See appropriate curriculum.													

**Cal Poly Majors:**

Aero = Aeronautical Engineering  
 BRAE = Agricultural Engineering  
 CE = Civil Engineering  
 CpE = Computer Engineering

CSc = Computer Science  
 EE = Electrical Engineering  
 GENE = General Engineering  
 EnvE = Environmental Engineering

IE = Industrial Engineering  
 MfgE = Manufacturing Engineering  
 MatE = Materials Engineering  
 ME = Mechanical Engineering

# *Master of Science in Engineering*

## PROGRAMS

### MS Engineering with Specializations in:

Biochemical Engineering  
 Bioengineering  
 Biomedical Engineering  
 Industrial Engineering  
 Integrated Technology Management  
 Materials Engineering  
 Mechanical Engineering  
 Water Engineering

### BS + MS, Accelerated 4 + 1 Programs

#### Joint Programs:

Engineering Management Specialization,  
 MBA/MS Engineering  
 Transportation Planning Specialization,  
 MCRP/MS Engineering

## MS Engineering

### General Characteristics

The Master of Science degree program in Engineering has the following objectives:

- Provide preparation for further study in engineering, leading to the Doctor of Engineering or Ph.D. degree.
- Provide an empowering terminal professional degree for students who intend to become practicing engineers. A degree which not only retains the strong laboratory emphasis and industrial interaction found in the BS curriculum, but which also provides an attractive, efficient educational option to undergraduate students.
- Provide job-entry education for the more complex and evolving interdisciplinary areas of engineering, such as research and development, innovative design, systems analysis and design, bio-engineering, manufacturing, mechatronics and engineering management.
- Update and upgrade opportunities for practicing engineers.
- Allows graduates to maintain currency in their fields.

### Prerequisites

For admission as a classified graduate student, an applicant should hold a bachelor's degree in engineering or a closely related physical science with a minimum grade point average of 2.5 in the last 90 quarter units (60 semester units) attempted. Applicants for graduate engineering programs are required to submit scores for the General Test of the Graduate Record Examination. An applicant who meets these standards but lacks prerequisite coursework

may be admitted as a conditionally classified student and must make up any deficiencies before advancement to classified graduate standing.

### Program of Study

Graduate students must file formal study plans with their adviser, department, college and university graduate studies office by no later than the end of the quarter in which the 12th unit of approved courses is completed.

The formal program of study must include a minimum of 45 units (at least 23 of which must be at the 500 level) with a specialization in one of the following areas: Biochemical Engineering, Bioengineering, Biomedical Engineering, Industrial Engineering, Integrated Technology Management, Materials Engineering, Mechanical Engineering, or Water Engineering.

Participants in the 4 + 1 Program should submit a tentative study plan, developed in conjunction with their adviser, to the Dean of the College of Engineering at the end of the second quarter of their junior year.

### Requirements

The broad curriculum requirements for the Master of Science degree in Engineering are:

- a) a minimum of 24 units in the field of specialization, with at least 18 units at the 500 level;
- b) a minimum of 9 units from an approved list of mathematics, statistics, computer science, or analytic engineering courses, with at least 3 units at the 500 level;
- c) the remaining units taken from a list of approved electives;
- d) at least 23 units of the 45 unit program at the 500 level.

In some specializations, two program options are available: a thesis program which requires coursework, a thesis and oral defense of thesis; *or* a nonthesis option which involves additional coursework and a comprehensive examination. The nonthesis option is normally allowed only for those students who have completed a senior project or have had significant engineering project experience.

### Joint Programs

The College of Engineering offers two joint programs: in conjunction with the College of Business, the MBA/MS Engineering with a specialization in Engineering Management; and with the College of Architecture and Environmental Design (City and Regional Planning Department), the MCRP/MS Engineering with a specialization in Transportation Planning.

### Other Graduate Engineering Programs

In addition to the MS in Engineering, the college also offers several other graduate programs: MS Aeronautical Engineering, MS Civil and Environmental Engineering, MS Computer Science, and MS Electrical Engineering. Information regarding these programs is listed with the respective department.

### BS + MS Engineering, Accelerated 4 + 1 Program

The 4 + 1 Program is an accelerated route to the professional degree. In many evolving technical areas, four years is not enough time for the formal education of an engineer about to enter a lifelong career of professional practice, even when the individual is committed to life long learning.

The college offers an accelerated program for directed and motivated students. The 4 + 1 program allows General Engineering, Industrial Engineering, Manufacturing Engineering, and Mechanical Engineering students to progress toward the terminal applied MS in Engineering degree with specialization in Biochemical Engineering, Bioengineering, Biomedical Engineering, Industrial Engineering, Integrated Technology Management, or Mechanical Engineering, while still undergraduates. The program enables students to earn both a BS and an MS degree in five calendar years.

#### Prerequisites for the 4 + 1 Program

Students are eligible to apply to this program after the first quarter of their junior year. Participation in the program is based on prior academic performance and other measures of professional promise. Students are selected by an interdisciplinary faculty committee, chosen on the basis of the student's area of interest.

The thesis serves to complete the senior project requirement in addition to fulfilling the requirement for the MS degree, reducing total unit requirements. The program allows the student to complete a more meaningful capstone experience, linking the classroom experience to thesis work. Furthermore, this arrangement increases a student's possibilities for industrial interaction in their professional program.

In addition, the 4 + 1 student is allowed to earn graduate credit for several of their senior electives, effectively decreasing the summed unit requirement for the two degrees. The scheduling flexibility provided by the 4 + 1 program enables students to complete their degrees in the most efficient manner. An example 4 + 1 curriculum is provided on the following pages.

Additional information may be obtained from the College of Engineering.

### Example Curriculum for General Engineering student in 4 + 1 Program

In this example, a student chose to focus on biomaterials aspects of the field.

1st Year		
Fall (15 units)	Winter (15 units)	Spring (15 units)
ENGR 110 I	ENGR 111	ENGR 112
CHEM 124	CHEM 125	<i>Life science ge</i>
<i>Area A ge</i>	<i>Area A ge</i>	<i>Area A ge</i>
MATH 141	MATH 142	MATH 143
	PHYS 131	PHYS 132
2nd Year		
Fall (17 units)	Winter (17 units)	Spring (18 units)
EE 201	CE 204	MATE 210
ME 211	ME 212	MATE 215
<i>Area D ge</i>	<i>Area D ge</i>	CSC 101
MATH 241	MATH 242	HIST 204 <i>ge</i>
PHYS 133	CHEM 305*	MATH 317*
3rd Year		
Fall (17 units)	Winter (15 units)	Spring (16 units)
ME 302	ME 313	ME 341
IME 314	ME 328 <i>tech</i>	MATE 424 <i>tech</i>
MATE 230 <i>tech</i>	CHEM 328 <i>elec</i>	CSC 342 <i>tech</i>
<i>Area D ge</i>	<i>Area E ge</i>	<i>Area C ge</i>
CHEM 326 <i>elec</i>	<i>Area C ge</i>	<i>Area C ge</i>
4th Year		
Fall (16 units)	Winter (14 units)	Spring (13 units)
MATE 440 <i>tech</i>	CSC 480 <i>tech</i>	IME 319 <i>tech</i>
MATE 425 <i>tech</i>		EE 321 <i>tech</i>
CSC 103 <i>tech</i>	ENGR 581 <i>tech</i> *	MATE 570 <i>tech</i> *
<i>Area D ge</i>	<i>Area C ge</i>	<i>Area D ge</i>
5th Year		
Fall (15 units)	Winter (11 units)	Spring (11 units)
STAT 512	ENGR 590	ENGR 591
ENGR 582	EE 500-level	MATE 400-level
MATE 530		
Thesis 599 <i>tech</i> *	Thesis 599 <i>tech</i> *	Thesis 599 <i>tech</i> *
<b>Total Units = 231</b>		

<i>ge</i>	General Education
*	Math & Science Elective
<i>elec</i>	Elective
<i>tech</i>	Technical Elective
<i>tech</i> *	Shared BS and MS Technical Elective

**MS Engineering, Specialization in  
BIOCHEMICAL ENGINEERING**

<b>Required Courses</b> .....	37
Analytical methods for engineering (6)	
Advanced mathematics (3)	
ENGR 599 Design Project (Thesis) (2) (2) (5) <i>or</i> 9 units of approved technical electives <i>and</i> written comprehensive examination	
<i>Select 19 units from the following:</i>	
ME 541 Advanced Thermodynamics (4)	
ME 552 Conductive Heat Transfer (3)	
ME 553 Convective Heat Transfer (3)	
ENVE 421 Mass Transfer Operations (3)	
ENGR 581,582,583 Biochemical Engr I,II,III (4,4,4)	
<b>Approved Electives</b> .....	<u>8</u>
	45

**MS Engineering, Specialization in  
BIOENGINEERING**

<b>Required Courses</b> .....	33
ENGR 550 Advanced Topics in Bioengineering (4)	
MATE 530 Biomaterials (4)	
ENGR 581 Biochemical Engineering I (4)	
ENGR 599 Design Project (Thesis) (9)	
<i>Select 12 units from the following:</i>	
BIO 431, 432, 442, 542	
CSC 471, 473, 474, 475, 541	
EE/CPE 436	
ENGR 450, 582	
ENVE 443, 536	
IME 502	
MATE 425, 570	
ME 401, 502, 551, 552, 553, 554	
STAT 512, 542	
<b>Approved Engineering Electives</b> .....	<u>12</u>
	45

**MS Engineering, Specialization in  
BIOMEDICAL ENGINEERING**

<b>Required Courses</b> .....	32
MATE/CHEM 446 Surface Chemistry/Materials (3)	
ENGR 450 Special Topics in Bioengineering (4)	
ENGR 550 Advanced Topics in Bioengineering (4)	
ENGR 599 Design Project (Thesis) (9)	
<i>Select 12 units from the following:</i>	
CHEM 473; CHEM/BIO 475	
CSC 471, 473, 474, 475	
EE 419; EE/CPE 436	
ENVE 421	
IME 437, 543	
MATE 446, 530, 570	
ME 401, 422, 423, 445, 502, 551	
STAT 542	
<b>Approved Engineering Electives</b> .....	<u>13</u>
	45

**MS Engineering, Specialization in  
INDUSTRIAL ENGINEERING**

<b>Required Courses</b> .....	36
Analytical methods for engineering (12)	
IME 599 Design Project (Thesis) (2) (2) (5) <i>or</i> 9 units of approved technical electives <i>and</i> written comprehensive examination	
<i>Select 15 units from the following:</i>	
IME 426 Engr Test Design and Analysis (4)	
IME 526 Adv Topics Mftg System Design (4)	
IME 541 Advanced Operations Research (3)	
IME 542 Reliability Engineering (3)	
IME 543 Advanced Human Factors (4)	
IME 544 Adv.Topics in Engineering Economy (3)	
IME 545 Advanced Topics in Simulation (3)	
<b>Approved electives</b> .....	<u>9</u>
	45

**MS Engineering, Specialization in  
INTEGRATED TECHNOLOGY MANAGEMENT**

The program goal is to develop "industry ready" graduates who will be integrators of engineering disciplines, industry concerns, and technology management. Many of the program courses involve actual integrated problems or opportunities from industrial organizations in a collaborative learning environment.

<b>Required Courses</b> .....	33
IME 502 Graduate Survey (3)	
IME 556 Technological Project Management (4)	
IME 580 Manufacturing Systems (4)	
IME 557 Technological Assessment & Planning (4)	
IME 596 Team Project/Internship (4) (6)	
Approved electives in specialization (8)	
<b>Approved Engineering Electives</b> .....	9
9 units of approved technical electives <i>and</i> written comprehensive examination	
<b>Approved Electives</b> .....	<u>6</u>
	48

**MS Engineering, Specialization in  
MATERIALS ENGINEERING**

<b>Required Courses</b> .....	35
MATE 570 Advanced Materials (4)	
STAT 512 Statistical Methods (4)	
MATE 599 Design Project (Thesis) (2) (2) (5)	
<i>Select 18 units from the following:</i>	
MATE 410 Materials Engineering (4)	
MATE 440 Joining (5)	
MATE 530 Biomaterials (4)	
MATE 562 Mechanical Behavior of Materials (4)	
MATE 580 Fracture Mechanics (3)	
MATE 590 Densification Processing (4)	
<b>Approved Electives</b> .....	<u>10</u>
	45

**MS Engineering, Specialization in MECHANICAL ENGINEERING**

<b>Core Courses</b> .....	29
ME 599 Design Project (Thesis) (2)(2)(5) <i>or</i> 9 units of approved technical electives <i>and</i> a comprehensive examination	
MATH, STAT or CSC approved courses (8) <i>Select 12 units from the following:</i>	
ME 502 Stress Analysis (4)	
ME 517 Advanced Vibrations (4)	
ME 531 Acoustics and Noise Control (3)	
ME 541 Advanced Thermodynamics (4)	
ME 542 Dynamics of Compressible Flow (4)	
ME 552 Conductive Heat Transfer (3)	
ME 553 Convective Heat Transfer (3)	
ME 554 Computational Heat Transfer (3)	
<b>Approved Engineering electives</b> .....	16
	<hr/> 45

**MS Engineering, Specialization in WATER ENGINEERING**

<b>Required Courses</b> .....	35
Analytical methods for engineering (6)	
Advanced Mathematics (3)	
ECON 410 Public Finance/Cost-Benefit Analysis (4)	
BRAE 435/BRAE 414/BRAE 440 (3)	
BRAE 533 Irrigation Project Design (4)	
CE 533 Adv Water Resources Engineering (3)	
CE 573 Public Works Administration (3)	
BRAE/CE 599 Design Project (Thesis) (2) (2) (5) <i>or</i> 9 units of approved technical electives <i>and</i> written comprehensive examination	
<b>Approved Elective Courses</b> .....	10
<i>Select 10 units from the following:</i>	
BRAE 414, 437, 440, 492, 5331	
CE 434, 440	
ENVE 438, 439, 535	
	<hr/> 45

**MBA/MS Engineering, Specialization in ENGINEERING MANAGEMENT**

The joint Engineering Management Program (EMP) specialization is an interdisciplinary program linking the MBA and MS in Engineering degree programs. It is a cooperative effort between the College of Engineering (Industrial and Manufacturing Engineering Department) and the College of Business. Students are required to have a prerequisite degree in engineering, computer science, or equivalent technical degree and to be admitted to both the College of Engineering and the College of Business, and to be enrolled in both degree programs.

The program can be completed in 21 months. Upon completion, graduates will receive both MBA and MS in Engineering degrees each with a specialization in Engineering Management.

The mission of the program is to develop "industry ready" graduates who will be facilitators of change and integrators of engineering, business, and people issues.

The three major objectives are:

- 1) to integrate knowledge and skills from engineering and business disciplines for effective responses to rapidly changing technological and business environments;
- 2) to prepare engineers for effective participation in management of technology, management of technology-based organizations, and management of technological change; and
- 3) to take advantage of the unique background of program participants and the unique strengths of Cal Poly.

**MBA/MS Engineering Management**

GSB Core (three 12-unit classes) .....	36
<i>The MBA program is currently undergoing change and core classes are being offered on an experimental basis. For more information, contact Director of Graduate Management Programs....</i>	
<sup>1</sup> GSB electives .....	16
GSB 562 Graduate Seminar/General Mgt Strategy ..	4
IME 502 Graduate Survey .....	3
IME 556 Technological Project Management .....	4
IME 557 Technological Assessment & Planning .....	4
IME 580 Manufacturing Systems.....	4
IME 596 Team Project.Internship (10) <i>or</i> IME 599 Design Project/Thesis (9).....	10
<sup>1</sup> Engineering electives .....	17
	<hr/> 98

<sup>1</sup> Engineering electives to be selected with College of Engineering adviser's approval. GSB electives, including at least one international business elective, to be selected with College of Business adviser's approval.

**MCRP/MS Engineering with Specialization in TRANSPORTATION PLANNING**

The Transportation Planning Specialization is a joint interdisciplinary program between the College of Engineering and the College of Architecture and Environmental Design. Participation in the program requires enrollment in both Colleges. Participants successfully completing the program will be awarded both the MCRP and the MS in Engineering, each with a Specialization in Transportation Planning.

The major objectives of this joint program are:

- (a) To provide an interdisciplinary graduate program which combines elements of transportation planning with city and regional planning to address a need for professionals who have a command of both the technology of transportation planning and the place of transportation within the urban environment. The required master's project is intended to allow the students a period of directed study that will allow them to integrate their work and to apply this to special areas of their choosing.
- (b) To provide planners with courses essential to understanding the technologies of transportation planning. To provide engineers with a broad background in urban studies and a knowledge of contemporary environmental issues.
- (c) To take advantage of the backgrounds of program participants. The graduate students of both sponsoring departments include both mature professionals returning for advanced degrees and recent graduates with a diversity of specializations.

**Prerequisites**

Applicants must have satisfactorily completed courses that cover the following or equivalent subject areas:

- CE 221 Fundamentals of Transportation Engineering
- CE 381 Geotechnical Engineering *or*
- GEOL 201 Physical Geology
- CSC 231 Fortran for Engineering Students
- ECON 211 Principles of Economics
- ENGL 218 Professional Writing: Argument & Reports
- MATH 143 Calculus
- PHYS 131 General Physics
- SPC 201 Public Speaking
- STAT 321 Statistical Analysis

Applicants for admission are expected to:

- \* Have earned a bachelor's degree from an accredited university or college,
- \* Have attained a grade point average of 3.0 in last 90 units of undergraduate work,
- \* Provide results of the Graduate Record Examination (GRE) Aptitude Test to the Admissions Committee.
- \* Give indications of motivation, maturity, and high standards of academic involvement through work and references (three letters required) and submission of a project or paper demonstrating writing ability,
- \* Provide a statement (maximum of 300 words) addressing their understanding of and areas of interest in planning, career objectives, and educational objectives.

Applicants lacking prerequisites or other background requirements for classified standing may be admitted on a conditionally classified basis, depending on the results of an individual analysis of their applications.

<b>Core Courses</b> .....	68
CE 523 Transportation System Planning (4)	
CE 528 Transportation Analysis <i>or</i>	
CE 525 Airport Planning and Design (4)	
CE 571 Selected Advanced Laboratory (3)	
CE 574 Computer Applications in C.E. (3)	
CE 591 Graduate Seminar (1)	
CE 599 <i>or</i> CRP 599 Project /Thesis (2,2,2)	
CRP 409 Planning Internship (2)	
CRP 420 Land Use Law (4)	
CRP 435 Transportation Theory (3)	
CRP 501 Foundations of Cities and Planning (4)	
CRP 510 Planning Theory (4)	
CRP 513 Planning Research Methods (4)	
CRP 515 Planning Presentation/Communication (3)	
CRP 516 Quantitative Methods in Planning (4)	
CRP 518 Policy Analysis for Planners (4)	
CRP 525 Plan Implementation (4)	
CRP 530 Planning Agency Management (3)	
CRP 552 Urban Planning Laboratory (4)	
CSC, MATH, STAT or other approved quantitative methods course (3)	
<b>Emphasis Area (select one of the following)</b> .....	14
<i>Urban Land Planning Emphasis</i>	
CRP 520 Feasibility Studies in Planning (4)	
CRP 548 Principles of City Design (3)	
CRP 553 Project Planning Laboratory (4)	
Urban Land Planning electives (4)	
<i>Regional and Environmental Planning Emphasis</i>	
CRP 404 Environmental Law (3)	
CRP 545 Environ Planning, Policies & Principles (4)	
CRP 554 Regional Planning and Analysis (4)	
Regional and Environmental Planning electives (3)	
<b>Approved CE/ENVE electives:</b> .....	8
	90

# Aeronautical Engineering

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**College of Engineering Advising Center**  
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## Department Chair, Jin Tso

Daniel J. Biezad                      Faysal A. Kolkailah  
 Russell M. Cummings              Jordi Puig-Suari  
 Jon A. Hoffmann

## ACADEMIC PROGRAMS

### BS, MS Aeronautical Engineering

The Bachelor of Science degree in Aeronautical Engineering prepares students for engineering work related to aerodynamics, flight testing, structures, propulsion, control systems, dynamics, stability and control, flight simulation, and design for both fixed and rotary wing aircraft, missiles, and spacecraft. The problems faced by the aerospace industry offer an unusual engineering challenge. Much of the analysis and testing must be accomplished at the very frontiers of knowledge. Nevertheless, products must be designed and manufactured; thus, an exceptionally wide range of engineering abilities is required within the industry and government.

The main focus of the program is to prepare graduates for practice in professional engineering. Thus, Cal Poly's "learn by doing" philosophy is emphasized by integrating design throughout the curriculum in the numerous design-centered laboratories. In the required senior design project, which is completed in a three-quarter set of capstone courses, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

Graduates in aeronautical engineering obtain employment in all phases of the aerospace industry such as general design, aerodynamics, stress analysis, flight testing, flight simulation, dynamics, stability and control, and propulsion systems.

The BS degree program in Aeronautical Engineering is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology. It places emphasis on both analysis and design. Supplementary to both is the basic work in graphics and laboratory. Throughout the entire program there is constant interplay between theory and application. Opportunities are available for advanced elective work in the student's field of special interest.

There are laboratory facilities for fabrication, propulsion, structural test, aerodynamics, dynamics, flight simulation and flight test, and design.

There are three student chapters of the national societies—the American Institute of Aeronautics and Astronautics, the American Helicopter Society, and the Society for the Advancement of Material and Process Engineering. There is also a student chapter of the national aerospace engineering honor society, Sigma Gamma Tau.

### 4 + 1 Program

In many evolving technical areas, four years are not enough time for the formal education of an engineer about to enter a lifelong career of professional practice, even when the individual is committed to life long learning.

The department offers an accelerated program for directed and motivated students. The 4 + 1 Program allows Aeronautical Engineering students to progress toward the terminal applied masters degree while still undergraduates. Students may earn graduate credit for several of their senior electives, effectively decreasing the summed unit requirement for the two degrees. The scheduling flexibility provided by the program enables students to complete their BS and MS degrees in the most efficient manner.

### Prerequisites

Students are eligible to apply to this program after the first quarter of their junior year. Participation in the program is based on prior academic performance and other measures of professional promise, with a minimum GPA of 2.5 required (3.0 GPA recommended). Students are selected by a faculty committee.

### Program of Study

Participants in the 4 + 1 Program should submit a formal study plan, developed in conjunction with their adviser, to the Chair of the Aeronautical Engineering Department, at the end of the second quarter of their junior year. The formal program of study must include a minimum of 45 units (at least 23 of which must be at the 500 level).

Upon completion of the program, students are awarded the BS degree and the MS degree. Five of the nine units of AERO 599 Thesis serve to complete the senior project requirement. Furthermore, this arrangement increases opportunities for industrial interaction.

**BS AERONAUTICAL ENGINEERING**

For course prerequisites, please refer to the "Course Descriptions" section of this catalog. In scheduling your courses each quarter, consult with your academic adviser. \* Satisfies GE requirement; see page 79.

**Freshman**

AERO 121 Aerospace Fundamentals.....	2
IME 144 Intro Design and Manufacturing	4
Life Sciences elective (B1b)* .....	2
CHEM 124 Genl Chemistry/Engineering (B1a)* ...	4
CSC 231 Fortran for Engineering Students (F1)*...	2
ENGL 114 Writing: Exposition (A1)*.....	4
ENGL/PHIL/SPC 125 Critical Thinking (A2)*.....	3
SPC 20/ SPC 202 Speech Communication (A3)*...	3
MATH 141, 142, 143 Calculus I, II, II (B2)*.....	4,4,4
PHYS 131, 132 General Physics (B1a)* .....	4,4
Life Understanding elective (Area E)* .....	3
	<hr/>
	47

**Sophomore**

AERO 215 Introduction to Aerospace Design.....	2
CE 204 Strength of Materials .....	3
CE 205, 206 Strength of Materials and Lab.....	2,1
EE 201, 251 Electric Circuit Theory and Lab.....	3,1
ME 211 Engineering Statics .....	3
ME 212 Engineering Dynamics .....	3
ENGL 218 Prof Writing: Argument/Reports (A4)*.	4
PHYS 133 General Physics (Area B)* .....	4
MATH 241 Calculus IV .....	4
MATH 242 Differential Equations .....	4
CSC 341 Numerical Engineering Analysis .....	4
Literature elective (C1)* .....	3
Philosophy elective (C1)*.....	3
Fine and performing arts elective (C2)* .....	3
Social, political, economics electives (Area D)* ....	3
	<hr/>
	50

**Junior**

AERO 301, 302 Aerothermodynamics .....	5,5
AERO 303, 304 Aerothermodynamics .....	5,2
AERO 306 Aerodynamics/Flight Performance.....	4
AERO 307 Wind Tunnel & Flight Test Lab.....	2
AERO 315 Aerospace Engineering Analysis .....	4
AERO 320 Fund Guidance and Control .....	4
AERO 330 Aerospace Structural Analysis .....	4
EE 321, 361 Electronics and Lab.....	3,1
MATE 210 Materials Engineering.....	3
American Institutions/History (D1a)*.....	3
American Institutions/Political Science .....	3
Social, political, economics elective (Area D)*	3
	<hr/>
	51

**Senior**

AERO 401 Propulsion Systems .....	4
AERO 420 Stability & Control/Aerospace Vehicles	4
AERO 430 Adv Composite Structures Anlys/Des...	4
AERO 461, 462 Senior Project.....	2,3
Arts and humanities elective (Area C)* .....	3
Literature, philosophy, arts (300-400 level) (C3)*..	3

Social, political, econ (300-400 level) (Area D)* ....	3
Courses to complete concentration.....	22
	<hr/>
	48
	<hr/>
	196

**BS AERONAUTICAL ENGINEERING**

- 60 units upper division       GWR  
 2.0 GPA                               USCP

\* = Satisfies General Education requirement

**MAJOR COURSES**

AERO 121 Aerospace Fundamentals.....	2
AERO 215 Introduction to Aerospace Design .....	2
AERO 301, 302 Aerothermodynamics.....	5,5
AERO 303, 304 Aerothermodynamics.....	5,2
AERO 306 Aerodynamics and Flight Performance .	4
AERO 307 Wind Tunnel and Flight Test Lab	2
AERO 315 Aerospace Engineering Analysis .....	4
AERO 320 Fundamentals Guidance and Control....	4
AERO 330 Aerospace Structural Analysis.....	4
AERO 401 Propulsion Systems .....	4
AERO 420 Stability/Control Aerospace Vehicles....	4
AERO 430 Adv Composite Structures Anlys/Des ..	4
AERO 461, 462 Senior Project .....	2,3
CE 204 Strength of Materials.....	3
CE 205, 206 Strength of Materials and Lab.....	2,1
EE 201, 251 Electric Circuit Theory and Lab.....	3,1
Concentration courses (see below).....	22
	<hr/>
	88

**SUPPORT COURSES**

CHEM 124 Genl Chemistry/Engineering (B1a)* ....	4
CSC 231 Fortran for Engineering Students (F1)* ...	2
CSC 341 Numerical Engineering Analysis .....	4
EE 321, 361 Electronics and Lab.....	3,1
ENGL 218 Prof Writing: Argumt/Reports (A4)* ...	4
IME 144 Intro Design and Manufacturing .....	4
MATE 210 Materials Engineering.....	3
MATH 141, 142, 143 Calculus I, II, III (B2)* .....	4,4,4
MATH 241 Calculus IV (Area B)*.....	4
MATH 242 Differential Equations (Area B)*.....	4
ME 211 Engineering Statics.....	3
ME 212 Engineering Dynamics .....	3
PHYS 131, 132, 133 General Physics (B1a)* .....	4,4,4
	<hr/>
	63

**GENERAL EDUCATION (GE)** ..... 45

72 units required; 27 units are in Major/Support.  
 →See page 79 for complete GE course listing.  
 →Minimum of 3 GE courses required at the 300-400 level.

**Area A Communication** (minimum 10 units)

1 unit is in Support  
 Take one course from A1, A2, A3:  
 A1 Expository Writing  
 A2 Critical Thinking  
 A3 Speech  
 A4 Argumentative Writing \*see Support

**Area B Science and Mathematics** (minimum 2 units)

24 units are in Support.  
 Take one course from B1b:  
 B1a Physical Sciences \*see Support  
 B1b Life Sciences elective  
 B2 Mathematics and/or Statistics \*see Support  
 Area B \* see Support

**Area C Arts and Humanities** (minimum 15 units)

Take one course from each Area C category:  
 C1 Literature  
 C1 Philosophy  
 C2 Fine/Performing Arts  
 C3 Lit/Phil/Arts (300-400 level)  
 If less than 15 units, take one course from C1, C2, C3

**Area D Social, Political, Economic Inst.** (min 15 units)

No more than one course in any Area D category.  
 Take one course from D1a and one from D1b  
 D1a HIST 202 (USCP) or HIST 204 or LS 211  
 D1b POLS 110 or LS 212  
 Take three courses from D2, D3, D4a, D4b  
 D2 History (300-400 level)  
 D3 Economics  
 D4a Social Institutions  
 D4b Social Institutions (300-400 level)

**Area E Life Understanding** (minimum 3 units)

Take one course from E1 or E2  
 E1 PSY 201/PSY 202 or E2 Self Development

**Area F Technology** (no additional units required)

2 units are in Support.  
 F1 Computer Literacy \*see Support

**ELECTIVES** ..... 0  
 196

**CONCENTRATIONS (select one)**

**Aeronautics Concentration**

AERO 405 Supersonic/Hypersonic Aerodynamics ....	4
AERO 443, 444, 445 Aircraft Design .....	2,4,4
Aeronautics electives.....	8
	<hr/> 22

**Astronautics Concentration**

AERO 451 Orbital Mechanics I .....	4
AERO 447, 448, 449 Spacecraft Design .....	2,4,4
Astronautics electives.....	8
	<hr/> 22

**MS AERONAUTICAL ENGINEERING**

**General Characteristics.** The Master of Science program in Aeronautical Engineering prepares the student for entry into a well- established field of aeronautical engineering. The subject matter relative to flight simulation and controls, structures, and aerothermal sciences has been integrated into coursework. The program emphasizes engineering science and research activity. Graduates have an increased capability for complex research, development, and innovative design, and are prepared for further study in engineering, leading to the Doctor of Engineering or Ph.D.

**Prerequisites.** For admission as a classified graduate student, an applicant must hold a bachelor's degree in engineering (preferably aeronautical engineering) or a closely related physical science with a minimum grade point average of 3.0 in the last 90 quarter units (60 semester units) attempted. Applicants are required to submit satisfactory scores for the General (Aptitude) Test and Subject (Advanced) Test of the Graduate Record Examination in engineering.

An applicant who meets these standards but lacks prerequisite coursework may be admitted as a conditionally classified student and must make up any deficiencies before advancement to classified graduate standing. Information pertaining to specific requirements for admission to graduate standing (classified or conditionally classified) may be obtained from the Graduate Coordinator, Department of Aeronautical Engineering.

**Program of Study.** Graduate students must file a formal study plan with their adviser, department, college and graduate studies office by no later than the end of the quarter in which the 12th unit of approved courses is completed. The formal program of study must include a minimum of 45 units (at least 24 of which must be at the 500 level). A thesis or project is required as a culminating experience.

The Department also offers the same M.S. degree program to Air Force officers and engineers at Vandenberg Air Force Base (VAFB), about 60 miles south of Cal Poly. This off-campus site has the same curriculum and faculty as the main campus. During the fall, winter, and spring quarters, courses will be offered via video teleconferencing and during the summer quarter via on-site teaching. Courses will typically be offered between 4-8 p.m. to accommodate the students' working schedules.

<b>Required Courses</b> .....	37
AERO 520 Theoretical Aerodynamics (4)	
AERO 535 Adv Aerospace Structural Analysis (4)	
AERO 540 Elements of Rocket Propulsion (4)	
AERO 550 Analysis/Design Flight Control Sys (4)	
AERO 599 Design Project (Thesis) (3) (3) (3)	
MATH 501, 502 Applied Mathematics I, II (4) (4)	
AERO 515 Continuum Mechanics (4)	

**Adviser approved electives** ..... 8  
 45

# Civil and Environmental Engineering

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## Department Chair, Robert J. Lang

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Gregg L. Fiegel	Nirupam Pal
Rakesh K. Goel	Jeffrey G. Sczechowski
Stephen L. M. Hockaday	S. Somayaji
Carl C. F. Hsieh	Edward C. Sullivan
Eric P. Kasper	Samuel A. Vigil
Stuart E. Larsen	

## ACADEMIC PROGRAMS

**BS Civil Engineering**  
**BS Environmental Engineering**  
**MS Civil and Environmental Engineering**

### BS Civil Engineering

The Board of Directors of the American Society of Civil Engineers has defined Civil Engineering as "...the profession in which a knowledge of the mathematical and physical sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the progressive well-being of mankind in creating, improving and protecting the environment, in providing facilities for community living, industry and transportation, and in providing structures for the use of mankind."

The Bachelor of Science degree in Civil Engineering emphasizes the application of scientific knowledge and technology for the betterment of humankind. The program stresses the team design concept and systems approach to problem solving and is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Students learn to solve practical engineering problems and design civil engineering facilities and systems using traditional and state-of-the-art techniques. Extensive experience is gained through the use of modern, well-equipped laboratories. The program focuses on the preparation of graduates for immediate entry into the profession; however, adequate scientific depth is maintained throughout the curriculum so that graduates are readily accepted into graduate programs in civil engineering.

The main focus of the program is to prepare graduates for practice in professional engineering. Thus, Cal Poly's "learn by doing" philosophy is emphasized by integrating

design throughout the curriculum and the numerous design-centered laboratories. In the required senior design project, which is completed in a two-quarter set of capstone courses, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

Graduates of the program accept a wide variety of positions in local, state and federal government service or with private engineering firms. Typically, graduates are immediately involved in the planning, design, and construction of civil engineering projects.

The Civil Engineering curriculum includes broad coverage of the engineering sciences and basic sciences, mathematics, social sciences, and humanities. Essential training is given in each of the principal civil engineering emphasis areas: environmental engineering, geotechnical engineering, structural engineering, transportation engineering, and water resources engineering. Flexibility within the curriculum allows students to take 29 units of upper division civil engineering technical electives. A student may choose to use these technical elective units to study topics related to one or more of the five principal civil engineering emphasis areas listed above. Suggested emphasis area curricula are available from the department. In lieu of choosing a particular emphasis area, students have the opportunity to design a curriculum of their own, allowing for a broad range of civil engineering interests.

The Society of Civil Engineers (SCE) student organization is recognized as one of the nation's premiere student chapters. The organization sponsors a variety of opportunities for professional development, community service, and social activities to supplement the formal academic program. SCE is made up of chartered student chapters of the following professional organizations: American Public Works Association, American Society of Civil Engineers, and Institute of Transportation Engineers.

### BS Environmental Engineering

The Bachelor of Science degree program in Environmental Engineering is concerned with the interrelation of people, materials, and processes in a complex and changing environment. The broad field of environmental engineering includes control of air and water pollution, industrial hygiene, noise and vibration control, and solid waste and hazardous waste management. Cal Poly has one of the few undergraduate programs in this field.

The program offers a sound background in the fundamentals of thermodynamics, heat transfer, fluid mechanics, mass transfer, water resources and geotechnical engineering. The problem-oriented approach to instruction, in modern well-equipped laboratories, provides an excellent opportunity to gain understanding and experience. The program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

The main focus of the program is to prepare graduates for practice in professional engineering. Thus, Cal Poly's "learn by doing" philosophy is emphasized by integrating design throughout the curriculum and the numerous design-centered laboratories. In the required senior design project, which is completed in a two-quarter set of capstone courses, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

The Society of Environmental Engineers offers technical programs and other activities, including field trips each year to Los Angeles and San Francisco to study typical installations of systems. Student memberships also are available in the Air and Waste Management Association, the California Water Pollution Control Association, and the Water Environment Federation.

An engineering approach to the subject enables graduates to pursue careers in industry, consulting firms, and public agencies concerned with air and water pollution control, groundwater, potable water treatment, solid waste management, and hazardous waste management.

**BS CIVIL ENGINEERING**

*For course prerequisites, please refer to the "Course Descriptions" section of this catalog. In scheduling your courses each quarter, consult with your academic adviser. \* Satisfies GE requirement; see page 79.*

**Freshman**

CE 111 Introduction to Civil Engineering .....	1
CE 114 Intro CAD in Civil/Environ Engr.....	4
CHEM 124, 125 General Chemistry for the Engineering Disciplines (B1a)* .....	4,4
ENGL 114 Writing: Exposition (A1)* .....	4
ENGL/PHIL/SPC 125 Critical Thinking (A2)* .....	3
SPC 201 <i>or</i> SPC 202 (A3)* .....	3
ENGL 218 Prof Writing: Argument/Reports (A4)*.	4
MATH 141, 142, 142 Calculus I,II,III (B2)* .....	4,4,4
PHYS 131, 132 General Physics (B1a)* .....	4,4
CSC 231 Fortran <i>or</i> CSC 234 C/UNIX (F1*).....	2/3
<sup>1,2</sup> Social, political, economic institutions (Area D)*.	3
	52

**Sophomore**

CE 201 Strength of Materials (5) <i>or</i> CE 204, CE 205 Strength of Materials I, II (3)(2) .....	5
CE 206 Strength of Materials Laboratory .....	1
CE 221, 222 Fund Transportation Engr and Lab .....	3,2
CE 259 Civil Engineering Materials .....	2

BRAE 239 Engineering Surveying .....	4
GEOL 201 Physical Geology (B1a)* .....	3
MATE 210, 215 Materials Engineering and Lab .....	3,1
MATH 241 Calculus IV (B2)* .....	4
MATH 242 Differential Equations (B2)* .....	4
ME 211 Engineering Statics.....	3
ME 212 Engineering Dynamics .....	3
ME 302 Thermodynamics.....	3
ME 341 Fluid Mechanics.....	3
PHYS 133 General Physics (B1a)*.....	4
<sup>1</sup> Literature elective (C1)* .....	3
	38
	1

**Junior**

CE 336 Water Resources Engineering .....	4
CE 337 Hydraulics Laboratory .....	1
CE 351 Structural Analysis .....	5
CE 355 Reinforced Concrete Design .....	3
CE 381, 382 Geotechnical Engineering and Lab .....	4,1
CE 407 Structural Dynamics.....	4
CE 453 Structural Steel Design.....	3
ENVE 331 Intro to Environmental Engineering .....	4
CSC 341 Numerical Analysis <i>or</i> IME 314 Engr Econ.....	4/3
EE 201 Electric Circuits Theory .....	3
STAT 312 Statistical Methods for Engineers (B2)*	4
<sup>1</sup> Life sciences elective (B1b)* .....	2
American Institutions-History (D1a)* .....	3
American Institutions-Politics (D1b)*.....	3
<sup>1</sup> Philosophy elective (C1)* .....	3
<sup>3,4</sup> Adviser approved technical electives.....	4
	54

**Senior**

CE 461, 462 Senior Project.....	2,2
<sup>1</sup> Arts and humanities elective (Area C)* .....	3
<sup>1</sup> Fine and performing arts elective (C2)* .....	3
<sup>1</sup> Literature, phil, arts elective (300-400 level) (C3)*.	3
<sup>1</sup> Social, political, economic institutions (Area D)*....	3
<sup>1</sup> Social, political, econ (300-400 level) (Area D)* ....	3
<sup>1</sup> Life understanding elective (Area E)* .....	3
<sup>3</sup> Adviser approved emphasis area to be selected from: general civil, geotechnical, structural, transportation, or water resources engineering .....	14
<sup>3,4</sup> Adviser approved technical electives.....	10
	46
	<b>203</b>

<sup>1</sup> For selection of GEB electives, see page 79 or current *Class Schedule*.  
<sup>2</sup> ECON 201 or equivalent if planning to take IME 314.  
<sup>3</sup> To be selected in accordance with the A.B.E.T. 24-unit Engineering Design requirement, after consultation with your academic adviser.  
<sup>4</sup> No more than 4 units of coursework other than CE/ENVE may be used to satisfy the Civil Engineering degree requirement.

**BS CIVIL ENGINEERING**

- ☐ 60 units upper division      ☐ GWR
- ☐ 2.0 GPA                              ☐ USCP

\* = Satisfies General Education requirement

**MAJOR COURSES**

CE 111 Civil Introduction to Civil Engineering .....	1
CE 114 Intro CAD in Civil & Environmental Engr. ....	4
CE 201 Strength of Materials (5) or CE 204, CE 205 Strength of Materials I, II (3)(2) .....	5
CE 206 Strength of Materials Laboratory .....	1
CE 221, 222 Fund Transportation Engr and Lab .....	3,2
CE 259 Civil Engineering Materials .....	2
CE 336 Water Resources Engineering .....	4
CE 337 Hydraulics Laboratory .....	1
CE 351 Structural Analysis .....	5
CE 355 Reinforced Concrete Design .....	3
CE 381, 382 Geotechnical Engineering and Lab .....	4,1
CE 407 Structural Dynamics .....	4
CE 453 Structural Steel Design .....	3
CE 461, 462 Senior Project .....	2,2
<sup>1</sup> Adviser approved emphasis area to be selected from: general civil, geotechnical, structural, transportation, or water resources engineering .....	14
<sup>1,2</sup> Adviser approved technical electives .....	14
	<b>75</b>

**SUPPORT COURSES**

BRAE 239 Engineering Surveying .....	4
CHEM 124 Gen Chemistry for Engineering (B1a)* .....	4
CHEM 125 Gen Chem for Engineering (Area B)* ..	4
CSC 231 Fortran for Engineering Students or CSC 234 C and UNIX (F1)* .....	2/3
CSC 341 Numerical Analysis or IME 314 Engineering Economics .....	4/3
EE 201 Electric Circuits Theory .....	3
ENGL 218 Prof Writing: Argument/ Reports (A4)* .....	4
ENVE 331 Intro to Environmental Engineering .....	4
GEOL 201 Physical Geology (Area B)* .....	3
MATE 210 Materials Engineering .....	3
MATE 215 Materials Engineering Laboratory .....	1
MATH 141 Calculus I (B2)* .....	4
MATH 142 Calculus II (B2)* .....	4
MATH 143 Calculus III (Area B)* .....	4
MATH 241 Calculus IV (Area B)* .....	4
MATH 242 Differential Equations (Area B)* .....	4
ME 211 Engineering Statics .....	3
ME 212 Engineering Dynamics .....	3
ME 302 Thermodynamics .....	3
ME 341 Fluid Mechanics .....	3
PHYS 131 General Physics (Area B)* .....	4
PHYS 132 General Physics (Area B)* .....	4
PHYS 133 General Physics (Area B)* .....	4
STAT 312 Statistical Methods for Engr (Area B)* ..	4

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**GENERAL EDUCATION (GE) .....** **45**  
 72 units required; 27 of these units are in Major/Support.  
 →See page 79 for complete GE course listing.  
 →Minimum 3 GE courses required at the 300-400 level.

**Area A Communication** (minimum 10 units)

- 1 unit is in Support*
- Take one course from A1, A2, A3:*
- A1 Expository Writing
- A2 Critical Thinking
- A3 Speech
- A4 Argumentative Writing \*see Support

**Area B Science and Mathematics** (minimum 2 units)

- 24 units are in Support.*
- Take one course from B1b:*
- B1a Physical Sciences \*see Support
- B1b Life Sciences elective
- B2 Mathematics and/or Statistics \*see Support
- Area B \* see Support

**Area C Arts and Humanities** (minimum 15 units)

- Take one course from each Area C category:*
- C1 Literature
- C1 Philosophy
- C2 Fine/Performing Arts
- C3 Lit/Phil/Arts (300-400 level)
- If less than 15 units, take one course from C1, C2, C3*

**Area D Social, Political, Economic Inst.** (min 15 units)

- No more than one course in any Area D category.*
- Take one course from D1a and one from D1b*
- D1a HIST 202 (USCP) or HIST 204 or LS 211
- D1b POLS 110 or LS 212
- Take three courses from D2, D3, D4a, D4b*
- D2 History (300-400 level)
- D3 Economics
- D4a Social Institutions
- D4b Social Institutions (300-400 level)

**Area E Life Understanding** (minimum 3 units)

- No more than one course in any Area E category.*
- Take one course from E1 or E2*
- E1 PSY 201/PSY 202
- E2 Self Development

**Area F Technology** (no additional units required)

- 2 units are in Support.*
- F1 Computer Literacy \*see Support

**ELECTIVES .....** **0**  
**203**

<sup>1</sup> To be selected in accordance with the A.B.E.T. 24-unit Engineering Design requirement, after consultation with your academic adviser.  
<sup>2</sup> No more than 4 units of coursework other than CE/ENVE may be used to satisfy the Civil Engineering degree requirement.

**BS ENVIRONMENTAL ENGINEERING**

For course prerequisites, please refer to the "Course Descriptions" section of this catalog. In scheduling your courses each quarter, consult with your academic adviser. \* Satisfies GE requirement; see page 79.

**Freshman**

CE 114 Intro CAD in Civil & Environmental Engr.	4
CHEM 124, 125 General Chemistry for the Engineering Disciplines (B1a)	4,4
CHEM 129 General Chemistry	4
MATH 141, 142, 143 Calculus I,II,III (B2)	4,4,4
MCRO 221 Survey of Microbiology (B1b, E2)	4
PHYS 131, 132 General Physics (B1a)	4,4
ENGL 114 Writing: Exposition (A1)	4
ENGL/PHIL/SPC 125 Critical Thinking (A2)	3
<sup>1</sup> Social, political, economic institutions (Area D)	3
<sup>1</sup> Life understanding elective (Area E)	3
	<u>53</u>

**Sophomore**

CE 201 Strength of Materials (5) or CE 204, 205 Strength of Materials I, II (3)(2)	5
CE 221 Fundamentals Transportation Engineering	3
CHEM 212 Survey of Organic Chemistry (B1a)	5
CSC 231 Fortran or CSC 234 C/UNIX (F1)	2/3
ENGL 218 Prof Writing: Argument/Reports (A4)	4
MATH 241 Calculus IV (B2)	4
MATH 242 Differential Equations (B2)	4
ME 211 Engineering Statics	3
ME 212 Engineering Dynamics	3
ME 302 Thermodynamics	3
PHYS 133 General Physics (B1a)	4
STAT 312 Statistical Methods for Engineers (B2)	4
SPC 201 or SPC 202 (A3)	3
American Institutions-History (D1a)	3
	<u>50</u>

**Junior**

CE 336 Water Resources Engineering	4
CE 337 Hydraulics Laboratory	1
CE 381 Geotechnical Engineering	4
ENVE 304 Thermodynamics of Processes	3
ENVE 309 Noise and Vibration Control	3
ENVE 316 Automatic Process Control	2
ENVE 325 Environmental Air Quality	3
ENVE 331 Intro Environmental Engineering	4
ENVE 426 Air Quality Measurements	3
EE 201, 251 Electric Circuit Theory and Lab	3,1
ME 313 Heat Transfer	3
ME 341 Fluid Mechanics	3
<sup>1</sup> Literature elective (C1)	3
<sup>1</sup> Philosophy elective (C1)	3
<sup>1</sup> Fine and performing arts elective (C2)	3
American Institutions-Politics (D1b)	3
<sup>1</sup> Social, political, econ institutions (Area D)	3
	<u>52</u>

**Senior**

CE 434 Groundwater Hydraulics and Hydrology	3
ENVE 411 Air Pollution Control	3
ENVE 421 Mass Transfer Operations	3
ENVE 434 Water Quality Measurements	2
ENVE 436 Intro Hazardous Waste Management	3
ENVE 438 Water & Wastewater Treatment Design	3
ENVE 439 Solid Waste Management	3
ENVE 442 Advanced System Design	3
ENVE 461, 462 Senior Project	2,2
ME 456 Ventilation Principles and Design	4
<sup>1</sup> Arts and humanities elective (Area C)	3
<sup>1</sup> Literature, phil, arts elective (300-400 level) (C3)	3
<sup>1</sup> Social, political, econ inst (300-400 level) (Area D)	3
<sup>2</sup> Adviser approved technical electives	11
	<u>51</u>
	<b>206</b>

**BS ENVIRONMENTAL ENGINEERING**

- 60 units upper division       GWR
- 2.0 GPA                               USCP

\* = Satisfies General Education requirement

**MAJOR COURSES**

CE 114 Intro CAD in Civil and Env Engr	4
CE 201 or CE 204, 205 Strength of Materials	5
CE 221 Fundamentals Transportation Engineering	3
CE 336 Water Resources Engineering	4
CE 337 Hydraulics Laboratory	1
CE 381 Geotechnical Engineering	4
CE 434 Groundwater Hydraulics and Hydrology	3
ENVE 304 Thermodynamics of Processes	3
ENVE 309 Noise and Vibration Control	3
ENVE 316 Automatic Process Control	2
ENVE 325 Environmental Air Quality	3
ENVE 331 Intro to Environmental Engineering	4
ENVE 411 Air Pollution Control	3
ENVE 421 Mass Transfer Operations	3
ENVE 426 Air Quality Measurements	3
ENVE 434 Water Quality Measurements	2
ENVE 436 Intro Hazardous Waste Management	3
ENVE 438 Water & Wastewater Treatment Design	3
ENVE 439 Solid Waste Management	3
ENVE 442 Advanced System Design	3
ENVE 461, 462 Senior Project	2,2
<sup>2</sup> Adviser approved technical electives	11
	<u>77</u>

**SUPPORT COURSES**

CHEM 124, 125 General Chemistry for the Engineering Disciplines (B1a)*	4,4
CHEM 129 General Chemistry (Area B)*	4
CHEM 212 Survey of Organic Chemistry (B1a)*	5

<sup>1</sup> For selection of GEB electives, see page 79 or current *Class Schedule*.

<sup>2</sup> To be selected in accordance with the A.B.E.T. 24-unit Engineering Design requirement, in consultation with your academic adviser

CSC 231 Fortran or CSC 234 C/UNIX (F1)* .....	2
EE 201, 251 Electric Circuit Theory and Lab.....	3,1
ENGL 218 Prof Writing: Argument/Reports (A4)*.	4
MATH 141, 142, 143 Calculus I,II,III (B2)* .....	4,4,4
MATH 241 Calculus IV (Area B)*.....	4
MATH 242 Differential Equations (Area B)* .....	4
MCRO 221 Survey of Microbiology (B1b, E2)*.....	4
ME 211, 212 Engr Statics, Engr Dynamics .....	3,3
ME 302 Thermodynamics.....	3
ME 313 Heat Transfer .....	3
ME 341 Fluid Mechanics.....	3
ME 456 Ventilation Principles and Design.....	4
PHYS 131, 132, 133 General Physics (Area B)* ..	4,4,4
STAT 312 Statistical Methods/Engineers (Area B)*	4
	<b>86</b>
<b>GENERAL EDUCATION (GE)</b> .....	<b>43</b>
<i>72 units required; 29 of these units are in Major/Support.</i>	
→See page 79 for complete GE course listing.	
→Minimum 3 GE courses required at the 300-400 level.	
<b>Area A Communication</b> (minimum 10 units)	
<i>1 unit is in Support. Take one course from A1, A2, A3:</i>	
A1 Expository Writing	
A2 Critical Thinking	
A3 Speech	
A4 Argumentative Writing *see Support	
<b>Area B Science and Mathematics</b> (no additional units required)	
<i>26 units are in Support.</i>	
B1a Physical Sciences *see Support	
B1b Life Sciences elective *see Support	
B2 Mathematics and/or Statistics *see Support	
Area B * see Support	
<b>Area C Arts and Humanities</b> (minimum 15 units)	
<i>Take one course from each Area C category:</i>	
C1 Literature	
C1 Philosophy	
C2 Fine/Performing Arts	
C3 Lit/Phil/Arts (300-400 level)	
<i>If less than 15 units, take one course from C1, C2, C3</i>	
<b>Area D Social, Political, Economic Inst.</b> (min 15 units)	
<i>No more than one course in any Area D category.</i>	
<i>Take one course from D1a and one from D1b</i>	
D1a HIST 202 (USCP) or HIST 204 or LS 211	
D1b POLS 110 or LS 212	
<i>Take three courses from D2, D3, D4a, D4b</i>	
D2 History (300-400 level)	
D3 Economics	
D4a Social Institutions	
D4b Social Institutions (300-400 level)	
<b>Area E Life Understanding</b> (minimum 3 units)	
<i>No more than one course in any Area E category.</i>	
<i>Take one course from E1 or E2</i>	
E1 PSY 201/PSY 202	
E2 Self Development	
<b>Area F Technology</b> (no additional units required)	
<i>2 units are in Support.</i>	
F1 Computer Literacy *see Support	
<b>ELECTIVES</b> .....	<b>0</b>
	<b>206</b>

## MS Civil and Environmental Engineering

### General Characteristics

The Master of Science program in Civil and Environmental Engineering has the following objectives:

- Job-entry education for the more complex areas of engineering, such as research and development, innovative design, systems analysis and design, and managerial engineering;
- Updating opportunities for practicing engineers;
- Graduate preparation for further study in engineering, leading to the Doctor of Engineering or Ph.D. degree;
- Graduates who are able to maintain currency in their fields.

### Prerequisites

For admission as a classified graduate student, an applicant must hold a bachelor's degree in engineering or a closely related physical science with a minimum GPA of 3.0 in the last 90 quarter units (60 semester) attempted. Applicants are required to submit satisfactory scores for the General (Aptitude) Test of the Graduate Record Examination. An applicant who meets these standards but lacks prerequisite coursework may be admitted as a conditionally classified student and must make-up any deficiencies before advancement to classified graduate standing.

Information pertaining to specific requirements for admission to graduate standing (classified or conditionally classified) may be obtained from the Graduate Coordinator, Civil and Environmental Engineering Department.

### Program of Study

Graduate students must file a formal study plan with their adviser, department, college and university graduate studies office by no later than the end of the quarter in which the 12th unit of approved courses is completed. The formal program of study must include a minimum of 45 units (at least 24 of which must be at the 500 level). With the graduate adviser's approval, students select their elective units in one of the following areas of study: geotechnical engineering, transportation and planning, or water resources and environmental engineering.

The broad curriculum requirements for the MS in Civil and Environmental Engineering are:

- \* a core of 10 units as required;
- \* a minimum of 26 units of adviser approved electives within the major;
- \* a minimum of 9 units of adviser-approved electives outside the major;
- \* at least 24 units of the 45 unit program at the 500 level;
- \* a comprehensive written examination (non-thesis option) or an oral defense examination (thesis option).

Two program options are available:

**Thesis option.** 36 units of adviser-approved coursework, 9 units of thesis research/design, and an oral thesis defense examination administered by a panel of three faculty.

**Non-thesis option.** 45 units of adviser-approved coursework and a written comprehensive examination administered by a panel of three faculty (maximum of three opportunities to pass this examination).

	<i>Units</i>
<b>Required Courses</b> .....	10
CE 591 Graduate Seminar (1)	
CE 599/ENVE 599 Design Project (Thesis) (9) <i>or</i> additional 9 units of adviser approved analysis and design electives within the major (non- thesis option) and Comprehensive Examination.	
<b>Adviser approved analysis and design CE and ENVE electives</b> (to be selected from the following list after consultation with your academic adviser and the CE/ENVE graduate coordinator): .....	26
<b>Adviser approved analysis electives outside the major</b> (to be selected after consultation with your academic adviser and the CE/ENVE Graduate Coordinator). .....	9
	45

**Analysis and design CE and ENVE electives:**

- CE 405 Advanced Strength of Materials (3)
- CE 407 Structural Dynamics (4)
- CE 421 Traffic Engineering (4)
- CE 422 Highway Geometrics and Design (4)
- CE 424 Public Transportation (4)
- CE 431 Coastal Hydraulics (3)
- CE 432 Coastal Engineering (3)
- CE 434 Ground Water Hydraulics and Hydrology (3)
- CE 440 Hydraulic Systems Engineering (3)
- CE 453 Structural Steel Design (3)
- CE 454 Structural Design (4)
- CE 481 Analysis & Design of Shallow Foundations (4)
- CE 482 Conventional Subsurface Exploration (4)
- CE 483 Environmental Geotechnology (4)
- CE 521 Airfield and Highway Pavement Design (4)
- CE 522 Advanced Transportation Design (4)
- CE 523 Transportation Systems Planning (4)
- CE 525 Airport Planning and Design (4)
- CE 528 Transportation Analysis (4)
- CE 529 Modeling and Simulation in Transportation (4)
- CE 533 Adv Water Resources Engineering (3)
- CE 535 Water Resources System Plan/Analysis (3)
- CE 537 Groundwater Contamination (3)
- CE 554 Matrix Analysis of Structures (3)
- CE 555 Adv Civil Engineering Materials Lab (2)
- CE 557 Earthquake Analysis/Design of Structures (4)
- CE 558 Introduction to Finite Element Analysis (3)
- CE 559 Advanced Structural Design (4)

- CE 571 Selected Advanced Laboratory (1-3)
- CE 573 Public Works Administration (3)
- CE 574 Computer Applications in Civil Engineering (3)
- CE 581 Advanced Geotechnical Engineering (4)
- CE 582 Advanced Geotechnical Testing (4)
- CE 583 Geotechnical Earthquake Engineering (4)
- CE 584 Lateral Support Systems (4)
- CE 585 Slope Stability Analysis (4)
- CE 586 Analysis and Design of Deep Foundations (4)
- CE 599 Design Project Thesis (9)
- ENVE 411 Air Pollution Control (3)
- ENVE 421 Mass Transfer Operations (3)
- ENVE 434 Water Quality Measurements (2)
- ENVE 436 Intro Hazardous Waste Management (3)
- ENVE 437 Industrial and Hazardous Waste Treatment Technologies (4)
- ENVE 438 Water/Wastewater Treatment Design (3)
- ENVE 439 Solid Waste Management (3)
- ENVE 443 Bioenvironmental Engineering I (4)
- ENVE 465 Environmental Mgt/Urban Systems (2)
- ENVE 534 Adv Design Pollution Control Systems (3)
- ENVE 535 Advanced Wastewater Treatment (3)
- ENVE 536 Biological Wastewater Treatment Processes Engineering (3)
- ENVE 541 Resource and Energy Recovery (3)
- ENVE 551 Environmental Unit Operations (4)

# Computer Engineering

**Program Office**  
**Engineering East Building (20), Room 215**  
**(805) 756-1229**

**College of Engineering Advising Center**  
**Engineering South (40), Room 115**  
**(805) 756-1461**

## Director, Joseph E. Grimes

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David B. Braun	C. Arthur MacCarley
Fred W. DePiero	Richard S. Sandige
James G. Harris	Chris J. Scheiman
Lewis D. Hitchner	Clinton A. Staley
John Y. Hsu	Daniel J. Stearns

## ACADEMIC PROGRAMS

### BS Computer Engineering

The goal of the BS program in Computer Engineering is the education of those students with an interest in designing computer based systems with an emphasis on integrating hardware and software systems. The program offers a firm foundation in both electrical engineering and computer science. This balanced background allows the graduate to make intelligent decisions in the area of the definition and design of systems, hardware and software, and the tradeoffs among these components of design.

The student builds on this foundation by specializing in a technical track. Current technical elective tracks are:

- computer architecture and system integration
- computer networks
- computer based controls and robotics
- software engineering

The main focus of the program is to prepare graduates for practice in professional engineering. Thus, Cal Poly's "learn by doing" philosophy is emphasized by integrating design throughout the curriculum and the numerous design-centered laboratories. In the required senior design project, which is completed in a two-quarter set of capstone courses, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

This integrated approach will allow students to work effectively in such areas as digital systems simulation and digital control systems. Knowledge and skills in the technical areas of computer architecture and structures will provide the basic understanding necessary to work with computer networks and communications. A thorough knowledge of modern microprocessors enables the graduate to apply these machines to such diverse fields as robotics and data acquisition. Twelve units of technical electives

allow the student to specialize in an area of special interest to the student and of expertise of the faculty.

In addition to a sound theoretical background in the field of computer engineering, students encounter many practical design courses and problems. Laboratory courses supplement the program to bring "hands on" skills in all areas of study. Students are exposed to the wide variety of campus computing equipment: microprocessor development systems, networks of personal computers and workstations, minicomputers, and mainframes.

Active student groups of interest to computer engineering majors include the Association for Computing Machinery, the IEEE Computer Society, and the IEEE Student Branch.

## BS COMPUTER ENGINEERING

*For course prerequisites, please refer to the "Course Descriptions" section of this catalog. In scheduling your courses each quarter, consult with your academic adviser. \* Satisfies GE requirement; see page 79.*

### Freshman

CPE 100 Computer Engineering Orientation .....	1
CSC 101 Fund Computer Science I (F1)* .....	4
CSC 102, 103 Fund Computer Science II, III .....	4,4
CSC 141 Discrete Math for Computer Scientists I...	4
CHEM 124 Genl Chemistry/Engr Disc (B1a)* .....	4
ENGL 114 Writing: Exposition (A1)* .....	4
ENGL/PHIL/SPC 125 Critical Thinking (A2)* .....	3
SPC 201 <i>or</i> SPC 202 (A3) .....	3
MATH 141,142, 143 Calculus I, II, III (B2)* .....	4,4,4
PHYS 131 General Physics (B1a)* .....	4
American Institutions-History (D1a)* .....	3
	<u>50</u>

### Sophomore

CPE 219, 259 Logic and Switching Circuits & Lab.	3,1
CPE 215, 315 Computer Architecture I, II .....	4,4
EE 112 Electric Circuit Analysis I .....	2
EE 211, 241 Electric Circuit Analysis II and Lab...	3,1
EE 212, 242 Electric Circuit Analysis III and Lab...	3,1
ENGL 218 Prof Writing: Argument/Reports (A4)*.	4
MATH 241 Calculus IV (Area B)* .....	4
MATH 242 Differential Equations (Area B)* .....	4
MATH 317 Topics Engineering Math (Area B)* ....	4
PHYS 132, 133 General Physics (B1a)* .....	4,4
PHYS 211 Modern Physics .....	4
Literature elective (C1)* .....	3
	<u>53</u>

**Junior**

CSC 205 Software Engineering I.....	4
CSC 453 Operating Systems I .....	4
CPE 316 <i>or</i> CPE 436 .....	4
CPE 319, 359 Digital System Design and Lab .....	3,1
CPE 434 Compilers: Hardware/Software Interface .	4
EE 208, 248 Electronic Devices and Lab .....	3,1
EE 307, 347 Digital Integrated Electronics and Lab	3,1
ME 211 Engr Statics <i>or</i> MATE 210, 215 (4)	3
STAT 321 Statistical Analysis I (Area B)*.....	4
American Institutions-Politics (D1b)* .....	3
Philosophy elective (C1)*.....	3
Fine and performing arts elective (C2)* .....	3
Social, political, economics institutions (Area D)*..	3,3
	<u>50</u>

**Senior**

CPE 464 Computer Networks.....	4
CPE 461, 462 Senior Project .....	3,2
EE 301, 341 Linear Systems Analysis and Lab .....	3,1
Life sciences elective (B1b)* .....	2
Arts and humanities elective (Area C)* .....	3
Literature, philosophy, arts (300-400) (C3)* .....	3
Social, political, econ inst (300-400) (Area D)*.....	3
Life understanding elective (Area E)* .....	3
Adviser approved technical electives.....	12
Free electives .....	4
	<u>43</u>
	<b>196</b>

**BS COMPUTER ENGINEERING**

- 60 units upper division       GWR
- 2.0 GPA                               USCP

\* = Satisfies General Education requirement

**MAJOR COURSES**

CPE 100 Computer Engineering Orientation.....	1
CPE 215, 315 Computer Architecture I, II .....	4,4
CPE 219, 259 Logic & Switching Circuits and Lab	3,1
CPE 316 <i>or</i> CPE 436 .....	4
CPE 319, 359 Digital System Design and Lab .....	3,1
CPE 434 Compilers: Hardware/Software Interface .	4
CPE 461, 462 Senior Project .....	3,2
CPE 464 Computer Networks.....	4
CSC 101 Fundamentals Computer Science I (F1)* .	4
CSC 102, 103 Fund Computer Science II, III.....	4,4
CSC 141 Discrete Math for Computer Scientists I..	4
CSC 205 Software Engineering I.....	4
CSC 453 Operating Systems I .....	4
EE 112 Electric Circuit Analysis I.....	2
EE 208, 248 Electronic Devices and Lab .....	3,1
EE 211, 241 Electric Circuit Analysis II and Lab....	3,1
EE 212, 242 Electric Circuit Analysis III and Lab ..	3,1
EE 301, 341 Linear Systems Analysis and Lab .....	3,1
EE 307, 347 Digital Integrated Electronics and Lab	3,1
Adviser approved technical electives.....	12
	<u>92</u>

**SUPPORT COURSES**

CHEM 124 Genl Chemistry/Engr Disc (B1a)* .....	4
ENGL 218 Prof Writing: Argument/ Reports (A4)*	4
MATH 141, 142, 143 Calculus I, II, III (B2)* .....	4,4,4
MATH 241 Calculus IV (Area B)*.....	4
MATH 242 Differential Equations (Area B)*.....	4
MATH 317 Topics in Engineering Mathematics .....	4
ME 211 Engr Statics <i>or</i> MATE 210, 215 (4).....	3
PHYS 131, 132, 133 Genl Physics (Area B)* .....	4,4,4
PHYS 211 Modern Physics (Area B)*.....	4
STAT 321 Statistical Analysis I (Area B)* .....	4
	<u>55</u>

**GENERAL EDUCATION (GE) .....**

**45**  
 72 units required; 27 of these units are in Major/Support.  
 →See page 79 for complete GE course listing.  
 →Minimum 3 GE courses required at the 300-400 level.

**Area A Communication** (minimum 10 units)

1 unit is in Support  
 Take one course from A1, A2, A3:  
 A1 Expository Writing  
 A2 Critical Thinking  
 A3 Speech  
 A4 Argumentative Writing \*see Support

**Area B Science and Mathematics** (minimum 2 units)

24 units are in Support.  
 Take one course from B1b:  
 B1a Physical Sciences \*see Support  
 B1b Life Sciences elective  
 B2 Mathematics and/or Statistics \*see Support  
 Area B \* see Support

**Area C Arts and Humanities** (minimum 15 units)

Take one course from each Area C category:  
 C1 Literature  
 C1 Philosophy  
 C2 Fine/Performing Arts  
 C3 Lit/Phil/Arts (300-400 level)

If less than 15 units, take one course from C1, C2, C3

**Area D Social, Political, Economic Inst.** (minimum 15 units)

No more than one course in any Area D category.  
 Take one course from D1a and one from D1b  
 D1a HIST 202 (USCP) *or* HIST 204 *or* LS 211  
 D1b POLS 110 *or* LS 212  
 Take three courses from D2, D3, D4a, D4b  
 D2 History (300-400 level)  
 D3 Economics  
 D4a Social Institutions  
 D4b Social Institutions (300-400 level)

**Area E Life Understanding** (minimum 3 units)

No more than one course in any Area E category.  
 Take one course from E1 *or* E2  
 E1 PSY 201/PSY 202  
 E2 Self Development

**Area F Technology** (no additional units required)

2 units are in Support.  
 F1 Computer Literacy \*see Support

<b>ELECTIVES</b> .....	<u>4</u>
	<b>196</b>

# Computer Science

**Department Office**  
**Computer Science Bldg. (14), Room 254**  
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John Y. Hsu	Emilia E. Villarreal
Elmo A. Keller	Patrick O. Wheatley

## ACADEMIC PROGRAMS

**BS, MS Computer Science**  
**BS Computer Engineering**  
**Computer Science Minor**

The BS Computer Science program provides an in-depth study of computer science fundamentals and practice, including: programming, operating systems, computer architecture, languages and translators, database systems, telecommunications, and software engineering.

The BS Computer Science program is accredited by the Computing Sciences Accreditation Commission of the Computer Science Accreditation Board.

The curriculum offers technical electives so that students can specialize in various aspects of computation and its applications. Typical areas of emphasis: artificial intelligence, computer graphics, computer systems, scientific computation, business computation, computer hardware and computer simulation.

The curriculum is project-oriented and is designed to develop an ability to solve problems through efficient utilization of modern computer concepts. Students can expect to complete many projects on a variety of computer systems and in a variety of programming languages. During their last year of study, students complete a significant project experience through enrollment in the senior project, a two-quarter course. The project may be done either as an individual or as a member of a team. Graduates of this program are well prepared to become practicing computer scientists and to pursue graduate study.

Graduates of the computer science program are sought by the computer industry for positions as systems engineers, software engineers, applications programmers, program analysts and sales representatives.

A wide variety of computing equipment is available on campus. Lower division courses are usually conducted using the equipment of the university's Information Technology Services. These resources consist of several mainframe and mini-computers in a time-sharing environment as well as workstations, and a variety of micro-computers. Upper division courses are usually conducted using the facilities of the department's Computer Systems Laboratory. This laboratory has a variety of advanced workstations, mini- and micro-computers, and a parallel computer. It also houses a graphics laboratory and several research systems which provide an environment suitable for advanced studies.

The department has active student chapters of the Association for Computing Machinery, and Upsilon Pi Epsilon (computer science honor society).

## BS Computer Engineering

For information regarding this program, please refer to Computer Engineering. This program is jointly administered by the Computer Science Department and the Electrical Engineering Department.

## Computer Science Minor

Nearly all disciplines need to integrate and utilize the capabilities of computers. The computer science minor consists of a core of 16 units and the choice of a track for specialized study. The core is to provide the common knowledge and skills that all need who wish to advance further in computer science. The track consists of one or more required courses and several restricted elective courses.

Minor courses can be counted toward the student's major, support and general education & breadth requirements. Once students have completed the core courses, they should make an appointment to see the director of the College of Engineering Advising Center to request acceptance to the minor. The Computer Science minor is not open to CSC or CPE major students. Questions concerning the minor should be directed to the College of Engineering Advising Center.

<b>Computer Science Minor</b>	
CSC 101,102,103 Fund Computer Science I,II,III	4,4,4
CSC 141 Discrete Structures I (4)	
<b>Tracks (select one)</b> .....	8
<i>Database and Application Development (8)</i>	
CSC 365 Introduction to Database Systems	
CSC 366 Database, Modeling, Design, Implement	
<i>Computer Architecture (8)</i>	
(Note: CPE 215, 219, 259 are prerequisite to CPE	
CPE 315, 316 Computer Architecture II,III	
<i>Artificial Intelligence (8)</i>	
CSC 480, 481 Artificial Intelligence I,II	
<i>Graphics (8)</i>	
CSC 471 Computer Graphics I	
CSC 473 Advanced Rendering Techniques <i>or</i>	
CSC 477 Computer Vision	
<b>Upper-division restricted electives</b> .....	8
	32

**BS COMPUTER SCIENCE**

*For course prerequisites, please refer to the "Course Descriptions" section of this catalog. In scheduling your courses each quarter, consult with your academic adviser. \* Satisfies GE requirement; see page 79.*

<b>Year 1</b>	
CSC 101 Fundamentals Computer Science I (F1)* .	4
CSC 102, 103 Fund Computer Science II.....	4,4
CSC 141 Discrete Structures I .....	4
MATH 141, 142 Calculus I, II (B2) .....	4,4
ENGL 114 Writing: Exposition (A1).....	4
ENGL/PHIL/SPC 125 Critical Thinking (A2)*.....	3
SPC 201 <i>or</i> SPC 202 Speech (A3)*.....	3
American Institutions-Politics (D1b)* .....	3
Life understanding elective (Area E)* .....	3
Electives.....	5
	46
<b>Year 2</b>	
CSC 205, 206 Software Engineering I, II .....	4,4
CPE 219, 259 Logic & Switching Circuits and Lab	3,1
CSC 215, 315 Computer Architecture I, II .....	4,4
ENGL 218 Prof Writing: Argument/Reports (A4)*	4
American Institutions-History (D1a)*.....	3
Laboratory science electives (B1a)* .....	12
<sup>1</sup> Life science elective (B1b)*.....	2
<sup>1</sup> Fine and performing arts elective (C2)*.....	3
<sup>1</sup> Philosophy elective (C1)* .....	3
	47
<b>Year 3</b>	
CSC 300 Professional Responsibilities.....	4
CSC 330 Programming Languages .....	4
CSC 349 Design and Analysis of Algorithms .....	4
STAT 321 Statistical Analysis I (B2)* .....	4
Mathematics/statistics electives .....	8

Social, political, economics institutions (Area D)*..	3,3
Adviser approved technical electives .....	12
Elective .....	5
	23

**Year 4**

CSC 445 Theory of Computing .....	4
CSC 453 Introduction to Operating Systems .....	4
CSC 491, 492 Senior Project .....	2,3
Literature elective (C1) .....	3
Lit, philosophy, arts electives (300-400) (C3)*.....	3
Arts and humanities elective (Area C)*.....	3
Social, political, econ inst (300-400) (Area D)* .....	3
Adviser approved technical electives .....	16
Electives .....	6
	47
	<b>186</b>

**BS COMPUTER SCIENCE**

- 60 units upper division       GWR
- 2.0 GPA                               USCP
- \* = Satisfies General Education requirement

**MAJOR COURSES**

CSC 101 Fundamentals Computer Science I (F1)*	4
CSC 102, 103 Fund. Computer Science II, III .....	4,4
CSC 141 Discrete Structures I .....	4
CSC 205, 206 Software Engineering I, II .....	4,4
CPE 219, 259 Logic and Switching Circuits,Lab ....	3,1
CSC 215, 315 Computer Architecture I, II .....	4,4
CSC 300 Professional Responsibilities .....	4
CSC 330 Programming Languages .....	4
CSC 349 Design and Analysis of Algorithms .....	4
CSC 445 Theory of Computing .....	4
CSC 453 Introduction to Operating Systems .....	4
CSC 491, 492 Senior Project .....	2,3
Adviser approved technical electives .....	28
300-400 level. Must include at least three courses with CSC or CPE prefix; two of the CSC/CPE courses must be from one two-quarter sequence.	
	<b>89</b>

**SUPPORT COURSES**

ENGL 218 Prof Writing: Argument/Reports (A4)* .	4
MATH 141, 142 Calculus I, II (B2)*.....	4,4
STAT 321 Statistical Analysis I (Area B)* .....	4
Mathematics/statistics electives. Select from .....	8
CSC 142; MATH 143, 206, 241, 242, 248, 306, 335, 336, 437, 470; STAT 322.	
Physical science electives (B1a) .....	12
CHEM 124, 125, 129 <i>or</i>	
PHYS 131, 132, 133.	
	<b>36</b>

**GENERAL EDUCATION (GE)** ..... **45**

72 units required; 27 of these units are in Major/Support.

→See page 79 for complete GE course listing.

→Minimum 3 GE courses required at the 300-400 level.

**Area A Communication** (minimum 10 units)

1 unit is in Support

Take one course from A1, A2, A3:

- A1 Expository Writing
- A2 Critical Thinking
- A3 Speech
- A4 Argumentative Writing \*see Support

**Area B Science and Mathematics** (minimum 2 units)

24 units are in Support.

Take one course from B1b:

- B1a Physical Sciences \*see Support
- B1b Life Sciences elective
- B2 Mathematics and/or Statistics \*see Support
- Area B \* see Support

**Area C Arts and Humanities** (minimum 15 units)

Take one course from each Area C category:

- C1 Literature
- C1 Philosophy
- C2 Fine/Performing Arts
- C3 Lit/Phil/Arts (300-400 level)

If less than 15 units, take one course from C1, C2, C3

**Area D Social, Political, Economic Inst.** (min 15 units)

No more than one course in any Area D category.

Take one course from D1a and one from D1b

- D1a HIST 202 (USCP) or HIST 204 or LS 211
- D1b POLS 110 or LS 212

Take three courses from D2, D3, D4a, D4b

- D2 History (300-400 level)
- D3 Economics
- D4a Social Institutions
- D4b Social Institutions (300-400 level)

**Area E Life Understanding** (minimum 3 units)

No more than one course in any Area E category.

Take one course from E1 or E2

- E1 PSY 201/PSY 202
- E2 Self Development

**Area F Technology** (no additional units required)

2 units are in Support.

- F1 Computer Literacy \*see Support

**ELECTIVES** ..... **16**

**186**

**MS COMPUTER SCIENCE**

The MS program in Computer Science offers students the opportunity to prepare for careers in several areas of emphasis including: computer graphics, computer architecture, operating systems, programming languages, database systems, AI/expert systems, computer communication networks, modeling and simulation. The program is designed for maximum flexibility to allow the student to concentrate in one or more areas of study.

The department has a Computer Systems Laboratory (CSL) to provide a variety of computing resources for instructional and research purposes. The CSL has a SUN workstation cluster, a Hewlett Packard workstation cluster, a logic development lab, a distributed systems lab, a multiprocessor system for parallel programming, and a variety of graphics workstations and personal computers. The University's Academic Computing Services also provides a variety of microcomputer, workstation, and mainframe computing resources available to students.

Admission to the program requires a baccalaureate degree from an accredited institution and good standing at the last college attended. During the last 90 quarter hours of study, the student must have earned a minimum grade point average of 3.0 if the undergraduate degree is in Computer Science, or 3.25 for other degrees. The Graduate Record Exam (GRE) is required, with a minimum combined score of 1650 (verbal, quantitative, and analytical), and a minimum of 400 on verbal. Foreign applicants must have a minimum score of 550 on the TOEFL and 4.5 on the TWE. Women and underrepresented minorities are strongly encouraged to apply for admission.

Qualified students who do not have an undergraduate degree in Computer Science may be admitted as unclassified students. Unclassified students must complete the necessary undergraduate coursework to be admitted to candidacy. While fulfilling the undergraduate requirements, unclassified students retain official status as graduate students in the University.

Unclassified students may advance to candidacy by completing each of the following undergraduate courses with a "B" or better. These courses do not count toward the graduate degree:

- CSC 103 Fundamentals of Computer Science III (4)
- CSC 205 Software Engineering I (4)
- CSC 315 Computer Architecture II (4)
- CSC 330 Programming Languages (4)
- CSC 349 Design and Analysis of Algorithms (4)
- CSC 445 Theory of Computing (4)
- CSC 453 Introduction to Operating Systems (4)

The department offers several graduate teaching assistantships. Preference is given to continuing graduate students and experienced teachers. Other grant, fellowship, scholarship and loan information can be obtained from the Financial Aid office.

**Degree Requirements**

The students must file a formal study plan with the Computer Science Department office no later than the end of the quarter in which they complete the first unit of coursework to be counted toward the degree. The formal

study plan identifies specific courses to be taken to fulfill requirements of the MS degree. The formal study plan may be amended with approval of the graduate coordinator.

The MS degree requires at least 45 units beyond the undergraduate degree. Courses must be chosen according to the following requirements:

### **Curriculum for MS Computer Science**

<b>Select five courses from the following: .....</b>	<b>20</b>
CSC 508 Software Engineering I (4)	
CSC 509 Software Engineering II (4)	
CSC 520 Computer Architecture (4)	
CSC 530 Language and Translators (4)	
CSC 540 Theory of Computing II (4)	
CSC 550 Operating Systems (4)	
CSC 560 Database Systems (4)	
CSC 569 Distributed Computing (4)	
CSC 580 Artificial Intelligence III (4)	
<b>Thesis/Project and Seminar.....</b>	<b>9</b>
CSC 590 Graduate Seminar (3)	
CSC 599 Thesis (6)	
<b>Electives to be selected with Graduate Adviser's approval.....</b>	<b>16</b>
	—
	<b>45</b>

For further information or advisement students should communicate with the Graduate Coordinator of the Computer Science Department.

# Electrical Engineering

**Department Office**  
**Engineering East Bldg. (20), Room 200**  
**(805) 756-2781**

**College of Engineering Advising Center**  
**Engineering South (40), Room 115**  
**(805) 756-1461**

## Department Chair, Martin E. Kaliski

Samuel O. Agbo	C. Arthur MacCarley
David B. Braun	Shien-Yi Meng
Jerome R. Breitenbach	Ahmad Nafisi
Michael M. Cirovic	Mahmood Nahvi
Samir K. Datta	Richard S. Sandige
Fred W. DePiero	Ali O. Shaban
Saul Goldberg	Cheng Sun
Gary Granneman	Shyama C. Tandon
James G. Harris	Donley J. Winger
Michael Hawes	Michael T. Wollman
William F. Horton	

## ACADEMIC PROGRAMS

### BS, MS Electrical Engineering BS Computer Engineering

The department offers the BS program in Electrical Engineering which is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, and the MS in Electrical Engineering.

The main focus of the program is to prepare graduates for practice in professional engineering. Thus, Cal Poly's "learn by doing" philosophy is emphasized by integrating design throughout the curriculum in the numerous design-centered laboratories. In the required senior design project, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

The main objective of the department is to prepare students for pursuing engineering solutions to urgent problems in reshaping the environment to meet human needs while being responsibly aware of all implications. The curriculum provides a sound theoretical background along with current, practical engineering knowledge. The student begins the major in the first quarter with orientation and generally has one or more major courses each quarter until graduation. The many laboratory courses provide practical experience and lead logically into design which begins in the third year.

During their junior and senior years, students choose technical electives in either Electronics or Power. The Electronics courses deal with the development, design and application of circuits, devices and systems for communication, computers, controls, information processing and display, and system instrumentation. Senior

elective courses in this area provide specialized preparation in a selected area such as active and passive network synthesis, advanced communications systems, computer system design, microelectronic circuit engineering, microprocessor systems applications, microwave engineering, electro-optics, and solid state devices. The Power courses deal with industrial process control systems and with generation, distribution, control and utilization of electric power. Senior elective courses in this area provide specialized preparation in a selected area such as advanced control systems, energy conversion, power system analysis, protection and stability and solid state motor control.

Industry recognizes that students who have completed specialized technical courses are early contributors in the workforce. Students wishing to pursue graduate work may select appropriate senior courses in keeping with this goal.

Laboratories are well-equipped to provide students with both hands-on instrumentation and design experiences. Involvement in faculty research is possible for outstanding students. Research areas include computer-aided education, advanced electronics for automotive and transportation applications, signal and image processing, electric vehicles, computer architecture and software systems, electro-optics, and electric power quality.

The Electric Power Institute, sponsored by the university and underwritten by major utility companies and electrical equipment manufacturers, offers advanced seminars and lectures in the electrical power field and provides limited student and faculty exchange opportunities.

Students are encouraged to participate in professional clubs such as: Eta Kappa Nu, Amateur Radio Club, Audio Engineering Society, the Electronic and Electrical Engineering Council, the Student Branch of the Institute of Electrical and Electronics Engineers (IEEE), International Society of Hybrid Microelectronics (ISHM), Society of Photo-Optical Instrumentation Engineers (SPIE), Poly Phase Club, and Power Engineering Society.

The Department supports the concept of international education and encourages students to investigate opportunities for overseas study. For further information, see the Study Abroad programs.

### BS Computer Engineering

For information regarding this program, please refer to Computer Engineering. This program is jointly offered by

the Computer Science Department and the Electrical Engineering Department.

**Honors Program for Joint  
BS & MS ELECTRICAL ENGINEERING**

**Synopsis**

This program provides a means for academically excellent upper-division students to complete MS graduate studies concurrently with completion of BS degree requirements.

**Program Features**

Students may apply for admission to the Joint BS/MS Honors Program after completion of all EE 300-level courses required by their undergraduate program. The academic requirements for acceptance into this program are determined by the Graduate Committee and the Department Chair. The Graduate Committee evaluates applicants and renders decisions on their admission.

A feature of the program is to allow the use of a common project for fulfillment of the requirements for both the Master's Thesis (EE 599) and Senior Project (EE 461/462). In this case, a separate senior project deliverable is not required. A faculty adviser serves as both the thesis committee chairperson and the senior project adviser. The unit requirements for either degree are unchanged. The student must elect the MS thesis option. A student in this program, at his/her request, may be awarded the BS degree prior to the completion of the program, at a point when all requirements for the BS degree have been met, including an acceptable senior project report.

**BS ELECTRICAL ENGINEERING**

*For course prerequisites, please refer to the "Course Descriptions" section of this catalog. In scheduling your courses each quarter, consult with your academic adviser. \* Satisfies GE requirement; see page 79.*

**Freshman**

EE 110 Orientation .....	1
EE 112 Electric Circuit Analysis I.....	2
IME 157 Electronic Manufacturing .....	3
CHEM 124, 125 General Chemistry for the Engineering Disciplines (B1a)* .....	4,4
CSC 234 C and UNIX (F1)*.....	3
ENGL 114 Writing: Exposition (A1)*.....	4
ENGL/PHIL/SPC 125 Critical Thinking (A2)*	3
SPC 201 <i>or</i> SPC 202 Speech (A3)*.....	3
MATH 141, 142, 143 Calculus I, II, III (B2)* .....	4,4,4
PHYS 131, 133 General Physics (B1a)* .....	4,4
	47

**Sophomore**

EE 211, 241 Electric Circuit Analysis and Lab II....	3,1
EE 212, 242 Electric Circuit Analysis and Lab III ..	3,1
EE 208, 248 Electronic Devices and Lab .....	3,1
EE 219, 259 Logic and Switching Circuits, and Lab	3,1
ENGL 218 Pro Writing: Arg and Reports (A4).....	4
MATH 241 Calculus IV (B2) .....	4
MATH 242 Differential Equations (B2).....	4

MATH 317 Topics in Engineering Math. (B2).....	4
ME 211 Engineering Statics.....	3
ME 212 Engineering Dynamics .....	3
PHYS 132 General Physics (B1a)*.....	4
PHYS 211 Modern Physics.....	4
Philosophy elective (C1)* .....	3
Social, economics, political institutions (Area D)*..	3
	52

**Junior**

EE 301, 341 Linear Systems Analysis and Lab.....	3,1
EE 302, 342 Linear Control Systems and Lab .....	3,1
EE 304 Random Signals and Noise.....	3
EE 307, 347 Digital Integrated Electronics and Lab	3,1
EE 308, 348 Electronic Circuits and Lab.....	3,1
EE 309, 349 Integrated Electronic Circuits and Lab	3,1
EE 319, 359 Digital System Design and Lab .....	3,1
EE 325, 365 Energy Conversion Electromag & Lab	3,1
EE 328 Discrete Time Systems .....	3
EE 334 Electromagnetic Fields I.....	3
MATE 210 Materials Engineering .....	3
American Institutions-History (D1a)* .....	3
Life sciences elective (B1b)* .....	2
Fine and performing arts elective (C2)* .....	3
<sup>1</sup> Electronic or Power restricted technical elective ....	3
	51

**Senior**

EE 460 Senior Seminar .....	1
EE 461, 462 Senior Project.....	3,2
ME 302 Thermodynamics.....	3
American Institutions-Politics (D1b)*.....	3
Arts and humanities elective (Area C)*.....	3
Literature elective (C1)* .....	3
Literature, phil, arts elective (300-400) (C3)*.....	3
Social, economics, political institutions (Area D)*..	3
Social, political, economics (300-400) (Area D)*....	3
Life understanding elective (Area E)*.....	3
<sup>1</sup> Electronic or Power restricted technical electives....	7
<sup>2</sup> Approved technical electives.....	12
	49
	<b>199</b>

<sup>1</sup> Select one block of courses, either EL or EE:  
*Electronic (EL) Block:* EE 313, EE 353, EE 401, EE 414  
*Power (EE) Block:* EE 303, EE 406, ME 341

<sup>2</sup> A minimum of two EE senior design labs and two EE design lecture courses is required. To be approved by major adviser.

**BS ELECTRICAL ENGINEERING**

- ☐ 60 units upper division      ☐ GWR
- ☐ 2.0 GPA                              ☐ USCP

\* = Satisfies General Education requirement

**MAJOR COURSES**

EE 110 Orientation .....	1
EE 112 Electric Circuit Analysis I.....	2
EE 208, 248 Electronic Devices and Lab .....	3,1
EE 211, 241 Electric Circuit Analysis II and Lab ...	3,1
EE 212, 242 Electric Circuit Analysis III and Lab ..	3,1
EE 219, 259 Logic and Switching Circuits & Lab...	3,1
EE 301, 341 Linear Systems Analysis and Lab .....	3,1
EE 302, 342 Linear Control Systems and Lab .....	3,1
EE 304 Random Signals and Noise .....	3
EE 307, 347 Digital Integrated Electronics & Lab ..	3,1
EE 308, 348 Electronic Circuits and Lab.....	3,1
EE 309, 349 Integrated Electronic Circuits & Lab ..	3,1
EE 319, 359 Digital System Design and Lab.....	3,1
EE 325, 365 Energy Conversion Electromag & Lab	3,1
EE 328 Discrete Time Systems.....	3
EE 334 Electromagnetic Fields I .....	3
EE 460 Senior Seminar.....	1
EE 461 Senior Project.....	3
EE 462 Senior Project.....	2
Select <i>Electronic</i> or <i>Power</i> technical electives .....	10
<i>Electronic:</i> EE 313, 353, EE 401, EE 414	
<i>Power:</i> EE 303, EE 406, ME 341	
Adviser approved technical electives.....	12
Select a minimum of 2 EE senior design	
laboratories and 2 EE senior design lectures with	
approval by major adviser.	

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**SUPPORT COURSES**

CHEM 124, 125 General Chemistry for	
Engineering Disciplines (B1a)* .....	4,4
CSC 234 C and UNIX (F1)* .....	3
ENGL 218 Prof Writing: Argument/Reports (A4)*.	4
IME 157 Electronic Manufacturing .....	3
MATE 210 Materials Engineering.....	3
MATH 141 Calculus I (B2)* .....	4
MATH 142 Calculus II (B2)* .....	4
MATH 143 Calculus III (Area B)*.....	4
MATH 241 Calculus IV (Area B)*.....	4
MATH 242 Differential Equations (Area B)* .....	4
MATH 317 Topics in Engineering Math. (Area B)*	4
ME 211 Engineering Statics .....	3
ME 212 Engineering Dynamics .....	3
ME 302 Thermodynamics.....	3
PHYS 131, 132, 133 General Physics (Area B)* ..	4,4,4
PHYS 211 Modern Physics .....	4

**70**

**GENERAL EDUCATION (GE) ..... 45**

72 units required; 27 of these units are in Major/Support.  
 →See page 79 for complete GE course listing.  
 →Minimum 3 GE courses required at the 300-400 level.

**Area A Communication** (minimum 10 units)

1 unit is in Support  
 Take one course from A1, A2, A3:  
 A1 Expository Writing  
 A2 Critical Thinking  
 A3 Speech  
 A4 Argumentative Writing \*see Support

**Area B Science and Mathematics** (minimum 2 units)

24 units are in Support.  
 Take one course from B1b:  
 B1a Physical Sciences \*see Support  
 B1b Life Sciences elective  
 B2 Mathematics and/or Statistics \*see Support  
 Area B \* see Support

**Area C Arts and Humanities** (minimum 15 units)

Take one course from each Area C category:  
 C1 Literature  
 C1 Philosophy  
 C2 Fine/Performing Arts  
 C3 Lit/Phil/Arts (300-400 level)  
 If less than 15 units, take one course from C1, C2, C3

**Area D Social, Political, Economic Inst.** (min 15 units)

No more than one course in any Area D category.  
 Take one course from D1a and one from D1b  
 D1a HIST 202 (USCP) or HIST 204 or LS 211  
 D1b POLS 110 or LS 212  
 Take three courses from D2, D3, D4a, D4b  
 D2 History (300-400 level)  
 D3 Economics  
 D4a Social Institutions  
 D4b Social Institutions (300-400 level)

**Area E Life Understanding** (minimum 3 units)

No more than one course in any Area E category.  
 Take one course from E1 or E2  
 E1 PSY 201/PSY 202  
 E2 Self Development

**Area F Technology** (no additional units required)

2 units are in Support.  
 F1 Computer Literacy \*see Support

**ELECTIVES** ..... 0  
**199**

**MS ELECTRICAL ENGINEERING**

**General Characteristics**

The Master of Science program in Electrical Engineering has the following objectives:

- Job-entry education for the more complex areas of engineering, such as research and development, innovative design, systems analysis and design, and managerial engineering;
- Updating and upgrading opportunities for practicing engineers;
- Graduate preparation for further study in engineering, leading to the Doctor of Engineering or Ph.D. degree;
- A base which allows graduates to maintain currency in their fields.

**Prerequisites**

For admission as a classified graduate student, an applicant must hold a bachelor's degree in engineering or a closely related physical science with a minimum grade point average of 3.0 in the last 90 quarter units (60 semester units) attempted. Applicants for graduate engineering programs are required to submit satisfactory scores for the General (Aptitude) Test of the Graduate Record Examination. Foreign applicants must have satisfactory scores on the TOEFL and TWE exams. An applicant who meets these standards but lacks prerequisite coursework may be admitted as a conditionally classified student and must make up any deficiencies before advancement to classified graduate standing.

Information pertaining to specific requirements for admission to graduate standing (classified or conditionally classified) may be obtained from the Graduate Coordinator, Electrical Engineering Department.

**Program of Study**

Graduate students in this program must file a formal study plan with their adviser, department, college and university graduate studies office by no later than the end of the second quarter in the program. The formal program of study must include a minimum of 45 units (at least 28 of which must be at the 500 level and the remainder at the 400 level).

The broad curriculum requirements for the MS in Electrical Engineering are:

- a) core of 16 units;
- b) a minimum of 12 units of additional electrical engineering courses;
- c) at least 17 units of approved electives;
- d) at least 28 units of the 45 unit program at the 500 level.

Two program options are available for MS in Electrical Engineering students: a thesis program which requires coursework, a thesis and oral defense of thesis; *or* a nonthesis option which involves additional coursework and a comprehensive examination. The thesis option is strongly encouraged for all students.

**Curriculum for MS Electrical Engineering**

<b>Core Courses</b> .....	16
EE 525 Stochastic Processes for Engineers (4)	
EE 563 Graduate Seminar (1) (1) (1)	
EE 599 Design Project (Thesis) (2) (2) (5) <i>or</i> 9 units of major field graduate level courses <i>and</i> a comprehensive written examination	

<b>Additional Electrical Engineering Graduate Courses</b> .....	12
---	----

*To be selected from the following list: Not all courses listed are offered each academic year.*

*Consult the EE Department for current information on course offerings*

- EE 502 Microwave Engineering (4)
- EE 511 Electric Machines Theory (3)
- EE 513 Control Systems Theory (4)
- EE 514 Advanced Topics in Automatic Control (4)
- EE 515 Discrete Time Filters (4)
- EE 517 Information Theory (4)
- EE 518 Advanced Power System Analysis (3)
- EE 519 Power System Design (4)
- EE 520 Solar-Photovoltaic Systems Design (3)
- EE 521 Computer Systems (4)
- EE 522 Microprocessor-Based Digital System Design (4)
- EE 523 Digital Systems Design (3)
- EE 524 Solid State Electronics (3)
- EE 526 Digital Communications (4)
- EE 527 Advanced Topics in Power Electronics (4)
- EE 528 Digital Image Processing (4)
- EE 529 Advanced Topics in Microwave Device Electronics (3)
- EE 530 Photonics Systems (4)
- EE 533 Antennas (4)
- EE 541 Advanced Microwave Laboratory (2)

<b>Approved Technical Electives (400-500 level)</b> .....	17
<i>May be selected from the course list above and other adviser approved technical electives.</i>	

# General Engineering

## An Interdisciplinary Curriculum in Engineering Science and Emerging Technologies

Coordinator, Daniel W. Walsh  
Engineering Bldg. (13), Room 266  
(805) 756-2131

College of Engineering Advising Center  
Engineering South (40), Room 115  
(805) 756-1461

### ACADEMIC PROGRAMS

#### BS General Engineering

The Bachelor of Science degree in General Engineering is designed to allow students the latitude in course selection required to educate themselves either in the classical study of engineering or in new and evolving interdisciplinary technologies such as bioengineering and mechatronics. The degree is an excellent preparation for an applied terminal masters degree in these interdisciplinary fields such as the accelerated 4 + 1 program described in the MS Engineering section of this catalog. General Engineering can also accommodate those students who wish to major in engineering but have not presently decided in which specific program their interest is centered. The curriculum builds a sound foundation in the fundamental principles of engineering and engineering systems during the early years of study. During their final quarters of study, students customize their study plan with the help of a faculty adviser and are given the opportunity to focus their education while still at the undergraduate level. The BS degree in General Engineering is, therefore, a direct path to employment in a classic engineering field or in an area of emerging technology. It is also a natural step toward a professional or a graduate degree.

The General Engineering Program encourages students to participate in the 4 + 1 BS and MS granting program. Currently, many students choose bioengineering, manufacturing engineering and mechatronics. The 4 + 1 program recognizes that the expertise required of entry level engineers in many field, particularly new and evolving technological fields, implies that a masters degree is a prerequisite for success. The program allows motivated students to reduce the time necessary to earn both degrees.

All practitioners of engineering must have an understanding of the physical sciences and mathematics. Further, they must have a firm grasp of engineering sciences. The General Engineering curriculum provides the framework for this matrix of understanding, upon which the practitioner may begin to develop a unique area of expertise.

The General Engineering program focuses on synthesis, the integration of diverse elements to produce a single entity –

an integral activity in the engineering profession. The Synthesis plan of study, developed with the support of the National Science Foundation, stresses integrated design, open-ended problem solving, experimentation, and manufacturing and construction. The program emphasizes phenomenological theory as well as analytical, experimental, and design skills – not in compartmentalized courses, but as a unified entity. The curriculum accents societal context, multidisciplinary teamwork and communication skills. It also emphasizes practical applications as well as principles. The laboratories in many of the courses are constantly evolving, so students benefit from a variety of state-of-the-art equipment.

This program is for directed, highly motivated students. The technical elective courses are selected to be consistent with a sharply defined career goal. Each student will be required to submit a study plan to the coordinator prior to the end of the first quarter of their junior year. Study plans selected in the past have emphasized engineering physics, biomedical engineering, and ocean engineering. Plans that are currently popular include biochemical engineering and synthesis.

The application of engineering to medicine and biology underpins a strong and growing segment of the industrial sector and continues to be an area of inherent interest to students. The need for well educated professionals in this area has become more acute as the technology being applied has become more sophisticated. Evolution in computing, electronics, signal analysis and mechatronic systems have been harbingers of improvement to diagnostic efforts, therapeutic approaches and bioindustrial applications. Studies of biological materials, physiological mechanisms, biochemical kinetics and heat and mass transfer in biological systems require engineering expertise. Applied medical and biological research has taken on a distinct engineering aspect.

Mechatronics, another popular student focus, is defined as the application of decision making to physical systems. Today's engineered products are complex, composed of integrated mechanical and electronic components and operate with the aid of control software. Design and fabrication of such products requires knowledge of manufacturing, mechanical engineering, electronics and materials as well as experience with concurrent engineering

tools. Embedded computers of all sizes and capabilities are used in the decision making elements of products which daily affect the lives of essentially each resident in the developed world. Microcontrollers and mechatronic systems are found in devices as mundane as lawnmowers and as esoteric as deep space probes - and every system in between.

**Bioengineering Concentration.** Provides students with interdisciplinary exposure in a burgeoning field. The program highlights an immediate introduction to the major, strong personal interaction with faculty, strong partnerships with industrial participants and a signature laboratory emphasis. Rooted in a strong engineering exposure, the curriculum allows students to pursue applied biotechnical research in practical, interdisciplinary settings. Students and faculty are concerned with the design, analysis, integration and operation of engineered materials and engineered systems in biological applications. Typical areas of study include bioinstrumentation, bioelectric signals and communication, remediation and bioindustrial systems.

**Biomedical Engineering Concentration.** Prepares students to enter the increasingly technical world of medicine and medical services. Steeped in a rigorous exposure to engineering, the curriculum allows students to explore biomedical engineering in practical interdisciplinary settings. Students and faculty are concerned with the design, analysis, integration and operation of engineered materials and engineered systems in biomedical applications. Graduates work or go on to graduate study in areas including biomedical instrumentation and medical device development and manufacture, biomaterials production and development, biomechanics or similar areas.

**Individualized Course of Study.** Permits students to pursue a course of study which meets their individual needs and interests. Courses are selected by the student with the advice and approval of the student's academic adviser and department chair.

**BS GENERAL ENGINEERING**

*For course prerequisites, please refer to the "Course Descriptions" section of this catalog. In scheduling your courses each quarter, consult with your academic adviser. \* Satisfies GE requirement; see page 79.*

**Freshman**

ENGR 110,111,112 Engineering Science I,II,III....	3,3,3
CHEM 124, 125 General Chemistry for the Engineering Disciplines (B1a)* .....	4,4
ENGL 114 Writing: Exposition (A1).....	4
ENGL/PHIL/SPC 125 Critical Thinking (A2)* .....	3
SPC 201 <i>or</i> SPC 202 Speech (A3)*.....	3
MATH 141, 142, 143 Calculus I,II,III (B2)* .....	4,4,4
PHYS 131, 132 General Physics (B1a)* .....	4,4
	<u>47</u>

**Sophomore**

CE 204 Strength of Materials.....	3
EE 201 Electric Circuit Theory .....	3
MATH 241 Calculus IV (B2)* .....	4
MATH 242 Differential Equations (B2)* .....	4
MATH 300-400 level elective.....	4
ME 211 Engineering Statics.....	3
ME 212 Engineering Dynamics .....	3
PHYS 133 General Physics (B1a)*.....	4
Physical science elective .....	4
CSC 101 Fundamentals of Computer Science <i>or</i> CSC 234 C and Unix (F1)* .....	4/3
ENGL 218 Prof Writing: Argument/Reports (A4)* ..	4
American Institutions-History (D1a)* .....	3
Social, political, economics institutions (Area D)* ..	3
Concentration or individual course of study.....	4
	<u>15.</u>
	33

**Junior**

IME 314 Engineering Economics .....	3
ME 302 Thermodynamics.....	3
ME 313 Heat Transfer .....	3
MATE 210, 215 Materials Engineering and Lab .....	3,1
American Institutions-Politics (D1b)*.....	3
Life science elective (B1b)*.....	2
Literature elective (C1)* .....	3
Philosophy elective (C1)* .....	3
Social, political, economics institutions (Area D)* ..	3
Life understanding elective (Area E)*.....	3
Concentration or individual course of study.....	18
	<u>48</u>

**Senior**

ME 341 Fluid Mechanics.....	3
Senior Project (in appropriate engineering discipline)	2,2
Fine and performing arts elective (C2)*.....	3
Arts and humanities elective (Area C)*.....	3
Literature, philosophy, arts (300-400) (C3)*.....	3
Social, political, economics (300-400) (Area D)*....	3
Concentration or individual course of study.....	18
Electives.....	9
	<u>46</u>

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**BS GENERAL ENGINEERING**

- 60 units upper division       GWR
- 2.0 GPA                               USCP
- \* = Satisfies General Education requirement

**MAJOR COURSES**

CE 204 Strength of Materials.....	3
CSC 101 Fund. of Computer Science (3) <i>or</i> CSC 234 C and Unix (4) (F1)*.....	4/3
EE 201 Electric Circuit Theory .....	3
ENGR 110,111,112 Engineering Science I,II,III	3,3,3
IME 314 Engineering Economics .....	3

MATE 210, 215 Materials Engineering and Lab..... 3,1

ME 211 Engineering Statics .....	3
ME 212 Engineering Dynamics .....	3
ME 302 Thermodynamics.....	3
ME 313 Heat Transfer .....	3
ME 341 Fluid Mechanics.....	3
Senior Project-appropriate engineering discipline	2,2
Concentration <i>or</i> individual course of study .....	40
(at least 11 units must be 300–400 level)	
	<b>59</b>

**SUPPORT COURSES**

CHEM 124, 125 General Chemistry for the Engineering Disciplines (B1a)* .....	4,4
ENGL 218 Prof Writing: Argument/Reports (A4)*.	4
MATH 141,142,143 Calculus I,II,II (B2)* .....	4,4,4
MATH 241 Calculus IV (Area B)* .....	4
MATH 242 Differential Equations (Area B)* .....	4
MATH 300–400 level elective .....	4
PHYS 131, 132, 133 General Physics (Area B)* ..	4,4,4
Physical science elective .....	4
	<b>52</b>

**GENERAL EDUCATION (GE) ..... 45**

*72 units required; 27 of these units are in Major/Support.*  
 →See page 79 for complete GE course listing.  
 →Minimum 3 GE courses required at the 300-400 level.

**Area A Communication** (minimum 10 units)

*1 unit is in Support*  
*Take one course from A1, A2, A3:*

- A1 Expository Writing
- A2 Critical Thinking
- A3 Speech
- A4 Argumentative Writing \*see Support

**Area B Science and Mathematics** (minimum 2 units)

*24 units are in Support.*  
*Take one course from B1b:*

- B1a Physical Sciences \*see Support
- B1b Life Sciences elective
- B2 Mathematics and/or Statistics \*see Support
- Area B \* see Support

**Area C Arts and Humanities** (minimum 15 units)

*Take one course from each Area C category:*

- C1 Literature
- C1 Philosophy
- C2 Fine/Performing Arts
- C3 Lit/Phil/Arts (300-400 level)

*If less than 15 units, take one course from C1, C2, C3*

**Area D Social, Political, Economic Inst.** (min 15 units)

*No more than one course in any Area D category.*

- Take one course from D1a and one from D1b*
- D1a HIST 202 (USCP) *or* HIST 204 *or* LS 211
  - D1b POLS 110 *or* LS 212

*Take three courses from D2, D3, D4a, D4b*

- D2 History (300-400 level)
- D3 Economics
- D4a Social Institutions
- D4b Social Institutions (300-400 level)

**Area E Life Understanding** (minimum 3 units)

*No more than one course in any Area E category.*  
*Take one course from E1 or E2*

- E1 PSY 201/PSY 202
- E2 Self Development

**Area F Technology** (no additional units required)

*2 units are in Support.*

- F1 Computer Literacy \*see Support

<b>ELECTIVES</b> .....	<b>9</b>
	<b>190</b>

**CONCENTRATIONS OR INDIVIDUALIZED COURSE OF STUDY** (*select one*)

**Bioengineering Concentration**

CSC 341 Numerical Engineering Analysis .....	4
ENGR 450 Special Topics in Bioengineering .....	4
IME 144 Introduction to Design and Manufacturing...	4
MATH 318 Advanced Engineering Mathematics.....	4
ME 326 Intermediate Dynamics .....	4
Select 12 units from the following:.....	12

- BIO 431, 432, 442; CHEM 305, 371; CSC 471;
- EE 219, 259, 319, 327, 419, 436; ENVE 304, 331, 421, 443; MATE 320, 330; MATH 317; ME 328, 329, 401, 428, 445; STAT 321

Adviser approved electives.....	<b>8</b>
	<b>40</b>

**Biomedical Engineering Concentration**

CHEM 212 Survey of Organic Chemistry .....	4
CHEM 313 Survey of Biochemistry and Biotechnology	5
ENGR 450 Special Topics in Bioengineering .....	4
IME 144 Introduction to Design and Manufacturing...	4
MATE 425 Corrosion Engineering .....	4
Select 12 units from the following:.....	12

- BIO 431, 432; BOT 426; CHEM 305, 306, 371, 473, 475, CSC 473, 474; EE 219, 259; ENVE 304, 331; MATE 310, 446; MATH 317, 318; IME 319, 437; ME 326, 401, 422, 423, 445; PHYS 315, 323; STAT 321

Adviser approved electives.....	<b>7</b>
	<b>40</b>

<b>Individualized Course of Study</b> .....	<b>40</b>
Technical electives. At least 11 units must be at 300-400 level.	

# *Industrial & Manufacturing Engineering*

**Department Office**  
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**(805) 756-2341**

**College of Engineering Advising Center**  
**Engineering South (40), Room 115**  
**(805) 756-1461**

## **Department Chair, Sema E. Alptekin**

K. N. Balasubramanian	A. Reza Pouraghabagher
Kenneth L. Brown	Paul E. Rainey
J. Kent Butler	Ahmad K. Seifoddini
Mark A. Cooper	Richard A. Strahl
H. Jo Anne Freeman	Daniel J. Waldorf
Anthony K. Mason	Donald E. White
Unny Menon	Tao H. Yang

## **ACADEMIC PROGRAMS**

### **BS Industrial Engineering** **BS Manufacturing Engineering**

The department focuses on programs that integrate engineering with a real concern for people. Our students and faculty study topics that lead to satisfying and productive careers as well as strong preparation for graduate work in many fields. Programs reflect the traditional strengths of Cal Poly through close interaction between students and faculty in classroom, laboratory, and other activities. See the descriptions below for details of the various programs; course descriptions provide an understanding of the breadth and depth of our majors.

Department and university laboratories and computers are integrated into coursework from matriculation until graduation to investigate, test, and apply theoretical principles learned in the classroom.

There are active student chapters of the Institute of Industrial Engineers; Alpha Pi Mu, the national honorary society for industrial engineers; Omega Rho, the national honor society for operations research; APICS, the American Production and Inventory Control Society; SME, the Society of Manufacturing Engineers; and AFS, the American Foundry Society.

### **BS Industrial Engineering**

Industrial Engineering is the profession concerned with solving integrated engineering and management problems. The definition by the Institute of Industrial Engineers is as follows: "Industrial Engineering is concerned with the design, installation, and improvement of integrated systems of people, material, information, equipment, and energy by drawing upon specialized knowledge and skills in the mathematical, physical, and social sciences, together with

the principles and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems." Key objectives of industrial engineering are to improve the quality and productivity of creating and delivering goods and services and to act as the interface between technology and humans. Engineering methods and practical knowledge are used in formulating decision models for the optimum application of engineering and management principles.

The main focus of the program is to prepare graduates for practice in professional engineering. Thus, Cal Poly's "learn by doing" philosophy is emphasized by integrating design throughout the curriculum in the numerous design-centered laboratories. In the required senior design project, which is completed in a two-quarter set of capstone courses, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

Graduates can choose from a challenging range of career activities: operations research and analysis, production planning and scheduling, plant design, management, human factors engineering design, data processing and analysis, measurement, quality control and reliability assurance, technical economic planning, resource conservation, productivity measurement, increasing productivity using computer integrated manufacturing techniques, robotics, and, in general, systems analysis and design. The physical, engineering, and social sciences form the broad base for these endeavors.

The Bachelor of Science program in Industrial Engineering is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

The program is oriented to provide graduates with the capability of producing results with a minimum of additional training. Health care industries, banks, retail chains, farms, airlines, mines, computer firms, as well as government and traditional manufacturing industries, employ graduates of this discipline. Graduates also are well prepared for successful graduate study.

## BS Manufacturing Engineering

Manufacturing engineering is the profession that applies engineering analysis and methods to the production of all manufactured goods and services. The manufacturing engineer plans, develops, and optimizes the processes of production including methods of manufacture, and designs tools and equipment for manufacturing. The emphasis is on both development and sustained operation of manufacturing systems, including computer-aided methods, automation, numerical control, production tooling, and material handling, as well as the processes and ancillary support systems of modern manufacturing.

The main focus of the program is to prepare graduates for practice in professional engineering. Thus, Cal Poly's "learn by doing" philosophy is emphasized by integrating design throughout the curriculum in the numerous design-centered laboratories. In the required senior design project, which is completed in a two-quarter set of capstone courses, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

Graduates typically work more directly with the manufacturing processes than do industrial engineers. Emphasis is placed upon application of a basic knowledge of physics and materials. Knowledge of basic processes, mechatronics, tool design, and computer-aided manufacturing are applied directly to the problems of development and sustained operation of manufacturing systems. Students can select electives to specialize in one of the following areas: mechatronics manufacturing, manufacturing systems, manufacturing process engineering, or metrology.

The Bachelor of Science program in Manufacturing Engineering is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Graduates are prepared for job-entry at the professional level in the areas of CAD/CAM, process engineering, mechatronics, quality assurance, and production engineering. They also are well prepared for successful graduate study.

### GRADUATE PROGRAMS

Cal Poly offers a Master of Science degree in Engineering with specializations in Industrial Engineering and Integrated Technology Management, and also offers a joint MS/MBA Engineering with a specialization in Engineering Management. A BS + MS, accelerated "4+1" program, is also available for Industrial Engineering and Manufacturing Engineering students. Please refer to the MS Engineering section of the College of Engineering

## BS INDUSTRIAL ENGINEERING

For course prerequisites, please refer to the "Course Descriptions" section of this catalog. In scheduling your courses each quarter, consult with your academic adviser. \* Satisfies GE requirement; see page 79.

### Freshman

IME 101 Intro Industrial/Manufacturing Engr .....	1
IME 141 Manufacturing Processes: Net Shape .....	1
IME 223 Work Design and Measurement .....	4
IME 144 Intro Design and Manufacturing .....	4
CHEM 124, 125 General Chemistry for the Engineering Disciplines (B1a)* .....	4,4
CSC 234 C and UNIX (F1)* .....	3
ENGL 114 Writing: Exposition (A1)* .....	4
ENGL/PHIL/SPC 125 Critical Thinking (A2)* .....	3
SPC 201 or SPC 202 Speech (A3)* .....	3
MATH 141, 142, 143 Calculus I, II, III (B2)* .....	4,4,4
American Institutions-History (D1a)* .....	3
Life understanding elective (Area E)* .....	3
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### Sophomore

IME 239 Industrial Costs and Controls .....	3
IME 251 Manufacturing Engineering Analysis .....	3
IME 314 Engineering Economics .....	3
MATH 241 Calculus IV (Area B)* .....	4
MATH 242 Differential Equations (Area B)* .....	4
ME 211 Engineering Statics .....	3
ME 212 Engineering Dynamics .....	3
ENGL 218 Prof Writing: Argument/Reports (A4)* ..	4
PHYS 131, 132, 133 General Physics (B1a)* .....	4,4,4
American Institutions-Politics (D1b)* .....	3
Philosophy elective (C1)* .....	3
Literature elective (C1)* .....	3
Social, political, economic instit (Area D)* .....	3
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### Junior

IME 301, 305 Operations Research I, II .....	4,4
IME 312 Data Management and System Design .....	3
IME 319 Human Factors Engineering .....	3
IME 335 Computer-Aided Manufacturing I .....	4
IME 421 Manufacturing Organization .....	3
IME 426 Engineering Test Design and Analysis .....	4
CE 204 Strength Materials/ME 341 Fluid Mech .....	3
EE 201 Electric Circuits Theory .....	3
EE 321 Electronics .....	3
MATE 210 Materials Engr/ME 302 Thermodyn .....	3
Life sciences elective (B1b)* .....	2
STAT 321 Statistical Analysis I (B2)* .....	3
<sup>1</sup> Technical electives .....	10
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### Senior

IME 410 Inventory Control Systems .....	4
IME 420 Simulation and Expert Systems .....	4
IME 429 Ergonomics Lab .....	1
IME 430 Quality Engineering .....	4
IME 441, 442 Engineering Supervision I, II .....	1,1

IME 443 Facilities Planning and Design .....	4
IME 461, 462 Senior Project .....	2,3
IME 463 Undergraduate Seminar .....	2
Arts and humanities elective (Area C)* .....	3
Fine and performing arts elective (C2)* .....	3
Literature, philosophy, arts (300-400) (C3)* .....	3
Social, political, economic (300-400) (Area D)* .....	3
Social, political, economic institutions (Area D)* .....	3
<sup>1</sup> Technical electives .....	9
	35
	202

**BS INDUSTRIAL ENGINEERING**

- 60 units upper division       GWR
- 2.0 GPA                               USCP
- \* = Satisfies General Education requirement

**MAJOR COURSES**

IME 101 Intro Industrial & Manufacturing Engr .....	1
IME 141 Manufacturing Processes: Net Shape .....	1
IME 144 Intro Design and Manufacturing .....	4
IME 223 Work Design and Measurement .....	4
IME 239 Industrial Costs and Controls .....	3
IME 251 Manufacturing Engineering Analysis .....	3
IME 301, 302 Operations Research I, II .....	4,4
IME 312 Data Management and System Design .....	3
IME 314 Engineering Economics .....	3
IME 319 Human Factors Engineering .....	3
IME 335 Computer-Aided Manufacturing I .....	4
IME 410 Inventory Control Systems .....	4
IME 420 Simulation and Expert Systems .....	4
IME 421 Manufacturing Organization .....	3
IME 426 Engineering Test Design and Analysis .....	4
IME 429 Ergonomics Lab .....	1
IME 430 Quality Engineering .....	4
IME 441, 442 Engineering Supervision I, II .....	1,1
IME 443 Facilities Planning and Design .....	4
IME 461, 462 Senior Project .....	2,3
IME 463 Undergraduate Seminar .....	2
<sup>1</sup> Technical electives .....	19
	89

**SUPPORT COURSES**

CE 204 Strength Materials/ME 341 Fluid Mech .....	3
CHEM 124, 125 General Chemistry for the Engineering Disciplines (B1a)* .....	4,4
CSC 234 C and UNIX (F1)* .....	3
EE 201 Electric Circuits Theory .....	3
EE 321 Electronics .....	3
ENGL 218 Prof Writing: Argument/Reports (A4)* .....	4
MATH 141, 142, 143 Calculus I (B2)* .....	4,4,4
MATH 241 Calculus IV (Area B)* .....	4
MATH 242 Differential Equations (Area B)* .....	4
ME 211 Engineering Statics .....	3
ME 212 Engineering Dynamics .....	3

ME 302 Thermodyn/MATE 210 Materials Engr .....	3
PHYS 131, 132, 133 General Physics (Area B)* .....	4,4,4
STAT 321 Statistical Analysis I (Area B)* .....	4
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**GENERAL EDUCATION (GE) .....** 45

72 units required; 27 of these units are in Major/Support.  
 →See page 79 for complete GE course listing.  
 →Minimum 3 GE courses required at the 300-400 level.

**Area A Communication** (minimum 10 units)

1 unit is in Support  
 Take one course from A1, A2, A3:

- A1 Expository Writing
- A2 Critical Thinking
- A3 Speech
- A4 Argumentative Writing \*see Support

**Area B Science and Mathematics** (minimum 2 units)

24 units are in Support.  
 Take one course from B1b:

- B1a Physical Sciences \*see Support
- B1b Life Sciences elective
- B2 Mathematics and/or Statistics \*see Support
- Area B \* see Support

**Area C Arts and Humanities** (minimum 15 units)

Take one course from each Area C category:

- C1 Literature
- C1 Philosophy
- C2 Fine/Performing Arts
- C3 Lit/Phil/Arts (300-400 level)

If less than 15 units, take one course from C1, C2, C3

**Area D Social, Political, Economic Inst.** (min15 units)

No more than one course in any Area D category.

Take one course from D1a and one from D1b

- D1a HIST 202 (USCP) or HIST 204 or LS 211
  - D1b POLS 110 or LS 212
- Take three courses from D2, D3, D4a, D4b
- D2 History (300-400 level)
  - D3 Economics
  - D4a Social Institutions
  - D4b Social Institutions (300-400 level)

**Area E Life Understanding** (minimum 3 units)

No more than one course in any Area E category.

Take one course from E1 or E2

- E1 PSY 201/PSY 202
- E2 Self Development

**Area F Technology** (no additional units required)

2 units are in Support.

- F1 Computer Literacy \*see Support

**ELECTIVES .....** 0

203

<sup>1</sup> Adviser approved technical electives.

**BS MANUFACTURING ENGINEERING**

For course prerequisites, please refer to the "Course Descriptions" section of this catalog. In scheduling your courses each quarter, consult with your academic adviser. \* Satisfies GE requirement; see page 79.

**Freshman**

IME 101 Intro Industrial/Manufacturing Engr.....	1
IME 141 Manufacturing Processes: Net Shape .....	1
IME 223 Work Design and Measurement .....	4
IME 142 Manufacturing Processes: Materials Joining	2
IME 144 Intro Design and Manufacturing.....	4
IME 157 Electronic Manufacturing .....	3
CHEM 124, 125 General Chemistry for the	
Engineering Disciplines (B1a)* .....	4,4
CSC 234 C and UNIX (F1)* .....	3
ENGL 114 Writing: Exposition (A1)* .....	4
ENGL/PHIL/SPC 125 Critical Thinking (A2)* .....	3
SPC 201 or SPC 202 Speech (A3)* .....	3
MATH 141, 142, 143 Calculus I, II, III (B2)* .....	4,4,4
PHYS 131 General Physics (B1a) .....	4
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**Sophomore**

IME 239 Industrial Costs and Controls.....	3
IME 241 Process Design I .....	1
IME 251 Manufacturing Engineering Analysis .....	3
CE 204 Strength of Materials .....	3
MATE 210, 215 Materials Engineering and Lab ....	3,1
MATH 241 Calculus IV (B2)* .....	4
MATH 242 Differential Equations (B2)* .....	4
ME 211 Engineering Statics .....	3
ME 212 Engineering Dynamics .....	3
ENGL 218 Prof Writing: Argument/Reports (A4)*.	4
PHYS 132, 133 General Physics (B1a)* .....	4,4
STAT 321 Statistical Analysis I (B2) .....	3
Philosophy elective (C1)* .....	3
Fine and performing arts elective (C2)* .....	3
American Institutions-History (D1a)* .....	3
	<hr/>
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**Junior**

IME 314 Engineering Economics .....	3
IME 335 Computer-Aided Manufacturing I .....	4
IME 341 Tool Engineering I.....	4
IME 342 Manufacturing Systems Integration .....	3
IME 356 Manufacturing Automation .....	4
CE 205,206 Strength Materials/ME 341 Fluid Mech	3
EE 201, 251 Electric Circuits Theory and Lab .....	3,1
EE 321 Electronics .....	3
ME 302 Thermodynamics.....	3
ME 313 Heat Transfer .....	3
American Institutions-Politics (D1b)* .....	3
Literature elective (C1)* .....	3
Social, political, economic institutions (Area D)* ...	3
<sup>1</sup> Technical electives .....	6
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**Senior**

IME 418 Product-Process Design .....	4
IME 426 Engineering Test Design and Analysis .....	4
IME 430 Quality Engineering .....	4
IME 455 Manufacturing Design/Implementation.....	3
IME 461, 462 Senior Project .....	2,3
IME 463 Undergraduate Seminar .....	2
Life sciences elective (B1b)* .....	2
Arts and humanities elective (Area C)* .....	3
Literature, philosophy, arts (300-400) (C3)* .....	3
Social, political, economic institutions (Area D)*....	3
Social, political, economic (300-400) (Area D)* .....	3
Life understanding elective (Area E)* .....	3
<sup>1</sup> Technical electives .....	8
	<hr/>
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**201 Corrected**

**BS MANUFACTURING ENGINEERING**

- 60 units upper division       GWR
- 2.0 GPA                               USCP

\* = Satisfies General Education requirement

**MAJOR COURSES**

IME 101 Intro. Industrial & Manufacturing Engr ....	1
IME 141 Manufacturing Processes: Net Shape.....	1
IME 142 Manufact Processes: Materials Joining.....	2
IME 144 Intro Design and Manufacturing .....	4
IME 157 Electronic Manufacturing .....	3
IME 223 Work Design and Measurement.....	4
IME 239 Industrial Costs and Controls.....	3
IME 241 Process Design I .....	1
IME 251 Manufacturing Engineering Analysis.....	3
IME 314 Engineering Economics .....	3
IME 335 Computer-Aided Manufacturing I.....	4
IME 341 Tool Engineering I.....	4
IME 342 Manufacturing Systems Integration .....	3
IME 356 Manufacturing Automation.....	4
IME 418 Product-Process Design .....	4
IME 426 Engineering Test Design and Analysis .....	4
IME 430 Quality Engineering .....	4
IME 455 Manufacturing Des. & Implementation I .	3
IME 461, 462 Senior Project .....	2,3
IME 463 Undergraduate Seminar .....	2
Technical electives .....	14
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**SUPPORT COURSES**

CE 204 Strength of Materials .....	3
CE 205, 206 Strength of Materials and Lab or	
ME 341 Fluid Mechanics .....	3

<sup>1</sup> Technical electives must meet EAC-ABET requirements. Select courses from the list below or with advisor's guidance, courses may be selected from an area of emphasis (mechatronics manufacturing, manufacturing process engineering, manufacturing systems, or metrology.) IME 242, 243, 301, 303, 312, 319, 336, 357, 410, 411, 413, 416, 421, 427, 428, 429, 431, 443; MATE 230/235, MATE 410/415, MATE 430/435, MATE 440/445, BUS 487 or current list.

CHEM 124, 125 General Chemistry for the Engineering Disciplines (B1a)* .....	4,4	D4a Social Institutions	
CSC 234 C and UNIX (F1)* .....	3	D4b Social Institutions (300-400 level)	
EE 201 Electric Circuits Theory .....	3	<b>Area E Life Understanding</b> (minimum 3 units)	
EE 251 Electric Circuits Lab .....	1	<i>No more than one course in any Area E category.</i>	
EE 321 Electronics .....	3	<i>Take one course from E1 or E2</i>	
ENGL 218 Prof Writing: Argument/Reports (A4)*.	4	E1 PSY 201/PSY 202	
MATE 210 Materials Engineering.....	3	E2 Self Development	
MATE 215 Materials Engineering Lab .....	1	<b>Area F Technology</b> (no additional units required)	
MATH 141 Calculus I (B2)* .....	4	<i>2 units are in Support.</i>	
MATH 142 Calculus II (B2)* .....	4	F1 Computer Literacy *see Support	
MATH 143 Calculus III (Area B)*.....	4	<b>ELECTIVES</b> .....	<b>0</b>
MATH 241 Calculus IV (Area B)*.....	4		<b>201</b>
MATH 242 Differential Equations (Area B)* .....	4		
ME 211 Engineering Statics .....	3		
ME 212 Engineering Dynamics .....	3		
ME 302 Thermodynamics .....	3		
ME 313 Heat Transfer .....	3		
PHYS 131 General Physics (Area B)* .....	4		
PHYS 132 General Physics (Area B)* .....	4		
PHYS 133 General Physics (Area B)* .....	4		
STAT 321 Statistical Analysis I (Area B)*.....	4		
	<b>80</b>		
<b>GENERAL EDUCATION (GE)</b> .....	<b>45</b>		
<i>72 units required; 27 of these units are in Major/Support.</i>			
<i>→See page 79 for complete GE course listing.</i>			
<i>→Minimum 3 GE courses required at the 300-400 level.</i>			
<b>Area A Communication</b> (minimum 10 units)			
<i>1 unit is in Support</i>			
<i>Take one course from A1, A2, A3:</i>			
A1 Expository Writing			
A2 Critical Thinking			
A3 Speech			
A4 Argumentative Writing *see Support			
<b>Area B Science and Mathematics</b> (minimum 2 units)			
<i>24 units are in Support.</i>			
<i>Take one course from B1b:</i>			
B1a Physical Sciences *see Support			
B1b Life Sciences elective			
B2 Mathematics and/or Statistics *see Support			
Area B * see Support			
<b>Area C Arts and Humanities</b> (minimum 15 units)			
<i>Take one course from each Area C category:</i>			
C1 Literature			
C1 Philosophy			
C2 Fine/Performing Arts			
C3 Lit/Phil/Arts (300-400 level)			
<i>If less than 15 units, take one course from C1, C2, C3</i>			
<b>Area D Social, Political, Economic Inst.</b> (min15 units)			
<i>No more than one course in any Area D category.</i>			
<i>Take one course from D1a and one from D1b</i>			
D1a HIST 202 (USCP) or HIST 204 or LS 211			
D1b POLS 110 or LS 212			
<i>Take three courses from D2, D3, D4a, D4b</i>			
D2 History (300-400 level)			
D3 Economics			

# Materials Engineering

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## Department Head, Robert H. Heidersbach, Jr.

William D. Forgeng                      Paul E. Rainey  
Lanny Griffin                              Linda S. Vanasupa  
Blair London                                Daniel W. Walsh  
Anny Morrobel-Sosa

## ACADEMIC PROGRAMS

### BS Materials Engineering

Materials engineers deal with materials spanning the spectrum from steels for large bridges, buildings, pipelines and similar structures to the ultralight, high-strength materials used in modern aerospace applications. Increasing numbers of materials engineers find employment in research related to ultrapure electronic materials and components. Materials engineers are heavily involved in the advances being made with high-temperature, superconducting ceramics, and with biomedical device applications.

Because virtually all engineering designs are limited by the availability and cost of materials, materials engineers work closely with all other engineering disciplines. They use knowledge of science, engineering, and state-of-the-art analytical instruments to make recommendations on virtually all major engineering designs. The ability to communicate with a wide variety of people with differing backgrounds is very important to the successful practice of materials engineering.

The main focus of the program is to prepare graduates for practice in professional engineering. Thus, Cal Poly's "learn by doing" philosophy is emphasized by integrating design throughout the curriculum in the numerous design-centered laboratories. In the required senior design project, which is completed in a two-quarter set of capstone courses, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

Materials engineers find employment in many industries offering a number of challenging career opportunities. Many graduates are employed in the aerospace, electronic, chemical and petroleum industries. Some work as

consultants for large or small organizations. Others become executives in industries ranging from defense contracting to biomedical-device manufacturing. A significant number of materials engineers are involved in research; many technological advances are limited by materials, and new materials are needed for virtually all evolving technologies. Many of our graduates are entrepreneurs who have started their own consulting or manufacturing companies. Others are attorneys or physicians.

The curriculum in materials engineering emphasizes practical applications as well as principles. The laboratories are constantly evolving, and our students benefit from frequent exposure to a wide variety of materials testing and analysis equipment. The program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology. Our students have a reputation for being immediately productive in industry, and they are also actively sought by graduate programs throughout the country.

Materials engineering students participate in a variety of professional societies on campus. They are especially active in the Student Chapter of ASM/TMS.

## BS MATERIALS ENGINEERING

*For course prerequisites, please refer to the "Course Descriptions" section of this catalog. In scheduling your courses each quarter, consult with your academic adviser. \* Satisfies GE requirement; see page 79.*

### Freshman

MATE 110 Introduction to Materials Engineering ..	1
MATE 120 Intro Materials Engineering Analysis....	1
CHEM 124, 125 General Chemistry for the Engineering Disciplines (B1a)*.....	4,4
CSC 101/234/231 (F1)*.....	4/3/2
ENGL 114 Writing: Exposition (A1)*.....	4
ENGL/PHIL/SPC 125 Critical Thinking (A2)*.....	3
SPC 201 or SPC 202 Speech (A3)*.....	3
ENGL 218 Prof Writing: Argument/Reports (A4)*.	4
MATH 141, 142, 143 Calculus I, II, III (B2)*.....	4,4,4
PHYS 131, 132 General Physics (B1a)*.....	4,4
<sup>1</sup> Engr Drawing/Manufacturing processes electives....	4
	<u>50</u>

**Sophomore**

MATE 210, 215 Materials Engineering and Lab.....	3,1
MATE 220, 225 Structure of Materials and Lab .....	3,1
MATE 230, 235 Metals and Lab .....	4,1
CE 204 Strength of Materials .....	3
EE 201, 251 Electric Circuits Theory and Lab .....	3,1
IME 314 Engineering Economics (or IME 426).....	3
MATH 241 Calculus IV .....	4
MATH 242 Differential Equations .....	4
ME 211 Engineering Statics .....	3
ME 212 Engineering Dynamics .....	3
PHYS 133 General Physics .....	4
American Institutions-History (D1a)*.....	3
Philosophy elective (C1)* .....	3
Fine and performing arts elective (C2)* .....	3
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**Junior**

MATE 310 Polymers .....	4
MATE 320 Ceramics .....	4
MATE 330 Composites .....	4
MATE 340,345 Electronic Prop Materials and Lab	3,1
MATE 350, 355 Mech Behavior Materials and Lab	3,2
MATE 360 Thermodynamics of Materials .....	4
MATE 405 Kinetics of Materials .....	5
CE 205, 206 Strength of Materials and Lab.....	2,1
ME 313 Heat Transfer <i>or</i> ME 302 Thermodyn .....	3
CHEM 305 Physical Chemistry .....	3
American Institutions-Politics (D1b)* .....	3
Literature elective (C1)* .....	3
Social, political, economic institutions (Area D)* ...	3
Life understanding elective (Area E)* .....	3
	<hr/>
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**Senior**

<sup>2</sup> MATE 400-level Analysis/Processing/Topics	
Requirements .....	14
MATE 400-level Analy/Procg/Topics Electives.....	5
MATE 461, 462 Senior Project .....	1,4
MATE 463 Undergraduate Seminar .....	1
Chemistry or physics elective (200–400 level) .....	3
Life sciences elective (B1b)* .....	2
Arts and humanities elective (Area C)* .....	3
Literature, philosophy, arts (300–400) (C3)* .....	3
Social, political, economic (300–400) (Area D)* .....	3
Select one of the following: MATH 206, 304, 317, 318, 408; STAT 312, 321 .....	3
Social, political, economic institutions (Area D)* ...	3
Electives.....	4
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	49

**200****BS MATERIALS ENGINEERING**

☐ 60 units upper division      ☐ GWR

☐ 2.0 GPA                              ☐ USCP

\* = Satisfies General Education requirement

**MAJOR COURSES**

MATE 110 Intro to Materials Engineering .....	1
MATE 120 Intro. Materials Engr Analysis .....	1
MATE 210, 215 Materials Engineering and Lab .....	3,1
MATE 220, 225 Structure of Materials and Lab.....	3,1
MATE 230, 235 Metals and Lab .....	4,1
MATE 310 Polymers .....	4
MATE 320 Ceramics .....	4
MATE 330 Composites .....	4
MATE 340, 345 Electronic Prop Materials and Lab	3,1
MATE 350, 355 Mech Behavior Materials and Lab..	3,2
MATE 360 Thermodynamics of Materials .....	4
MATE 405 Kinetics of Materials .....	5
MATE 461, 462 Senior Project .....	1,4
MATE 463 Undergraduate Seminar .....	1
<sup>2</sup> MATE 400-level Analysis/Processing/Topics	
Requirements .....	14
MATE 400-level Analy/Procg/Topics Electives .....	5
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	70

**SUPPORT COURSES**

CE 204 Strength of Materials.....	3
CE 205, 206 Strength of Materials and Lab .....	2,1
CHEM 124, 125 General Chemistry for the Engineering Disciplines (B1a)* .....	4,4
CHEM 305 Physical Chemistry .....	3
CSC 101/234/231 (F1)* .....	4/3/2
EE 201, 251 Electric Circuits Theory and Lab .....	3,1
ENGL 218 Prof Writing: Argument/Reports (A4)* .....	4
IME 314 Engineering Economics (or IME 426) .....	3
MATH 141 Calculus I (B2) * .....	4
MATH 142 Calculus II (B2)* .....	4
MATH 143 Calculus III (Area B)* .....	4
MATH 241 Calculus IV (Area B)* .....	4
MATH 242 Differential Equations .....	4
ME 211 Engineering Statics.....	3
ME 212 Engineering Dynamics .....	3
ME 313 Heat Transfer <i>or</i> ME 302 Thermodyn.....	3
PHYS 131, 132, 133 General Physics (B1a)* .....	4,4,4
Chemistry or Physics elective (200–400 level) .....	3
<sup>1</sup> Engineering Drawing and Manufacturing elective ...	4
Select one of the following: MATH 206, 304, 317, 318, 408; STAT 312, 321 .....	3
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	<b>81</b>

<sup>1</sup> Choose either IME 144 or a combination of ME 151 and one of IME 141, 142, 143, or IT 141, 302.<sup>2</sup> Must have at least one course from each of the three categories: Materials Analysis and Characterization, Materials Processing and Special Topics.

**GENERAL EDUCATION (GE) ..... 45***72 units required; 27 of these units are in Major/Support.*

→See page 79 for complete GE course listing.

→Minimum 3 GE courses required at the 300-400 level.

**Area A Communication** (minimum 10 units)*1 unit is in Support**Take one course from A1, A2, A3:*

A1 Expository Writing

A2 Critical Thinking

A3 Speech

A4 Argumentative Writing \*see Support

**Area B Science and Mathematics** (minimum 2 units)*24 units are in Support.**Take one course from B1b:*

B1a Physical Sciences \*see Support

B1b Life Sciences elective

B2 Mathematics and/or Statistics \*see Support

Area B \* see Support

**Area C Arts and Humanities** (minimum 15 units)*Take one course from each Area C category:*

C1 Literature

C1 Philosophy

C2 Fine/Performing Arts

C3 Lit/Phil/Arts (300-400 level)

*If less than 15 units, take one course from C1, C2, C3***Area D Social, Political, Economic Inst.** (min 15 units)*No more than one course in any Area D category.**Take one course from D1a and one from D1b*

D1a HIST 202 (USCP) or HIST 204 or LS 211

D1b POLS 110 or LS 212

*Take three courses from D2, D3, D4a, D4b*

D2 History (300-400 level)

D3 Economics

D4a Social Institutions

D4b Social Institutions (300-400 level)

**Area E Life Understanding** (minimum 3 units)*No more than one course in any Area E category.**Take one course from E1 or E2*

E1 PSY 201/PSY 202

E2 Self Development

**Area F Technology** (no additional units required)*2 units are in Support.*

F1 Computer Literacy \*see Support

**ELECTIVES ..... 4****200**

# Mechanical Engineering

Department Office  
Engineering Bldg. (13), Room 252  
(805) 756-1334

College of Engineering Advising Center  
Engineering South (40), Room 115  
(805) 756-1461

## Department Chair, Safwat M. A. Moustafa

Edward H. Baker	A. Masoud Mehdizadeh
Ernest W. Blattner	Joseph D. Mello
Thomas W. Carpenter	Ronald S. Mullisen
William E. Clark	Ronald L. Mussulman
Harold E. Gascoigne	Lawrence H. Nelson
Raymond G. Gordon	Saeed B. Niku
Michael A. Iannce	Franklin C. Owen
Ngozi Kamalu	William B. Patterson
Roger A. Keech	Ramesh T. Shah
James G. LoCascio	Glen E. Thorncroft
Fredrick B. Malmborg	Jack D. Wilson
James M. Meagher	Yuen Cjen Yong

## ACADEMIC PROGRAMS

### BS Mechanical Engineering

It is our goal to graduate students who are prepared to excel as entry-level professionals, and who are willing and able to grow professionally and personally throughout their careers. This goal is pursued through a strong education in fundamentals, meaningful introduction to applications, and development of a sense of commitment to ethical and competent professional practice and to citizenship.

The Bachelor of Science degree in Mechanical Engineering concerns itself primarily with the design, construction, and use of a wide variety of equipment ranging from manufacturing machinery and power generation equipment to consumer goods. Of primary concern to the mechanical engineer is the proper application of solid mechanics, fluid mechanics, and thermodynamics in the design, manufacturing, and use of this equipment.

The focus of the mechanical engineering program at Cal Poly is to prepare graduates for practice in professional engineering. Thus, our "learn by doing" philosophy is emphasized in the curriculum by the large number of design-centered laboratories, integrating design throughout the curriculum, and the senior project capstone design experience.

In the required senior design project, which is completed in a two-quarter set of capstone courses, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

Graduates obtain employment primarily with manufacturers, contractors, public utilities, and governmental agencies. They also often enhance their careers through further study in graduate programs. Types of work performed by graduates include design, engineering sales, engineering testing, engineering management, supervision of manufacturing and construction.

### Concentration or Adviser Approved Electives

The curriculum gives the student a thorough grounding in mechanical engineering and a choice of a curricular concentration in Mechatronics *or* adviser approved areas of emphasis. There is an opportunity for special emphasis in areas such as Heating, Ventilation, Air Conditioning and Refrigeration (HVAC); Mechatronics/Robotics; Petroleum; Automotive; Design; or Thermal-Fluids Engineering.

**Mechatronics Concentration.** Students are prepared to enter the high tech microprocessor-based product design and factory automation job markets as well as research in the areas of robotics, "intelligent" products and machinery, and automated manufacturing processes at research institutions.

Engineering courses are found in all years. In the junior and senior years, the professional specialties include such courses as turbomachinery, robotics, mechatronics, composite materials, advanced mechanics, mechanical design, heat and mass transfer, mechanical control systems, and solar systems. The program is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology.

Laboratories are an important part of the student's education. The student is enrolled in engineering laboratories from the beginning of the freshman year until graduation. These laboratories include work in power generation, fluid flow, heat transfer, vibration, strength of materials, electronics, controls, and others.

There are six organized student clubs associated with Mechanical Engineering: student branches of the American Society of Mechanical Engineers, the Society of Petroleum Engineers, the Society of Automotive Engineers, the American Society of Heating, Refrigerating and Air Conditioning Engineers, the Pi Tau Sigma honorary society, and the Alternative Energy Club. These clubs offer students an active program of professional and social activity.



ME 461, 462 Senior Project .....	2,3
ME 463 Undergraduate Seminar .....	1
Arts and humanities elective (Area C)* .....	3
Literature, philosophy, arts (300-400) (C3)* .....	3
Social, political, econ institutions (Area D)* .....	3,3
Social, political, enconomic (300-400) (Area D)* ...	3
Adviser approved electives/Mechatronics .....	20
	<u>41</u>
	202

## BS MECHANICAL ENGINEERING

- 60 units upper division       GWR  
 2.0 GPA                               USCP

\* = Satisfies General Education requirement

### MAJOR COURSES

ME 151 Engineering Design Communication I .....	2
ME 152 Engineering Design Communication II .....	2
ME 134 Mechanical Systems (Transfer students must take ME 234) .....	3
ME 211 Engineering Statics.....	3
ME 212 Engineering Dynamics .....	3
ME 236 Thermal Systems .....	3
ME 302 Thermodynamics .....	3
ME 313 Heat Transfer.....	3
ME 318 Mechanical Vibrations .....	4
ME 326 Intermediate Dynamics.....	4
ME 328 Introduction to Design.....	4
ME 329 Intermediate Design .....	4
ME 341 Fluid Mechanics .....	3
ME 342 Fluid Mechanics .....	3
ME 344 Thermal Engineering .....	4
ME 345 Fluid Mechanics Laboratory .....	1
ME 346 Thermal Science Laboratory .....	1
ME 422 Mechanical Control Systems .....	4
ME 440 Thermal System Design .....	4
ME 461 Senior Project.....	2
ME 462 Senior Project.....	3
ME 463 Undergraduate Seminar .....	1
Adviser approved emphasis area or mechatronics concentration .....	20
	<u>84</u>

### SUPPORT COURSES

CE 204 Strength of Materials.....	3
CE 205, 206 Strength of Materials and Lab .....	2,1
CHEM 124, 125 General Chemistry for the Engineering Disciplines (B1a)* .....	4,4
CSC 231 Fortran for Engineering Students (F1)* ...	2
EE 201, 251 Electric Circuit Theory and Lab .....	3,1
EE 321, 361 Electronics and Lab.....	3,1
ENGL 218 Prof Writing: Argument/Reports (A4)* .	4
IME 142 Mfg Processes: Materials Joining .....	2
IME 143 Mfg Processes: Material Removal .....	2
MATE 210, 215 Materials Engineering and Lab .....	3,1
MATH 141 Calculus I (B2)* .....	4
MATH 142 Calculus II (B2)* .....	4

MATH 143 Calculus III (Area B)* .....	4
MATH 241 Calculus IV (Area B)* .....	4
MATH 242 Differential Equations (Area B)* .....	4
MATH 318 Adv. Engineering Math (Area B)* .....	4
PHYS 131, 132, 133 General Physics (Area B)* ..	4,4,4
Manufacturing Processes elective .....	1/3/4
(IME 141, IT 141 or IT 327)	
	<b>73</b>

**GENERAL EDUCATION (GE) ..... 45**

*72 units required; 27 of these units are in Major/Support.*  
 →See page 79 for complete GE course listing.  
 →Minimum 3 GE courses required at the 300-400 level.

**Area A Communication** (minimum 10 units)

*1 unit is in Support*

*Take one course from A1, A2, A3:*

- A1 Expository Writing
- A2 Critical Thinking
- A3 Speech
- A4 Argumentative Writing \*see Support

**Area B Science and Mathematics** (minimum 2 units)

*24 units are in Support.*

*Take one course from B1b:*

- B1a Physical Sciences \*see Support
- B1b Life Sciences elective
- B2 Mathematics and/or Statistics \*see Support
- Area B \* see Support

**Area C Arts and Humanities** (minimum 15 units)

*Take one course from each Area C category:*

- C1 Literature
- C1 Philosophy
- C2 Fine/Performing Arts
- C3 Lit/Phil/Arts (300-400 level)

*If less than 15 units, take one course from C1, C2, C3*

**Area D Social, Political, Economic Inst.** (min 15 units)

*No more than one course in any Area D category.*

*Take one course from D1a and one from D1b*

- D1a HIST 202 (USCP) or HIST 204 or LS 211
- D1b POLS 110 or LS 212

*Take three courses from D2, D3, D4a, D4b*

- D2 History (300-400 level)
- D3 Economics
- D4a Social Institutions
- D4b Social Institutions (300-400 level)

**Area E Life Understanding** (minimum 3 units)

*No more than one course in any Area E category.*

*Take one course from E1 or E2*

- E1 PSY 201/PSY 202
- E2 Self Development

**Area F Technology** (no additional units required)

*2 units are in Support.*

- F1 Computer Literacy \*see Support

<b>ELECTIVES</b> .....	<b>0</b>
	<b>202</b>

**Adviser Approved Emphasis or Concentration**  
*(Select one)*

**Adviser Approved Emphasis Area**

ME 428 Design.....	4
EE 325 Energy Conversion Electromagnetics .....	3
EE 365 Energy Conversion Electromag Lab .....	1
Technical electives selected from emphasis area .....	12
	20

**Mechatronics Concentration**

IME 157 Electronic Manufacturing .....	3
ME 405 Mechatronics .....	4
ME 406 Mechatronics Design .....	4
ME 423 Robotics: Fundamentals and Applications..	4
<sup>1</sup> CPE 436 or IME 356 .....	4
ME 400 Special Problems Adv Undergraduates .....	1
	20

<sup>1</sup> Elective based on interests of students.