SMU

SCHOOL OF ENGINEERING AND APPLIED SCIENCE

GENERAL INFORMATION

THE SCHOOL OF ENGINEERING AND APPLIED SCIENCE

The School of Engineering and Applied Science (SEAS) traces its roots to 1925, when the Technical Club of Dallas, a professional organization of practicing engineers, petitioned SMU to fulfill the need for an engineering school in the Southwest. In response to the club's request, SEAS began one of the first cooperative education programs in the United States, a program that continues to put engineering students to work on real technical projects today.

Included in the SEAS curricula are programs in electrical engineering, environmental engineering, environmental science, computer engineering, computer science, management science, mechanical engineering, and telecommunications systems. And 1990 was the kickoff year for the Complete Engineer — a renewed emphasis on a well-rounded humanities and social sciences education combined with technical specialization. This emphasis continues today.

Corporate support for the engineering school has generated a remarkable array of equipment and laboratories. Recent additions include a microwave lab from General Dynamics, a robotics lab from General Electric, and an undergraduate circuit lab from Southwestern Bell. Other laboratories are in development, including one sponsored by AT&T. The Dallas area's national prominence in high technology and research has been a major plus for SEAS.

SEAS is a founder and charter member of the Association for Media-based Continuing Education for Engineers (AMCEE), a nationwide consortium of engineering schools that offer videotaped continuing education courses. In addition, the school is a founding member of the National Technological University (NTU), which offers engineering education to students across the country via direct broadcast satellite relay. SEAS is one of only 44 engineering schools in the United States to participate.

PROFESSIONAL ENGINEERING REGISTRATION

All senior-year engineering students are encouraged to take the first part of the examination for professional engineering registration in the state of Texas. This is known as the *Fundamentals of Engineering Examination* and is given twice each year, in early April and early October. Application forms for the examination may be obtained from the Office of the Dean.

PROGRAM INFORMATION

All programs of education and research in engineering and applied science are conducted through SEAS. The school is organized into the following three departments:

Computer Science and Engineering (CSE)
Electrical Engineering (EE)
Mechanical Engineering (ME)

SEAS offers curricula leading to the Bachelor of Science degree in the following programs (the department responsible for each program is indicated in parentheses):

Computer Engineering (CSE)
Computer Science (CSE)
Electrical Engineering (EE)
Environmental Engineering (EnvE)
Environmental Science (EnvS)
Management Science (CSE)
Mechanical Engineering (ME)
Telecommunications Systems (EE)

Each curriculum is under the jurisdiction of the faculty of the department in which the program is offered.

SEAS also offers graduate programs toward the degrees of Master of Science, Doctor of Engineering, and Doctor of Philosophy.

The departments are SEAS' basic operating and budgetary units. Each department is responsible for the development and operation of its laboratories at all levels of activity and for all purposes; for the content, teaching, and scheduling of its academic courses; and for the conduct of research programs. The chief administrative officer of each department is the department chair, who reports directly to the Dean.

Every effort has been made to include in this publication information that, at the time of preparation for printing, most accurately represents SMU within the context in which it was offered. The provisions of this publication are not, however, to be regarded as an irrevocable contract between the student and SMU. The University reserves the right to change or terminate, at any time and without prior notice, any provision or requirement including, but not limited to, policies, procedures, charges, academic programs, videotaped courses, and television courses offered through The Association of Graduate Education and Research (TAGER).

More information on SEAS and its programs is available on the World Wide Web at www.seas.smu.edu.

COOPERATIVE EDUCATION

The history of the School of Engineering and Applied Science at SMU demonstrates a commitment to the concept of cooperative education. When SEAS was established in 1925, it already had a close relationship with the Technical Club of Dallas. Members of this group owned factories and engineering consulting firms and wanted to participate in the training and development of their incoming employees. The Technical Club asked SMU to include the Cooperative Education Program (Co-op) in the original design of the school.

SMU was one of the first universities in the Southwest to adopt this concept of practical education. From 1925 to 1965, all SEAS undergraduate students participated in Co-op. Since 1965, the program has been optional.

In 1999, SMU became one of the first universities to receive accreditation from the newly formed Accreditation Council for Cooperative Education (ACCE). The SMU program is one of eight professional work-based university programs to receive ACCE accreditation, and the only Texas university to earn this distinction.

The SMU Co-op Program is designed so that each student can enhance his or her education and career by receiving professional training while alternating terms of classroom instruction. Today, approximately one-third of SEAS students choose to participate. Participation in the Co-op Program allows students to:

- Confirm that they like working in their major.
- Discover the kind of work they like within their major.
- Establish a professional reputation.
- Earn the cumulative equivalent of one year of starting salary before graduation.
- Gain invaluable work experience when competing for full-time jobs upon graduation.

HOW THE COOPERATIVE PROGRAM OPERATES

Entry into the Co-op Program typically is offered at either of two times during the student's academic progression. These are shown below:

Plan A	**5 Work Terms**			**Plan B**	**4 Work Terms**		
	Fall	*Spring*	*Summer*		*Fall*	*Spring*	*Summer*
First Year	SMU	SMU	Free	First Year	SMU	SMU	Free
Sophomore	SMU	Industry	SMU	Sophomore	SMU	SMU	Free
Junior	Industry	SMU	Industry	Junior	Industry	SMU	Industry
Senior 4th	SMU	Industry	SMU	Senior 4th	SMU	Industry	SMU
Senior 5th	Industry	SMU		Senior 5th	Industry	SMU	

Students who want to participate in the Co-op Program should begin the application process two terms before their anticipated first work term. The application process includes attending a Co-op Orientation (preferably during the first year), receiving interview skill training, learning the job search process, and completing a computerized application. The Co-op Director guides students through each step of the process.

Each applicant receives quality advising from the Co-op Director. A direct result of advising is that the student gains a better understanding of individual options and a strategy for pursuing those options. The application process requires one or two hours per week for almost two terms. The process normally results in an offer of Cooperative Education Training Employment beginning in the spring term during the sophomore year.

Who May Apply?

Any SEAS Undergraduate student in good standing who has enough time remaining before graduation to alternate at least three times between terms of full-time work and terms of full-time school may apply for admission into the SMU Co-op Program. Transfer students must be admitted and accepted at SMU.

When To Apply

- Many students choose to begin the application process during the first term of their first year. This head start is especially beneficial for students planning to participate in Greek Rush during the second term of their first year.
- Two or more terms before the work term begins.
- The first of these terms is for preparation.
- The second is for applying/interviewing with companies.

POLICIES OF THE COOPERATIVE ENGINEERING EDUCATION PROGRAM

Since 1925, SMU SEAS has created and maintained numerous strong corporate relationships. Many factors contribute to these relationships, including the quality of the academics and research, the advancement of alumni, and SMU's close proximity to high-tech corporations. An SMU Co-op student directly benefits from these relationships.

However, the student bears an obligation to preserve these relationships for future students by following SMU's SEAS Co-op Program Undergraduate Student Agreement. The agreement balances the student's individual needs with the long-term goal of maintaining corporate relationships so that future SMU students will have as many opportunities as possible.

- Students must maintain good standing with SMU and their employer at all times.
- All Co-op Training Jobs must be approved in advance by the SMU Co-op Director.
- Before each work term begins, each undergraduate Co-op student must enroll in the appropriate Co-op course for the term when they work.
- SMU charges no fees or tuition for these courses. Each course is graded as pass/fail by the Co-op Director. The courses do not count toward graduation. The course numbers for each work term are, respectively, SS 1099, SS 2099, SS 3099, SS 4099, SS 5099, and SS 6099.
- Students enroll at SMU each term, including summers, once they begin the Co-op alteration between work and school.
- Co-op students take full-time class loads at SMU during alternating school terms.
- Co-op students do not work part-time for the Co-op employer during school terms.
- Co-op students complete all work terms with the same company.
- Once a student accepts a Co-op Training Job, the student may switch jobs within the sponsoring company with the approval of the company.
- Each Co-op student completes their originally planned number and sequence of alternating work terms. The term of graduation must be a term of full-time study at SMU.
- Each Co-op student accepts responsibility for knowing and following all Co-op Regulations of SMU and the participating employer.

Co-op Certificate

Co-op students who plan and complete all originally scheduled co-op work terms in good standing with the university and the Co-op Office receive a Co-op Program Certificate to coincide with graduation.

Contact the Co-op Director at 214-768-3033 or by e-mail at coop@seas.smu.edu if you have additional questions. If you visit campus, the Co-op Office is in the School of Engineering and Applied Science in room 106 of Caruth Hall.

ADMISSION

For detailed information regarding Southern Methodist University's admission requirements, regulations, and procedures, see the University Admission section of this catalog.

Prospective students interested in undergraduate degrees in engineering and applied science apply for undergraduate admission to SMU as first-year or transfer students through the Office of Admission, Southern Methodist University, PO Box 750181, Dallas TX 75275-0181. The application deadline for entry into a fall term by a first-year student is April 1, and for a spring term, December 1. For transfer students, the application deadline is July 1 for a fall term and December 1 for a spring term.

All first-year applicants admitted to SMU initially enter Dedman College. To be considered for admission, a student must have graduated from an accredited secondary school and must submit the following information to the Office of Admission:

1. An official high-school transcript for grades 9-12, showing rank in class, G.P.A., and senior courses.
2. Results of the SAT or ACT. For foreign students, the result of the TOEFL is required as well.
3. Counselor recommendation.
4. Extracurricular activities.

A personal interview with the Office of Admission and the Assistant Dean of the School of Engineering and Applied Science is highly recommended.

HIGH SCHOOL PREPARATION

Because of the high standards of the School of Engineering and Applied Science and the rigorous character of its curricula, it is essential that the entering student be well prepared in basic academic subjects in high school.

The usual high-school preparation for entrance into SMU and study in Engineering and Applied Science includes the following courses:

English	4 units
Mathematics	4-5 units
Physics, Chemistry, Biology	At least 3 units
Social Studies	2 units
Foreign Language	2 units
Computer Programming	1 unit

However, a minimum of 15 academic units is required for admission. The courses listed above, with the exception of foreign languages, are recommended but are not required.

Most recently, students admitted to SMU with the intention of majoring in Engineering were our most competitive applicants. To be successful in our Engineering programs, the student *should* have the following academic strengths:

1. Enrollment in an appropriate program of study in high school, as outlined above.
2. Rank in the upper third of his or her graduating high school class.
3. Have a minimum SAT composite of 1100 with at least a 600 math score. Equivalent ACT scores may also be submitted.

These guidelines should assist students interested in studying engineering at SMU.

ADMISSION TO ADVANCED STANDING

Admission from Dedman College and Other Schools within SMU

After completion of the first year, admission to the School of Engineering and Applied Science is accomplished by an interschool transfer. These transfers are approved by the Assistant Dean of Undergraduate Studies. For admission, a student must have completed 24 credit hours and must demonstrate the ability to achieve academic success in engineering or applied science by attaining a 2.00 or higher G.P.A. For admission into either the computer engineering, electrical engineering, environmental engineering, or mechanical engineering program, a 2.00 or higher G.P.A. is required in the following five courses: ENGL 1301, ENGL 1302 or equivalent, MATH 1337, MATH 1338, and PHYS 1303. If a course is repeated, both grades will be used in computing the G.P.A.

Admission by Transfer from Another Institution

An undergraduate at a junior college, college, or university may apply for admission to the School of Engineering and Applied Science. Admission will be granted provided the prior academic records and reasons for transfer are acceptable to SEAS. Transfer credit will be awarded in courses that have identifiable counterparts in curricula of the School of Engineering and Applied Science, provided they carry grades of *C* or better. Transfer students will be expected to meet requirements equivalent to students admitted from Dedman College and other schools within SMU.

Transfer credit is awarded only for work completed at institutions that are regionally accredited. Because of SMU's 60-term-hour residency requirement for a Bachelor's degree, there is a limit on the total amount of credit that may be transferred from four-year institutions.

ACADEMIC REGULATIONS

GRADUATION REQUIREMENTS FOR BACCALAUREATE DEGREES

Graduation from the School of Engineering and Applied Science with a Bachelor's degree requires that the following standards of academic performance be met:

1. A passing grade must be received in every course in the prescribed curriculum.
2. An overall G.P.A. of 2.00 or better must be attained in all college and university courses.
3. An overall G.P.A. of 2.00 or better must be attained in all course work attempted at SMU for the degree.
4. An overall G.P.A. of 2.00 or better must be attained in all course work attempted for the degree in the major field of study.
5. A minimum of 122 term hours of credit, including 35-41 hours in the General Education Curriculum and the requirements for a major in engineering or applied science.

Residence Requirements

For graduation from the School of Engineering and Applied Science, 60 term credit hours must be earned in residence, including 30 term credit hours in the major department or interdisciplinary program. Of the last 60 term credit hours earned toward a degree, 45 must be in residence. Exceptions to this requirement will be made only under unusual circumstances at the discretion of the SEAS faculty.

The Major

A candidate for a degree must complete the requirements for a major in one of the departments of SEAS. The major requirements of each department and program are stated in the next section. The applicable requirements of the major are those in effect during the academic year in which the major is declared, or those of a subsequent academic year. Course work counting toward a major may not be taken pass/fail. Majors must be officially declared (or changed) through the office of the Assistant Dean of Undergraduate Studies.

GENERAL EDUCATION PROGRAM

All SMU undergraduate students have a common college requirement that is designed to assure them of a broad liberal education regardless of how specialized their majors might be. This requirement is so that each student learns to reason and think for oneself; becomes skilled in communicating meaning and in understanding it; understands something about both the social and the natural worlds and one's own place and responsibilities in them; and understands and appreciates human culture and history in their various forms, including religion, philosophy, and the arts.

The general education requirements for the SEAS program must follow the requirements of the University. See the General Education Curriculum section of this catalog for more information.

PROGRAMS OF STUDY

The School of Engineering and Applied Science offers the following degrees:

Bachelor of Science in Computer Engineering
Bachelor of Science in Electrical Engineering
Bachelor of Science in Environmental Engineering
Bachelor of Science (Environmental Science)
Bachelor of Science in Mechanical Engineering
Bachelor of Science (Computer Science)
Bachelor of Arts (Computer Science)
Bachelor of Science (Management Science)
Bachelor of Science (Telecommunications Systems)

Engineering and applied science work can be classified by function, regardless of the branch it is in, as follows: research, development, design, production, testing, planning, sales, service, construction, operation, teaching, consulting, and management. The function fulfilled by an engineer results in large measure from personal characteristics and motivations, and only partially from his or her curriculum of study. Nonetheless, although engineering and applied science curricula may be relatively uniform, their modes of presentation tend to point a student toward a particular large class of functions. Engineering curricula at SMU aim generally at engineering functions that include research, development, design, management, and teaching —functions ordinarily associated with additional education beyond the Bachelor's degree.

The curricula in computer engineering, electrical engineering, and mechanical engineering are accredited by the Accreditation Board for Engineering and Technology (ABET).

JUNIOR YEAR ABROAD

Many undergraduates in American universities have found it academically and culturally rewarding to spend their junior year at a university in another country. This opportunity has rarely been used by students concentrating in programs in engineering and applied science because of the integrated nature of curricula in these fields. However, as a result of arrangements with several of the Colleges in the University of London in England, it is now possible for undergraduates in SEAS to undertake their junior year as students at the University of London without delaying their progress toward a baccalaureate degree.

To be eligible for this program, students should normally have attained a G.P.A. of at least 3.00 and also have the academic and social maturity needed to adapt to the different academic and social customs in English universities. For detailed information about this program, students should consult their academic advisers and the undergraduate dean in SEAS early in their sophomore year.

DESCRIPTION OF COURSES

Courses offered in the School of Engineering and Applied Science are identified by a two- or three-letter prefix code designating the general subject area of the course, followed by a four-digit number. The first digit specifies the approximate level of the course as follows: 1 – first year, 2 – sophomore, 3 – junior, 4 – senior, and 5 – senior. The second digit denotes the term-hours associated with the course. The last two digits specify the course numbers. Thus, CSE 4322 denotes a course offered by the Department of Computer Science and Engineering at the senior (4) level, having three term hours, and with the course number 22. The prefix codes are as follows:

CSE — Department of Computer Science and Engineering
EE — Department of Electrical Engineering
ENV — Department of Environmental Engineering
ME — Department of Mechanical Engineering
SS — Center for Special Studies

COMPUTER SCIENCE AND ENGINEERING

Associate Professor HELGASON, *Interim Chair*

Professors: KENNINGTON, MATULA, MOLDOVAN; *Associate Professors:* BARR, W. CHEN, J. DUNHAM, M. DUNHAM, NAIR; *Assistant Professors:* HARABAGIU, OLINICK, SEIDEL, TIAN; *Lecturers:* COYLE, D. EVANS, LILLARD; *Adjunct Faculty:* BRALICK, DIAZ, FRAILEY, OSHANA, PETERSEN, PFISTER, PICKELS, SCHMIDT, SIEMS.

The department offers academic programs in *computer engineering* (with an emphasis on computer design), *computer science* (with an emphasis on systems design), and *management science* (with an emphasis on computer models for decision making). Faculty specializations include computer architecture, knowledge engineering, software engineering, design and analysis of algorithms, parallel processing, database and information systems, artificial intelligence, theory of computation, graph and network algorithms, and mathematical programming.

DEGREES

Bachelor of Science — Major in Computer Science (122 Term Credit Hours)
Bachelor of Science— Major in Computer Science with a Pre-Medical Specialization (129 Term Credit Hours)
Bachelor of Science in Computer Engineering (127 Term Credit Hours)
Bachelor of Science — Major in Management Science (122 Term Credit Hours)
Bachelor of Arts — Major in Computer Science (122 Term Credit Hours)

DUAL DEGREE PROGRAM

The School of Engineering and Applied Science offers a dual degree with the Meadows School of the Arts that leads to the degrees of Bachelor of Arts in Music and Bachelor of Arts in Computer Science. Please contact the department for additional details.

COMPUTING FACILITIES

Students in the Department of Computer Science and Engineering have access to a wide range of facilities and equipment. The department's computing environment has evolved into an Ethernet-based network of microcomputers and workstations. It now includes workstations from Sun Microsystems and Digital Equipment Corporation.

CURRICULUM IN COMPUTER SCIENCE

Computers play an ever increasing role in our society. Their use permeates all other academic disciplines and industrial arenas. Computer science is the study of the concepts and theory surrounding computer design and software construction. The SMU undergraduate program in Computer Science provides the student with a solid understanding of these concepts, which provides him or her with the technical knowledge needed to pursue either an advanced degree or a challenging career in the computer industry. The diversity of the SEAS computer environment exposes undergraduate computer science students to many different hardware and software systems.

To study and use computers we must communicate with them through a variety of software interfaces, including programming languages. At SMU the student will study several high-level languages — such as PASCAL, LISP, C, Ada, PROLOG, APL, Smalltalk, Java, and C++ — that simplify the use of computers. In addition, the student is exposed to a variety of Computer Aided Software Engineering (CASE) tools and expert systems shells. Assembly languages and operating systems (such as UNIX) for micro-, mini-, and mainframe computers are studied to provide an understanding of the architecture and organization of a digital computer. Mathematical topics such as discrete mathematics and data structures, graph theory, and Boolean and

linear algebra are taken by undergraduates so that they may better understand the internal structure of the computer and the effective utilization of its languages.

A knowledge of the computer's internal structure is important to understanding its capabilities. Thus, the Computer Science student will take courses in assembly language, computer logic, and computer organization. Courses in systems programming and operating systems extend this structural study into the "software" of the computer. A required sequence of software engineering courses prepares our students for advanced systems and software applications.

The free electives in the Computer Science program can also be used to individually tailor a student's study plan. For example, a student desiring a program even more intensive than the Computer Science major could satisfy his or her free electives with more Computer Science courses. A student wishing to obtain a broader education could satisfy these electives with courses offered by any department in the University.

BACHELOR OF SCIENCE WITH A MAJOR IN COMPUTER SCIENCE

Curriculum Requirements:

Area	*Required Courses*	*TCH*
Liberal Studies:	ENGL 1301, 1302	6
	Perspectives	15
	Cultural Formations	6
	(One Perspectives course *or* one Cultural Formations course must satisfy the Human Diversity requirement.)	
Mathematics:	MATH 1337, 1338, 3353	9
	MATH 2339 *or* CSE 3353	3
	CSE 3365, 4340	6
Science:	PHYS 1105, 1106, 1303, 1304	8
	Six TCH from the following list of courses: ANTH 2315, 2363 BIOL 1401, 1402 CHEM 1113/1303, 1114/1304, 1307, 1308 GEOL 1301, 1305, 1307, 1308, 1313 PHYS 3305	6
Computer Science:	CSE 1341, 2340, 2341, 2353, 3100, 3342, 3358, 3381, 4345, 4346, 4381, 5343	34
	12 TCH from the folowing, with exactly one selected from each area: Area I: CSE 5320, 5330, 5350 Area II: CSE 5381, 5385 Area III: CSE 5341, 5342, 5348 Area IV: CSE 5313, 5314, 5345, 5382	12
Engineering:	EE 1381	3
Broadening:	ENGL 2301, CSE 3150	4
Free Electives:	The free electives must be approved by the adviser.	8
Wellness:		2
		122

BACHELOR OF SCIENCE WITH A MAJOR IN COMPUTER SCIENCE
With Pre-Medical Specialization

Curriculum Requirements:

Area	*Required Courses*	*TCH*
Liberal Studies:	ENGL 1301, 1302	6
	Perspectives — 9-12 hours	

	Cultural Formations — 3-6 hours (One Perspectives course *or* one Cultural Formations course must satisfy the Human Diversity requirement.)	
Mathematics:	MATH 1337, 1338, 3353	9
	MATH 2339 *or* CSE 3353	3
	CSE 4340	3
Science:	PHYS 1105, 1106, 1303, 1304	8
	BIOL 1401, 1402, 3304, 3306	14
	CHEM 1303, 1304; 1113; 1114; 3117; 3118; 3371, 3372	16
Computer Science:	CSE 1341, 2340, 2341, 2353, 3100, 3342, 3358, 3365, 3381, 4345, 4346, 4381, 5343	37
	12 TCH from the folowing, with exactly one selected from each area: Area I: CSE 5320, 5330, 5350 Area II: CSE 5381, 5385 Area III: CSE 5341, 5342, 5348 Area IV: CSE 5313, 5314, 5345, 5382	12
Broadening:	ENGL 2301, CSE 3150	4
Wellness:		2
		129

BACHELOR OF ARTS WITH A MAJOR IN COMPUTER SCIENCE

Curriculum Requirements:

Area	*Required Courses*	*TCH*
Liberal Studies:	ENGL 1301, 1302	6
	Perspectives	15
	Cultural Formations (One Perspectives course *or* one Cultural Formations course must satisfy the Human Diversity requirement.)	6
Mathematics:	MATH 1337, 1338	6
	MATH 2339 *or* CSE 3353	3
	STAT 2331	3
Science:	PHYS 1313	3
	Three TCH from the following list of courses: ANTH 2315, 2363 BIOL 1303, 1305, 1306, 1307, 1308, 1401, 1402 CHEM 1301, 1302, 1303, 1304, 1307, 1308 GEOL 1301, 1305, 1307, 1308, 1313 PHYS 1303, 1304, 1309, 1314, 1407, 1408, 3305	3
Computer Science:	CSE 1341, 2340, 2341, 2353, 3100, 3342, 3358, 3381, 4345, 4346, 5343	31
	Nine TCH from the folowing, with exactly one selected from each area: Area I: CSE 4381, 5320, 5330, 5350, 5381, 5385 Area II: CSE 5341, 5342, 5348 Area III: CSE 5313, 5314, 5345, 5382	9
Engineering:	EE 1381	3
Broadening:	ENGL 2301, CSE 3150	4
Free Electives:	The free electives must be approved by the adviser.	28
Wellness:		2
		122

MINOR IN COMPUTER SCIENCE*

I. Requirements:
1. CSE 1341 Principles of Computer Science I
2. CSE 2341 Principles of Computer Science II
3. CSE 2353 Discrete Computational Structures
4. CSE 3358 Data Structures

II. Elective Courses (two of the following)
1. CSE 3342 Programming Languages
2. CSE 5320 Artificial Intelligence
3. CSE 5330 File Organization and Database Management
4. CSE 5343 Operating Systems and System Software
5. CSE 5350 Algorithms Engineering

*A student minoring in Computer Science may not minor in Computer Engineering.

CURRICULUM IN COMPUTER ENGINEERING

Computer engineering deals with computers and computing systems. The computer engineer must be capable of addressing problems in hardware, software, and algorithms, especially those problems whose solutions depends upon the interaction of these elements.

The career opportunities of the computer engineer will require a broad range of knowledge. The design and analysis of logical and arithmetic processes that are the basis of computer science provides basic knowledge. Computer engineering courses are concentrated on the interacting nature of hardware and software. Basic electrical engineering is a clear foundation for the computer engineer. The Computer Engineering Program at SMU is accredited by ABET.

BACHELOR OF SCIENCE WITH A MAJOR IN COMPUTER ENGINEERING

CURRICULUM REQUIREMENTS:

Area	*Required Courses*	*TCH*
Liberal Studies:	ENGL 1301, 1302	6
	Perspectives — 9-12 hours Cultural Formations — 3-6 hours (One Perspectives course *or* one Cultural Formations course must satisfy the Human Diversity requirement.)	15
Mathematics:	MATH 1337, 1338, 2339, 2343, 3353	12
	MATH 2339 *or* CSE 3353	3
	CSE 3365, 4340	6
Science:	PHYS 1106, 1303, 1304	7
	CHEM 1303	3
	Three TCH from CHEM 1304; BIOL 1401, 1402; GEOL 1301; PHYS 3305	3
Engineering Core:	EE 1381, 2122, 2152, 2322, 2350, 2352	14
	ME 1302	3
	Three TCH from ME 2310, 2320, 2331, 3332, 3341	3
Computer Science:	CSE 1341, 2340, 2341, 2353, 3100, 3342, 3358, 3381, 4345, 4346, 4381, 5343, 5381, 5385	40
	Six TCH from CSE 5313, 5314, 5320, 5330, 5341, 5348, 5350; EE 5357, 5380	6
Broadening:	ENGL 2301, CSE 3150	4
Wellness:		2
		127

MINOR IN COMPUTER ENGINEERING*

I. Requirements:

1. CSE 1341 Principles of Computer Science I
2. CSE 2341 Principles of Computer Science II
3. CSE 2353 Discrete Computational Structures
4. CSE 3358 Data Structures

II. Elective Courses (two of the following):

1. CSE 4381 Digital Computer Design
2. CSE 5343 Operating Systems and Software
3. CSE 5381 Computer Architecture I
4. CSE 5385 Microprocessor Architecture and Interfacing

*A student minoring in Computer Engineering may not minor in Computer Science.

CURRICULUM IN MANAGEMENT SCIENCE

Management Science deals with the development of mathematically based models for planning, operating, and decision-making. In our curriculum, these methods are also applied to the design and management of efficient production systems.

Using American Airlines as an example, a management scientist would be concerned with building models to decide the best scheduling of flights, routing of planes, assignment of pilots and crews to specific flights, and flight gate assignments, as well as deciding the best number of planes to own and operate, which cities to fly to, which cities to use as major hubs, how to lay out an airport terminal, which overbooking policy should be used, and other issues. The optimal decisions for such issues can be uncovered through analysis using computer-based mathematical models. Hence, the management scientist uses the data collected and managed by the MIS department in building his or her models.

Because of its generality, Management Science has a broad set of applications in all engineering disciplines and in the fields of computer science, economics, finance, marketing, medicine, transportation, production, and statistics, for example. The methods are used extensively in both the public and private sector.

BACHELOR OF SCIENCE WITH A MAJOR IN MANAGEMENT SCIENCE

CURRICULUM REQUIREMENTS:

Area	*Required Courses*	*TCH*
Liberal Studies:	ENGL 1301, 1302	6
	Perspectives	15
	Cultural Formations	6
	(One Perspectives course *or* one Cultural Formations course must satisfy the Human Diversity requirement.)	
Mathematics:	MATH 1337, 1338, 2339, 3353	9
	MATH 2339 *or* CSE 3353	3
	CSE 4340, 5377	6
Science:	3 TCH Natural Science from BIOL 1401, 1402, CHEM 1113/1303, 1114/1304, 1113/1307, 1114/1308, GEOL 1301, 1305, 1308, PHYS 1105/1303, 1106/1304	3
	3 TCH Natural Science or Technology from ANTH 2315, 2363; BIOL 1303, 1304, 1305, 1401, 1402; CHEM 1113/1303, 1114/1304, 1113/1307, 1114/1308; GEOL 1301, 1305, 1307,	

	1308, 1315; PHYS 1403, 1404, 1407, 1408; EE 1301, 1381; ME 1301, 1302, 1303, 1304	3
	9 TCH Natural Science, Technology, and/or Social Science including ANTH, ECO, PSYC, or SOCI	9
Major Concentration:	CSE 1341, 2341, 2360, 3360, 3365, 4395, 5362	21
	3 TCH from CSE courses at the 2000 level or above	3
Business:	ACCT 2311, MKTG 3340, OBBP 3370	9
Broadening:	ENGL 2301, CSE 3150	4
Electives:	Adviser must approve electives	17
Free Electives:	Adviser must approve electives	6
Wellness:		2
		122

MINOR IN MANAGEMENT SCIENCE

For information on a minor in management science, the student should consult the department. A total of 15 TCH in management science courses is necessary to meet the following requirements:

I. Requirements:
1. CSE 1341 Principles of Computer Science I
2. CSE 2341 Principles of Computer Science II
3. CSE 2360 Engineering Economy
4. CSE 3360 Operations Research Models

II. Elective Courses (two of the following – students must include one of CSE 4395 or CSE 5362):
1. CSE 4340 Statistics for Engineers and Applied Scientists
2. CSE 4395 Senior Design
3. CSE 5362 Production Management
4. CSE 5377 Statistical Design and Analysis of Experiments

THE COURSES (CSE)

1305. Computers and Information Technology. A survey course in computers and information technology that introduces the college student to the architecture of the personal computer, software, hardware, telecommunications, and artificial intelligence, as well as the social and ethical implications of information technology. The two-hour laboratory sessions reinforce the concepts learned in lecture, including a survey of word processing, spreadsheet, database management, presentation, and network software. Credit is not allowed for a CS, CpE, or MS major or minor.

1311. Introduction to Interactive Multimedia. An introduction to multimedia hardware technologies, software systems, and standards used to develop interactive multimedia applications. Topics include screen design, graphics, animation, audio, and still and motion video, as well as compression techniques. Each student will design personal multimedia Web pages that will include one common class theme plus a variety of personally selected subjects. *Prerequisite:* CSE 1305 or permission of instructor.

1340. Introduction to Computing Concepts. Introduction to computer concepts and structures and interactive application development. Programming with high-level languages, tools, and environments. Laboratory exercises will include programming assignments.

1341. Principles of Computer Science I. Introduction to the fundamental concepts of computer science – algorithms, program structures, data structures. Structured programming in C. Development of programming skills to solve problems of reasonable complexity. Introduction to UNIX. The first course for CS and CpE majors and minors. 0.5 TCH Design. *Prerequisite:* An introductory programming course.

2336. Visual Basic Programming. Introduction to programming using the Visual Basic environment, with focus on business applications. Software development life cycle, flowcharts, data types, control structures, debugging techniques, design and implementation of graphical interfaces, report generation, Visual Basic as a front end for database access. Students are required to design and write code. No prior programming experience required. No credit for CSE majors or minors. *Prerequisite:* CSE 1305 or permission of instructor.

2337. Introduction to Database Design and SQL. This course is designed to provide practical experience in using SQL and ACCESS 2000. It emphasizes hands-on practical training in implementing and accessing relational databases. No credit for CS and CpE majors or minors. *Prerequisite:* Familiarity with Microsoft Word and Excel packages and both creating and editing files in a Windows environment.

2340. Assembly Language Programming and Machine Organization. Computer number systems, arithmetic operations, machine organization, machine language, assembly language programming. 0.5 TCH Design. *Prerequisites:* CSE 1302, 1316, 1317, or 1341.

2341. Principles of Computer Science II. This course is intended as a continuation of CSE 1341, further developing program design skills and understanding of language concepts. Thorough coverage of the C programming language. Implementation of basic data structures (linked lists, stacks, queues, sets, and binary trees) and their use in efficient program design. 1 TCH Design. *Prerequisite:* CSE 1341.

2353. Discrete Computational Structures. Logic, proofs, partially ordered sets, and algebraic structures. Introduction to graph theory and combinatorics. Applications of these structures to various areas of computer science. 0.5 TCH Design. *Prerequisite:* CSE 1341, MATH 1338.

2360. Engineering Economy. Evaluation of engineering alternatives by equivalent uniform annual cost, present worth, and rate-of-return analysis. Use of a computerized financial planning system. 0.5 TCH Design. *Prerequisite:* MATH 1338 and a knowledge of finite probability.

3100. Digital Logic Design Laboratory. Complements basic courses in computer organization, logic, and switching theory. Emphasizes interconnection of logic modules to obtain counters, control circuits, arithmetic units, memories, and small computer circuits. 1 TCH Design. *Corequisite:* CSE 3381.

3150. Ethics in Computing. Computer professionals have a special responsibility to ensure ethical behavior in the design, development, and use of computers and computer networks. This course focuses on the education of the undergraduate through the study of ethical concepts and the social, legal, and ethical implications involved in computing. Issues to be studied include computer crimes, software theft, hacking and viruses, intellectual property, unreliable computers, technology issues in the workplace, and professional codes of ethics. *Prerequisite:* Junior standing.

3342. Programming Languages. Introduction to basic concepts of programming languages, including formal syntax, static and dynamic, scoping, equivalence and consistency of data types, control constructs, encapsulation and abstract data types, storage allocation, and runtime environment. Advanced programming techniques such as tail recursion, inheritance, polymorphism, static and dynamic binding, and exception handling. In-depth studies of representative languages of different programming paradigms — object-oriented, logic, and functional programming. 1 TCH Design. *Prerequisite:* CSE 2341.

3353. Discrete Mathematics With Algorithms. Introduction to algorithm analysis, big Oh notation, classifying algorithms by efficiency. Algorithms for arithmetic operations, binomial coefficients, prime factorization, gcd. Sorting and selection algorithms. Introduction to graph theory, graph algorithms. *Prerequisite:* CSE 2353.

3358. Data Structures. Representation and organization of data for fast access and computation. Consideration of efficient algorithms for storing and retrieving information using lists, trees, hash tables, etc. Dynamic storage allocation/collection techniques. Fast sorting techniques. Abstract data types (ADT). Implementation of data structures. 1 TCH Design. *Prerequisites:* CSE 2341 and 2353 or MATH 3308.

3360. Operations Research. A survey of models and methods of operations research. Deterministic and stochastic models in a variety of areas will be covered. Credit is not allowed for both CSE 3360 and CSE 6360. *Prerequisites:* A knowledge of matrices. An introduction to probability and statistics.

3365 (MATH 3315). Introduction to Scientific Computing. An elementary survey course that includes techniques for root-finding, interpolation, functional approximation, linear equations, and numerical integration. Special attention is given to C or FORTRAN programming, algorithm implementations, and library codes. *Prerequisites:* CSE 1341 and a grade of *C-* or higher in MATH 1338. Students registering for this course must register for an associated computer laboratory.

3381. Digital Logic Design. Boolean functions. Logic gates. Memory elements. Synchronous and asynchronous circuits. Shift registers and computers. Logic and control. 1 TCH Design. *Corequisite:* CSE 3100; *Prerequisites:* CSE 2340, 2353.

4340 (STAT 4340). Statistical Methods for Engineers and Applied Scientists. Basic concepts of probability and statistics useful in the solution of engineering and applied science problems. Topics: probability, probability distributions, data analysis, sampling distributions, estimations, and simple tests of hypothesis. *Prerequisite:* MATH 1338.

4345. Software Engineering Principles. Provides practical experience in proposal development, software system design, implementation, and validation. Integrates and develops skills in applied computer science, project management, communication, problem solving, design and validation methodology. Review of current software engineering literature. 1.5 TCH Design. *Prerequisites:* CSE 3358 and senior standing.

4346. Software Engineering Laboratory IV. Provides a project-contract environment for implementation of systems designed in CSE 4345. Emphasizes working from a set of specifications as a project team member. Project team organization. Project planning, scheduling, and management. Testing and validation methods. 3 TCH Design. *Prerequisite:* CSE 4345 or permission of instructor.

4381. Digital Computer Design. Machine organization, instruction set architecture design, memory design, control design: hardwired control and microprogrammed control, I/O organization, algorithms for computer arithmetic, computer peripherals, microprocessors, and Hardware Description Languages (HDLs) and simulations based on them. 1 TCH Design. *Prerequisite:* CSE 3381, or both EE 2381 and CSE 2340.

4(1-4)9(0-4). Undergraduate Project. An opportunity for the advanced undergraduate student to undertake independent investigation, design, or development. Variable credit from one to four term hours. Written permission of the supervising faculty member is required before registration. At least 0.5 of (1-4) TCH Design.

4395. Senior Design. This course consists of a large project involving the design of a management system. The project will involve model building, data collection and analysis, and evaluation of alternatives. 3 TCH Design. *Prerequisites:* CSE 5362 and senior standing.

5313. Software Requirements and Design Engineering. This course focuses on defining software requirements and provides an overview of design techniques that can be used to structure applications. Requirements topics include interacting with end users to determine needs and expectations, identifying functional requirements, and identifying performance requirements. Techniques studied include prototyping, modeling, and simulation. Design topics include design in the system life cycle, hardware vs. software trade-offs, subsystem definition and design, abstraction, information hiding, modularity, and reuse. 1.5 TCH Design.

5314. Software Testing and Quality Assurance. The relationship of software testing to quality is examined with an emphasis on testing techniques and the role of testing in the validation of system requirements. Topics include module and unit testing, integration, code inspection, peer reviews, verification and validation, statistical testing methods, preventing and detecting errors, selecting and implementing project metrics, and defining test plans and strategies that map to system requirements. Testing principles, formal models of testing, performance monitoring, and measurement also are examined. 1 TCH Design.

5320. Artificial Intelligence. Introduction to basic principles and current research topics in artificial intelligence. Formal representation of real-world problems, search of problem spaces for solutions, and deduction of knowledge in terms of predicate logic, nonmonotonic reasoning, and fuzzy sets. Application of these methods to important areas of artificial intelligence, including expert systems, planning, language understanding, machine learning, neural networks, computer vision, and robotics. 1 TCH Design. *Prerequisites:* CSE 3342, 3358.

5330. File Organization and Database Management. A survey of current database approaches and systems; principles of design and use of these systems. Query language design, implementation constraints. Applications of large databases. Includes a survey of file structures and access techniques. Use of a relational DBMS to implement a database design project. 1.5 TCH Design. *Prerequisite:* CSE 3358.

5341. Compiler Construction. Review of programming language structures, loading, execution, and storage allocation. Compilation of simple expressions and statements. Organization of a compiler including compile-time and run-time symbol tables, lexical analysis, syntax analysis, code generation, error diagnostics, and simple code optimization techniques. Use of a recursive high-level language to implement a complete compiler. 1 TCH Design. *Prerequisites:* CSE 3342, 3358.

5342. Concepts of Language Theory and Their Applications. Formal languages and their relation to automata. Introduction to finite state automata, context-free languages, and Turing machines. Theoretical capabilities of each model, and applications in terms of grammars, parsing, and operational semantics. Decidable and undecidable problems about computation. 1 TCH Design. *Prerequisite:* CSE 3342 or permission of instructor.

5343. Operating Systems and System Software. Theoretical and practical aspects of operating systems: overview of system software, time-sharing and multiprogramming operating systems, network operating systems and the Internet, virtual memory management, interprocess communication and synchronization, file organization, and case studies. 1 TCH Design. *Prerequisites:* CSE 2340, 3358.

5345. Advanced Java Programming. This course will provide the student with a foundation for building advanced distributed and embedded systems applications in Java through the use of Java's support for networking and concurrency. Topics will include exception handling, object serialization, thread and thread-safe programming issues, component frameworks, remote method invocation, security, and concurrency issues. Discussion of the issues and techniques necessary to develop high-performance, object-oriented concurrent Java applications and be able to apply advanced Java constructs to research projects in telecommunications, databases, networks, and mobile computing. *Prerequisites:* CSE 3342 or permission of instructor.

5348. Internetworking Protocols and Programming. Processing and Interprocess Communications (IPC), UNIX domain sockets, fundamentals of TCP/IP, Internet domain sockets, packet routing and filtering and firewall, SNMP and network management, client-server model and software design, Remote Procedure Call (XDR, RPC, DCE), design of servers and clients, networking protocols for the World Wide Web, internetworking over new networking technologies. 1 TCH Design. *Prerequisites:* CSE 5343 and C programming.

5350. Algorithm Engineering. Algorithm design techniques. Methods for evaluating algorithm efficiency. Data structure specification and implementation. Applications to fundamental computational problems in sorting and selection, graphs and networks, scheduling and combinatorial optimization, computational geometry, arithmetic, and matrix computation. Introduction to parallel algorithms. Introduction to computational complexity and a survey of NP-complete problems. Developing student facility to design efficient algorithms is emphasized. 1 TCH Design. *Prerequisite:* CSE 3358.

5362. Production Management. A survey of models and methods for designing and implementing quality-based, integrated, production/distribution systems. Topics include demand forecasting, product mix decisions, distribution systems, facilities location and layout, scheduling, inventory and materials management, just-in-time, and quality control for manufacturing and service operations. *Prerequisite:* CSE 3360.

5376 (EE 5301). Introduction to Telecommunications. Overview of public and private telecommunications systems, traffic engineering, switching, transmission, and signaling. Channel capacity; media characteristics; Fourier analysis and harmonics; modulation; electromagnetic wave propagation and antennae, modems, and interfaces; and digital transmission systems. T1 carriers, digital microwave, satellites, fiber optics and SONET, and Integrated Services Digital Networks. 0.5 TCH Design.

5377 (STAT 5377). Statistical Design and Analysis of Experiments. Introduction to statistical principles in the design and analysis of industrial experiments. Completely randomized, randomized complete and incomplete block, latin square, and Plackett-Burman screening designs. Complete and fractional factorial experiments. Descriptive and inferential statistics. Analysis of variance models. Mean comparisons. *Prerequisites and corequisites:* CSE 4340 and senior standing with a Science or Engineering major, or permission of instructor.

5381. Computer Architecture I. An advanced course in computer architecture introducing students to the state of the art in uniprocessor computer architecture. The focus is on the quantitative analysis and cost-performance trade-offs in instruction-set, pipeline, and memory design. Description of real systems and performance data also are presented, providing qualitative case studies that complement the quantitative analysis. Topics covered: quantitative performance measures, instruction set design, pipeline, vector processing, memory organization, input/output, and an introduction to parallel processing. *Prerequisites:* CSE 4381. Reasonable experience with any high-level language and any hardware description language.

5382. Computer Graphics. Hardware and software components of computer graphics systems: display files, two-dimensional and three-dimensional transformations, clipping and windowing, perspective, hidden line elimination and shaping, interactive graphics, and applications. 1 TCH Design. *Prerequisite:* CSE 3358 or equivalent.

5385. Microprocessor Architecture and Interfacing. Emphasizes the design of Intel-based microprocessor computer systems. The course starts with the presentation of Intel microprocessors and continues with the design of a personal computer system with hierarchical memory, input-output peripherals, and industry-standard bus interfaces (ISA, EISA, VLB, and PCI). In addition to hardware design techniques, the course has laboratory and design projects in which students learn to use state-of-the-art CAD tools and laboratory instruments for hardware design, simulation, implementation, and debugging. 2 TCH Design. *Prerequisites:* CSE 3381 or both EE 2381 and CSE 2340.

5(1-3)9(0-4). Special Topics. Individual or group study of selected topics in computer science. *Prerequisite:* Permission of instructor.

ELECTRICAL ENGINEERING

Professor Gibson, *Chair*

Professors: J. Butler, Çelik-Butler, Evans, Gosney, Gupta, Khotanzad, Peikari, Srinath; *Associate Professors:* D. Butler, Chen, Davila, Douglas, Dunham, Lee, Orsak; *Adjunct Associate Professors:* Ku, McMahon, Provence, R. Sharma; *Adjunct Assistant Professors:* Abuzaid, Levine, Loos, Pucacco, Rahman, Sohl, Triggs, Westerhold; *Emeritus Professors:* Ashley, Fossum, Heizer, Howard, Savage, Vacroux; *Senior Lecturer:* Baker.

The discipline of electrical engineering is at the core of today's technology-driven society. Personal computers, computer-communications networks, integrated circuits, optical technologies, digital signal processors, and wireless communications systems have revolutionized the way we live and work, and extraordinary advances in these fields are announced every day. Because today's society truly is a technological one, a degree in electrical engineering offers exceptional opportunities for financial security, personal satisfaction, and expanding the frontiers of technology.

The Department of Electrical Engineering at SMU offers a full complement of courses at the Bachelor's-degree level in communications, information technology, communication networks, digital signal processing, lasers and optoelectronics, electromagnetics and microwaves, microelectronics, VLSI design, systems and

control, and image processing and computer vision. The courses and curriculum are designed and continuously updated to prepare the student for a successful career in engineering design and development at the forefront of these fields — or, if desired, to allow the student to pursue an advanced degree in electrical engineering.

In addition to the B.S.E.E. degree, a professionally oriented Bachelor's degree in telecommunications systems is offered through the Electrical Engineering Department. The courses in this curriculum provide an overview of the telecommunications industry and prepare the student to become immediately involved in the development of new telecommunications products, services, and applications.

The SMU Electrical Engineering Department emphasizes the following major areas of interest:

1. *Biomedical Engineering* – Overview of biomedical engineering, biomedical devices and instrumentation, biomedical signal capture, processing and modeling.
2. *Communications and Information Technology* – Detection and estimation theory, digital communications, computer networks, spread spectrum, cellular communications, coding, encryption, compression, and wireless and optical communications.
3. *Control Systems* – Linear and nonlinear systems control, robotics, and computer and robot vision.
4. *Digital Signal Processing* – Digital filter design, system identification, spectral estimation, adaptive filters, neural networks, and DSP implementations.
5. *Image Processing and Computer Vision* – Digital image processing, computer vision, and pattern recognition.
6. *Lasers, Optoelectronics, Electromagnetic Theory and Microwave Electronics* – Classical optics, fiber optics, laser recording, integrated optics, dielectric waveguides, antennas, transmission lines, laser diodes and signal processors, and superconductive microwave and optoelectronic devices.
7. *Solid State Circuits, Computer Aided Circuit Design, and VLSI Design* – Electronic circuits, computer-aided design, VLSI design, neural network implementation, parallel array architectures, and memory interfaces.
8. *Electronic Materials and Solid State Devices* – Fabrication and characterization of devices and materials, device physics, noise in solid state devices, infrared detectors, AlGaAs and GaAs devices and materials, thin films, superconductivity, superconductive devices and electronics, hybrid superconductor-semiconductor devices, ultrafast electronics, and applications of Scanning Tunneling microscope.
9. *Telecommunications* – Overview of modern telecommunications components and systems, data communications, digital telephony, and digital switching.

DEPARTMENT FACILITIES

The department has access to the SEAS academic computing resources, which consist of four 600-MHz Digital Workstations, four multiprocessor 300-MHz Digital 2100 servers, five DecStation 5000/260s, and two 250-MHz Sun Ultra Enterprise 3000 servers. A DEC 8200 with dual 300-MHz processors and 2GB of RAM will accept batch jobs up to 9GB. SEAS file service is provided by a High Availability Digital clustered NFS/CIFS file server FibreChannel connected to RAID 3/5 disk arrays. Current capacity is 324 GB, with possible expansion to more than 9TB. The file server is connected to the Gigabit Ethernet backbone and serves all Unix machines and PCs in SEAS. An Auspex 7000/300 with 116GB is also available and is connected to the secondary FDDI backbone.

All SEAS resources are connected to SEASnet, which consists of a Gigabit Ethernet backbone with various segments connected via FDDI, 100Mb Ethernet, 10Mb Ethernet, and OC3 ATM.

Specific department laboratory facilities for instruction and research include:

BIOMEDICAL ENGINEERING LABORATORY. This lab is equipped to provide students with facilities for the study of a wide variety of problems in biomedical engineering. Equipment includes a Nikon light microscope, infrared spectrophotometer, thermograph, 4 Grass physiographs, personal computer with data acquisition capability, a variety of analog and digital oscilloscopes, signal generators, and meters.

CRYOELECTRONICS LABORATORY. The cryoelectronics laboratory is used in the investigation of electronic materials and devices at cryogenic temperatures and provides measurement capabilities from 2K to 450K. Two low-temperature Dewars, two closed-cycle helium refrigerators, one open-cycle helium cryostat, various cryogenic inserts, microprocessor-based programmable temperature controllers, temperature sensors, and fiber-optic instrumentation support low-temperature device characterization and superconductivity research. Two computer workstations are used as system controllers for data acquisition and modeling. There is close interaction with the Solid-State Device Characterization and the Microwave Electronics laboratories.

SOLID-STATE DEVICE CHARACTERIZATION LABORATORY. This facility is used for the characterization and modeling of solid-state devices and electronic materials. The laboratory has the capability for computerized I-V, C-V, microwave, optical, and noise characterization of devices. This lab is designed for computer-controlled data acquisition and modeling.

The electrical and noise-characterization facilities include an HP-UX workstation running IC-CAP with a HP4142 source monitor unit, HP4284 LCR meter for I-V and C-V characterization, and two magnets. The lab also contains a 6×6-ft shielded room with a noise attenuation of 100 dB to electric fields and plane waves from 14 kHz to 10 GHz and 30 dB to magnetic fields at 60 Hz. The lab includes two low-frequency dynamic signal analyzers, lock-in amplifiers, various programmable multimeters, oscilloscopes, and LCR meters, plus plotters, printers, and system controllers.

The microwave measurement equipment includes a 200-KHz to 22-GHz HP71200A spectrum analyzer, an HP8510 (40 MHz to 40 GHz) network analyzer, an HP54120T 20 GHz sampling oscilloscope, microwave power meters, and various microwave components and amplifiers. The optical characterization facilities include an Oriel MS257 spectrometer/monochrometer, two IR sources, a calibrated pyroelectric detector, various fiber-optic components, laser diodes, and Ortel 7 GHz photodiodes. The spectrometer/monochrometer and IR sources allow the characterization of devices and materials from one to 12 xmicrons.

PULSED LASER DEPOSITION LABORATORY. This facility is a Neocera turn-key pulsed laser deposition system, consisting of an 18-inch turbo-pumped vacuum chamber. The system has a three-inch *rf* sputter gun in addition to a six-target PLD carousel. The substrate can be heated to 950 C. The system uses a Lambda-Physik Compex 301 KrF excimer laser operating at 248 nm. The laser produces up to one joule per pulse with a repetition rate of one to 10 Hz. The PLD system is used primarily for the deposition of ferroelectric and pyroelectric materials used in uncooled infrared detectors. Other bolometric, superconductive, and optoelectronic materials are also investigated.

MICROWAVE ELECTRONICS LABORATORY. The lab uses HP-Series IV software, including the CAE packages Touchstone, Libra, OmniSys, J-Omega, and Communications Design Suite. The software is used for education in the design and analysis of microwave circuits and system. Also included in the facility are a 20-GHz

sampling oscilloscope, microwave frequency synthesizers, microwave power meter, pulse generator, 22-GHz HP71200A spectrum analyzer, and a 40-GHz HP8510 network analyzer plus microwave amplifiers, mixers, and components.

Optoelectronics Simulation Laboratory. Software programs to assist with the design of semiconductor optoelectronic devices have been evolving at SMU for decades and are currently used to design the epitaxy structures for strained-quantum-well semiconductor lasers and to predict the resulting device performance. These programs deal with three broad areas: 1) quantum-well gain optimization, 2) electromagnetic and optical field optimization, and 3) periodic structures and gratings. In addition to distributed feedback and distributed Bragg reflector laser design, grating software is used in the study of grating-assisted coupling between dielectric waveguides. MODEIG software (available free at www.seas.smu.edu/modeig/), used for solving the propagation characteristics of optical waveguides, is maintained and regularly upgraded by this laboratory. It is used by more than 50 corporations, universities, and government agencies worldwide. Students use software developed in this laboratory for assignments and projects.

Solid-State Technology Laboratory. The facility consists of a 3,000-square-foot Class 10,000 clean room with Class 100 laminar-flow work areas. Major equipment includes two projection printers and two contact printers for lithography; a plasma reactor for etching and deposition of dielectrics; an *rf/dc* sputter deposition system; two plasma etch systems; two reactive-ion etch systems; and a chemically assisted ion-beam etch system. Also available are e-beam evaporators for metallization and dielectric deposition; a thermal evaporator for metal deposition; a pulsed-laser deposition system; a scanning electron microscope; and oxidation, diffusion, and annealing furnaces. In addition to its instructional uses, this laboratory supports research in laser diodes, uncooled infrared detectors, microelectromechanical (MEM) devices, and NbN and YBaCuO superconductor devices.

Submicron Grating Laboratory. This laboratory is dedicated to the holographic fabrication of submicron gratings. Equipment includes a floating optical table, a visible argon ion laser, an ultraviolet argon ion laser, laser power meter, and optical components for holography. Typical grating linewidths range from 0.09 to 0.5 μm and can be specified to an accuracy of +0.0001 μm. In addition to supporting research on semiconductor lasers and telecommunications components, this laboratory is used by students to fabricate gratings.

Semiconductor Laser Characterization Laboratory. This laboratory is dedicated to measuring the performance of edge-emitting and surface-emitting semiconductor lasers fabricated at SMU from materials including AlGaAs, InGaAs, InGaAsP, AlGaInAs, and AlGaInP with wavelengths ranging from 0.63 to 2 μm. Equipment and instrumentation include optical spectrometers, visible and IR cameras and detectors for near-field and far-field measurements, power supplies for light-current measurements, temperature-controlled stages for laser characterization, and custom assemblies of optical components on two floating optical tables. Commercial beam-analysis software is used with several optical set-ups to characterize laser beams, and several of the semiconductor laser evaluation stations are computer-controlled. An automated probe station is used to evaluate vertical cavity surface-emitting lasers (VCSELs). In addition to laser research, students use this laboratory to produce video "virtual laboratory" experiences for distance students.

Digital Signal Processor Laboratory. Digital signal processors (DSPs) are programmable semiconductor devices that are used extensively in cellular telephones, high-density disk drives, and high-speed modems. Courses in this laboratory focus on programming the Texas Instruments TMS320C50, a fixed-point processor, with

emphasis on assembly-language programming, implementation of FIR and IIR filters, the FFT, and a real-time spectrum analyzer.

COMMUNICATIONS SYSTEMS SIMULATION LABORATORY. The lab consists of 12 high-speed Silicon Graphics Workstations with a large-screen projection system. These integrated multimedia workstations run a wide array of communication system design and analysis software, signal processing software, and multimedia and Web-based software tools.

NETWORKS LABORATORY. The Networks Laboratory provides opportunities to simulate and evaluate different network configurations, from local area networks to the Internet. High-end PCs are configured with OPNET, COMNET, and other simulation software to model telecommunications networks and study their performance.

CURRICULUM IN ELECTRICAL ENGINEERING

The undergraduate curriculum in electrical engineering provides the student with basic principles through required courses, and specialization through a guided choice of elective courses.

AREAS OF SPECIALIZATION

Due to the extensive latitude in course selection and to the wide variety of courses available within the Department of Electrical Engineering and within the University as a whole, it is possible for the electrical engineering student to concentrate his or her studies in a specific professional area. The areas available include the following:

Control Systems
Biomedical Engineering
Communications
Computer Engineering
Digital Signal Processing
Electromagnetics and Optics
Electronic Circuits
Electronic Devices and Materials
Networks
Systems
Telecommunications Engineering

In most cases, the concentration is satisfied by systematically taking a specified group of electrical engineering courses at the advanced level. However, the telecommunications engineering, computer engineering, and biomedical options are more specialized. Their requirements are described later.

BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

The electrical engineering curriculum is administered by the Department of Electrical Engineering and is accredited by the Accreditation Board of Engineering and Technology (ABET).

The term credit hours within this curriculum are distributed as follows:

Term Credit Hours	
124	Minimum total hours required
23	*College Requirements* (ENGL 1301, 1302, Perspectives including ECO 1311, Cultural Formations, and Wellness)
15	*Mathematics* (MATH 1337, 1338, 2339, 2343, and a three-hour elective course at the 3000 level or above)
13	*Science* (CHEM 1303 or 1305; PHYS 1303, 1304, and 1105; and a three-hour elective in physics or chemistry)
3	*Mathematics or Science Elective* (a three-hour course approved by adviser)
6	*Computer Science* (CSE 1341 and one of CSE 2340, 2341, 2353, 3342, or 3358)

6	*Technical Electives* from other SEAS departments
6	*Mechanical Engineering Fundamentals* (ME 1302 and one of ME 2310, 2320, 2331, 3332, or 3340)
20	*Core Electrical Engineering* (EE 1381, 2381, 2350, 2170, 2370, 2122, 2322, and 3360)
11	*Junior Electrical Engineering Electives* (three of EE 3311, 3322, 3330, 3362, 3372, and 3381; and EE 3122 and 3181)
15	*Advanced Electrical Engineering Electives*
6	*Electrical Engineering Senior Design Sequence* (EE 4311, 4312)

Three hours of advanced electrical engineering electives must be selected in each of the three areas listed below:

I. EE 4372, 4373, 5360, 5362, 5370, 5371, 5373, 5374, and 5375;
II. EE 5356, 5357, 5380, 5381, and 5385; and
III. EE 5310, 5312, 5315, 5321, 5330, and 5332.

The remaining six hours of advanced electrical engineering electives may be chosen from any of the above three areas, the telecommunications courses offered by the EE Department, or advanced (5000-level) CSE courses offered by the CSE Department. Please note that EE 8000-level courses are primarily for graduate students but may be taken by highly qualified undergraduates with the approval of the adviser and the instructor. Special topics courses also are available.

Each student is expected to complete and file a plan of study with his or her academic adviser. The plan should state specific choices to meet the foregoing requirements and develop an area of specialization when this is desired. This should be done as soon as possible; however, for many students, it is a process that continues from term to term as the individual becomes better acquainted with the discipline of electrical engineering and with the choices available.

Specializations are offered in four important areas: pre-medical or biomedical engineering, computer engineering, a dual degree in physics, and telecommunications engineering. Each student may select one of these specializations or may personalize his or her degree by a particular choice of advanced major electives.

BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

(Biomedical Engineering Specialization)

The Department of Electrical Engineering offers a B.S.E.E. degree with a specialization in biomedical engineering. This program enables students to satisfy requirements for admission to medical school, and it is carried out in cooperation with the Baylor University Medical Center in Dallas. Students may also work on projects under faculty supervision at the University of Texas Southwestern Medical School.

The term credit hours within this curriculum are distributed as follows:

Term Credit Hours	
128	Minimum total hours required
23	*College Requirements* (ENGL 1301, 1302, Perspectives including ECO 1311, Cultural Formations, and Wellness)
15	*Mathematics* (MATH 1337, 1338, 2339, 2343, and a three-hour elective course at the 3000 level or above)
36	*Science* (BIOL 1401, 1402, 3304, and 3306; CHEM 1303, 1304, 1113, 1114, 3117, 3118, 3371, and 3372; and PHYS 1303 and 1304*)
3	*Computer Science* (CSE 1341)
6	*Mechanical Engineering Fundamentals* (ME 1302 and one of ME 2310, 2320, 2331, 3332, or 3340)