Lyle School of Engineering

GENERAL INFORMATION

The Lyle School of Engineering, named in 2008 in honor of Dallas entrepreneur and industry leader Bobby B. Lyle, 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, the school began one of the first cooperative education programs in the United States, a program that continues today to put engineering students to work on real technical projects.

Included in the Lyle School of Engineering curricula are programs in civil engineering, computer engineering, computer science, electrical engineering, environmental engineering, mechanical engineering and management science. In 2000, a variety of programs known as Engineering and Beyond was introduced to provide a generous mix of a traditional engineering curriculum and selected leadership coursework. This leadership coursework is designed to train engineering students for futures in management, entrepreneurship and beyond.

The Dallas area's national prominence in high technology and research has been beneficial to the Lyle School of Engineering and its students. Corporate support for the Lyle School has generated a remarkable array of equipment and laboratories. Recent additions include the AT&T Mixed Signals Lab, the Texas Instruments Digital Signal Processing Lab, the Procter and Gamble Biomedical Research Lab, and the Nokia Wireless Communication Lab. Other laboratories include the Laser Micromachining Lab, the Nanoscale Electro-thermal Science Lab and the Enterprise Sys-

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

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. Participation in the 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 a new graduate's starting salary before graduation.
- Gain invaluable work experience when competing for full-time jobs upon graduation.

How the Cooperative Program Operates

Entry into the SMU Co-op Program is typically offered at the spring term of the sophomore year or the fall term of the junior year during the student's academic progression. Two sample terms of entry are shown below:

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

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

Students who want to participate in the SMU Co-op Program should begin the application process during their first year to allow for career preparation. The application process includes attending Co-op Orientation, receiving interview skills training, résumé review, learning the job search process, and completing the Co-op Program application. The program director guides students through each step of the process.

Each applicant receives quality advising from the program's associate 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 employment beginning in the spring term during the sophomore year or the fall term of the junior year.

Any Lyle School of Engineering 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 program. Transfer students must be admitted and accepted at SMU.

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 fraternity/sorority recruitment during the second term of their first year. Students should apply 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, the school has created and maintained numerous corporate relationships. Many factors contribute to these relationships, including the quality of SMU's academics and research, the achievements of alumni, and SMU's close proximity to high-tech corporations.

Each SMU Co-op Program student directly benefits from the program's strong corporate relationships and bears an obligation to preserve these relationships by following the Co-op Program Undergraduate Student Agreement. The agreement balances the student's individual needs with the long-term goal of maintaining the program's corporate relationships for future SMU students.

The terms of the program include, but are not limited to, the following:

- Students must maintain good standing with SMU and their employer at all times.
- All training jobs must be approved in advance by the SMU Co-op Program associate director.
- Before each work term begins, undergraduate students in the program must enroll in the appropriate program 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 program's associate director. The courses do not count toward graduation. The course numbers for each work term are, respectively, SS 1099, 2099, 3099, 4099, 5099, 6099.
- Students enroll at SMU each term, including summers, once they begin the program's rotation 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 employer during school terms.
- Co-op students complete all work terms with the same company
- Once a student accepts a Co-op Program position, the student may switch positions within the sponsoring company with the approval of the company.
- Each student in the program completes his or her originally planned number and sequence of alternating work terms. The term of graduation must be a term of full-time study at SMU.
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For additional information, students should contact the associate director of the SMU Co-op Program: phone 214-768-1845; email smucoop@engr.smu.edu.

ADMISSION

Note: Detailed information regarding SMU's admission requirements, regulations and procedures is found in the University Admission section of this catalog.

Prospective students interested in undergraduate degrees in engineering apply for undergraduate admission to SMU as first-year or transfer students through the Office of Admissions, Southern Methodist

of the major are those in effect during the academic year of matriculation, or those of a subsequent academic year. Coursework counting toward a major may not be taken pass/fail. Majors must be officially declared (or changed) through the Office of Undergraduate Studies.

Departmental Distinction

By successfully completing a special program of study in the major department, a student may be awarded departmental distinction regardless of eligibility for graduation honors. The program of study normally will be undertaken in both the junior and senior years and would require independent reading and research beyond the regular departmental requirements for a degree. This award is conferred by the major department on the basis of certain criteria prescribed by the department, but all programs include the following requirements:

- An overall GPA of 3.500 or higher must be attained in all undergraduate coursework attempted for the degree in the major field of study.
- Successful completion of three hours of senior thesis approved by the academic adviser.
- Formation of a supervisory committee consisting of three members, with the chair being a resident tenured or tenure-track faculty member of the department, and a minimum of two full-time Lyle faculty members.
- Successful defense of the senior thesis, which consists of the presentation of the senior thesis in a public forum and subsequent oral examination by the supervisory committee to satisfy itself that the student performed the independent reading and conducted the research.

University-Wide Requirements

All SMU undergraduate students have a common college requirement designed to assure them of a broad liberal education regardless of their major. This requirement is designed to help each student learn to reason and think for oneself; become skilled in communicating and understanding; understand both the social and the natural worlds and one's own place and responsibilities in these environments; and understand and appreciate human culture and history in various forms, including religion, philosophy and the arts. Students should see the University-Wide Requirements section of this catalog for more information.

PROGRAMS OF STUDY

The Lyle School of Engineering offers the following degrees:

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

Engineering work can be classified by function, regardless of the branch, 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, while engineering curricula may be relatively uniform, the modes of presentation tend to point a student toward a particular large class of functions. Engineering curricula at

Undergraduate programs within the Department of Civil and Environmental Engineering educate and train leaders in the fields of environmental protection, resource management, construction and engineering design. Programs are tailored

Both the civil and environmental engineering programs are designed to prepare students for the Fundamentals of Engineering Examination, the first step toward licensure as a professional engineer. Engineering design is integrated throughout the civil and environmental engineering curricula, each culminating in a major design

Requirements for the Specialization	*Credit Hours*
Mathematics and Science:	56
MATH 1337, 1338, 2339, 2343	
STAT 4340 *or* 5340	

For approval of a minor in environmental engineering, the student should consult the Civil and Environmental Engineering Department. A minimum of 15 term credit hours in environmental engineering courses are required. The following is an example of an approved set of courses that provides a broad introduction to environmental engineering: **CEE 2304, 2421, 3431, 4329, 5354.** Based on the student's interests and background, other sets of environmental engineering courses may be substituted with the approval of the Civil and Environmental Engineering Department.

Students may earn a minor in global de

CEE 1331 (3)
METEOROLOGY
Meteorology is the science and study of the earth's atmosphere and its interaction with the earth and all forms of life. Meteorology seeks to understand and predict the properties of the atmosphere, weather, and climate from the surface of the planet to the edge of space. Appropriate for all interested undergraduates.

CEE 1378 (3)
TRANSPORTATION INFRASTRUCTURE
An overview and definitions of infrastructure elements with concentration on transportation. Principals of infrastructure planning and management. Congestion and performance measures. Relationship with economy, environment, safety, homeland security and technology.

CEE 2140 / ME 2140 (1)
MECHANICS OF MATERIALS LABORATORY

CEE 2342 / ME 2342 (3)
FLUID MECHANICS
Fluid statics, fluid motion, systems and control volumes, basic laws, irrota

aquifer flow equation, heterogeneity and anisotropy, regional vertical circulation, unsaturated flow, and recharge are examined. Well hydraulics, stream-aquifer interaction, and distributed- and lumped-parameter numerical models are considered, as are groundwater quality, mixing cell models, contaminant transport processes, dispersion, decay and adsorption, and pollution sources. *Prerequisites:* MATH 2343 and CEE 2342.

CEE 3327 (3)
PRINCIPLES OF SURFACE WATER HYDROLOGY AND WATER QUALITY MODELING
The theory and applications of the physical processes of the hydrologic cycle are examined. Different types of water bodies – streams, rivers, estuaries, bays, harbors, and lakes – are reviewed. The principal quality problems associated with bacteria, pathogens, viruses, dissolved oxygen and eutrophication, toxic substances, and temperature are examined in detail. Theoretical model approaches are emphasized. *Prerequisites:* CEE 2421 and MATH 2343.

CEE 3341 (3)
INTRODUCTION TO SOLID AND HAZARDOUS WASTE MANAGEMENT
Solid and hazardous waste are defined. Technology, health, and policy issues associated with solid waste and hazardous materials are examined. Methods of managing solid and hazardous waste are introduced and regulations presented where appropriate. The characteristics of hazardous and solid waste materials, health frameworks, and the distribution of contaminants in the environment are reviewed. *Prerequisites:* CEE 2304 and 2421.

CEE 3451 (4)
INDUSTRIAL HYGIENE AND OCCUPATIONAL HEALTH
The recognition, evaluation, and control of health hazards in the working environment are presented. Principles of industrial toxicology, risk assessment/management, occupational diseases, and occupational health standards are examined. The application of industrial hygiene principles and practice as well as the measurement and control of atmospheric contaminants are presented. The design and evaluation of occupational exposure controls are introduced. Lecture and three hours of laboratory. *Prerequisite:* CHEM 1304.

CEE 4329 (3)
DESIGN OF WATER AND WASTEWATER SYSTEMS
Physical, chemical, and biological concepts and processes that are specific to public water supplies and municipal wastewater management are covered. Fluid mechanics is reviewed followed by an introduction to hydraulic modeling for design of water distribution networks and wastewater collection networks. Design and operation of treatment systems for both drinking water and municipal wastewater pollution control are covered. Process modeling is employed for completion of two design projects, one for a public water supply treatment plant and the other for municipal wastewater treatment plant. Field trips are conducted to a public water supply treatment plant and to a municipal wastewater treatment plant. *Prerequisite:* CHEM 1303, CEE 2304 and 2342.

CEE 4333 (3)
FUNDAMENTALS OF AIR QUALITY II
Fundamental and advanced topics in air quality are covered, building upon CEE 3431. Atmospheric dispersion of pollutants is examined and modern computer models are used to predict transport. A thorough review of energy technology and energy policy is presented, focusing on the economics and environmental impacts of conventional and alternative methods of energy generation. The importance of indoor air quality is discussed, including the risks from radon and biological aerosols. Additional topics of current interest are presented. Each student prepares a term paper related to energy policy and the environment. *Prerequisite:* CEE 2331 or equivalent and CEE 3431.

CEE 4350/ME 4350 (3)
DESIGN OF STEEL STRUCTURES
Study of strength, behavior and design of metal structures; flexural and axial members, bolted and welded connections, and composite beams. *Prerequisite:* CEE 3350.

CEE 4351 (3)

CEE 5050 (0)
UNDERGRADUATE INTERNSHIP

CEE 5090 (0)
CEE SEMINAR
Lectures by invited speakers from industry an

erties of air pollutants, air quality management, fate and transport of pollutants in the environment, regulations of air quality, and the operation and design of air pollution control

CEE 5383 (3)
HEATING, VENTILATING, AND AIR CONDITIONING
Examines the science and practice of controlling environmental conditions through the use of thermal process and systems. Specific applications include refrigeration, psychometrics, solar radiation, heating and cooling loads in buildings,

Computer Science and Engineering

Professor Sukumaran V.S. Nair, **Chair**

Professors: Margaret H. Dunham, Delores M. Etter (Electrical Engineering), David W. Matula, Sukumaran V.S. Nair, Stephen A. Szygenda, Mitchell A. Thornton, Jeff Tian. **Associate Professors:** James G. Dunham (Electrical Engineering), Ira Greenberg, Ping Gui (Electrical Engineering), Richard V. Helgason (Engineering Management, Information and Systems). **Assistant Professors:** Jennifer A. Dworak, Tyler W. Moore, LiGuo Huang. **Senior Lecturer:** Frank P. Coyle. **Lecturers:** Donald E. Evans, Mark E. Fontenot. **Visiting Fellow:** Daniel W. Engels. **Adjunct Faculty:** Jeffrey D. Alcantara, William A. Bralick, Jr., Ann E. Broihier, Christian P. Christensen, Aaron L. Estes, Dennis J. Frailey, Kenneth R. Howard, Bhanu Kapoor, Mohamed M.I. Khalil, Kamran Z. Khan, R. Mallik Kotamarti, Lun Li, D. Kall Loper, Matthew R. McBride, Lee D. McFearin, Freeman L. Moore, Padmaraj M.V. Nair, Robert S. Oshana, John J. Pfister, Leonid Popokh, Sohail Rafiqi, Mohamed O. Rayes, Gheorghe Spiride, Stephen L. Stepoway, Raymond E. Van Dyke.

The Department of Computer Science and Engineering at SMU offers academic programs in computer engineering and computer science. Faculty specializations include computer architecture, data mining, knowledge engineering, software engineering, design and analysis of algorithms, parallel processing, database management, very large-scale integration computer-aided design methods, bioinformatics, computer networks, data and network security, mobile computing, theory of com-

operating systems extend this structural study into the “software” of the computer. A required sequence of software engineering courses prepares students for advanced systems and software applications.

Many of the computer science core courses (CSE 2341, 3345, 3353, 4345, 4351 and 4352) contain major project-oriented components to prepare students for applying their theoretical knowledge in teams.

The free electives in the B.A. in computer science program can also be used to individually tailor a student’s study plan. For example, students who want a program even more intensive than the computer science major could satisfy their free electives with more computer science courses. Students interested in a broader education could satisfy these electives with courses offered by any department in the University.

The B.S. degree allows students to major in any of five concentration tracks or to

Requirements for the Major (continued)	*Credit Hours*
CSE 5330, 5331 3 credit hours of track electives approved by adviser	
CSE 5314, 5319 3 credit hours of track electives approved by adviser	
CSE 4051 HGAM 5200, 5201, 5202, 5221, 5222, 5292, 5311, 5312 (Must be admitted to Guildhall Professional Certificate program and attend class at The Guildhall at SMU.)	
CSE 5339, 5349 3 credit hours of track electives approved by adviser	
Three 3-hour, 4000-level CSE courses approved by adviser	
Electives:	6
Advanced electives in the Lyle School of Engineering	
Engineering Leadership:	9
CEE 3302, CSE 4360, and EMIS 3308 *or* CSE 3517	
	100/103*

* *Students choosing the game development track do not take CSE 4351 and 4352 and have a total degree requirement of 103 hours.*

Curriculum Notes. In addition to the University-Wide Requirements, the term credit hours within this curriculum are distributed as follows:

Requirements for the Major	*Credit Hours*
Mathematics and Science:	56
MATH 1337, 1338, 3353 CSE 2353, 3365, 4340 (Students may fulfill the CSE 4340 requirement by taking any one of CSE/STAT 4340, EMIS 3340, *or* STAT 5340.) BIOL 1401, 1402, 3304, 3350 CHEM 1303/1113, 1304/1114, 3371/3117, 3372/3118 PHYS 1303/1105, 1304/1106	
Computer Science:	44
CSE 1341, 1342, 2240, 2341, 3330, 3381,3342, 3345, 3353, 4344, 4345, 4351, 4352, 4381, 5343	
Engineering Leadership: CEE 3302, CSE 4360	6
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Curriculum Notes. In addition to the University-Wide Requirements, the term credit hours within this curriculum are distributed as follows:

Requirements for the Major	*Credit Hours*
Mathematics and Science:	18
MATH 1337, 1338	
CSE 2353	
PHYS 1301 *or* 1303	
STAT 2331	

Requirements for the Major	*Credit Hours*
Mathematics and Science:	

data types. *Prerequisite:* C- or better in CSE 1341 or equivalent, a grade of at least a 4 on the AP Computer Science A Exam, or departmental consent.

CSE 2240 (2)
ASSEMBLY LANGUAGE PROGRAMMING AND MACHINE ORGANIZATION
Computer-related number systems, machine arithmetic, computer instruction set, low-level programming, addressing modes and internal data representation. *Pre or Corequisite:* A grade of C- or better in 1341.

CSE 2337 (3)
INTRODUCTION TO DATA MANAGEMENT
This course is designed to provide practical experience using a relational database system and spreadsheet system. The course emphasizes hands-on practical training in creation and access of relational databases as well as basic and intermediate data analysis using spreadsheet software. Integrating data from a spreadsheet and relational database into other document types is also covered. No credit for CS and CpE majors or minors.

CSE 2341 (3)
DATA STRUCTURES
Emphasizes the object-oriented implementation of data structures, including linked lists, stacks, queues, sets, and binary trees. The course covers object-oriented software engineering strategies and approaches to programming. *Prerequisite:* A grade of C- or better in CSE 1342 or equivalent.

CSE 2353 (3)
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. *Prerequisite:* C- or better in CSE 1341.

CSE 3330 (3)
DATABASE CONCEPTS

CSE 3365 / MATH 3315 (3)
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 MATLAB programming, algorithm implementations, and library codes. *Prerequisites:* A grade of C- or higher in MATH 1338. *Corequisite:* CSE 1340 or 1341; Students registering for this course must also register for an associated computer laboratory.

CSE 3381 (3)
DIGITAL LOGIC DESIGN
Boolean functions, logic gates, memory elements, synchronous and asynchronous circuits, shift registers and computers, and logic and control. *Prerequisites:* C- or better in CSE 2240, 2353. *Corequisite:* Weekly no-credit lab.

CSE 4051 (0)
GAMING DESIGN PROJECT
This course requires students enrolled in HGAM 5292 to produce appropriate reports and other design documentation material resulting from their HGAM 5292 design experience. Design requirements, specifications, test plans, and other relevant documentation as required for assessing the design experience are included in these materials. *Corequisite:* HGAM 5292.

CSE 4090 (0)
SENIOR PROJECT

CSE 4190 (1), 4191 (1), 4192 (1), 4193 (1), 4194 (1), 4290 (2)
UNDERGRADUATE PROJECT
An opportunity for the advanced undergraduate student to undertake independent investigation, design, or development. Written permission of the supervising faculty member is required before registration. At least 0.5 of (1–4) TCH Design.

CSE 4197 (1), 4297 (2)
RESEARCH EXPERIENCE FOR UNDERGRADUATES
This course provides research experience for

CSE 4351 (3)
SENIOR DESIGN I
First part of a project course, with a major design component. Students participate in a multidisciplinary group project team. Topical, project-related discussions include project team organization, project planning and scheduling, management, testing and validation methods, and the importance of lifelong learning. *Prerequisite:* CSE senior standing.

CSE 4352 (3)
SENIOR DESIGN II
Second part of a project course, with a major design component. Students participate in a multidisciplinary group project team. Topical, project-related discussions include project team organization, project planning and scheduling, management, testing and validation methods, and the importance of lifelong learning. *Prerequisite:* CSE 4351.

CSE 4360 (3)
TECHNICAL ENTREPRENEURSHIP
Demonstrates the concepts involved in the management and evolution of rapidly growing technical endeavors. Students are expected to participate in active learning by doing, making mistakes and developing solutions, and observing mistakes and approaches made by the other teams. *Prerequisite:* Junior standing or higher.

CSE 4381 (3)
DIGITAL COMPUTER DESIGN
Machine organization, instruction set architecture design, memory design, control design: hardwired control and microprogrammed control, algorithms for computer arithmetic, microprocessors, and pipelining. *Prerequisite:* A grade of C- or better in CSE 3381.

CSE 4386 (3)
HARDWARE DESIGN PROJECT
This is a project course, which has a major design component. Students participate in a multidisciplinary group project team. There will be topical discussions in relationship with the project, which include the hardware design and manufacturing process, hardware description languages, modular design principles, quantitative analysis, industrial standards and interfaces, and the importance of lifelong learning. The group project will provide the major design experience for students in the Hardware track of the Computer Engineering program. *Prerequisite:* A grade of C- or better in CSE 4381.

CSE 4391 (3), 4392 (3), 4393 (3), 4394 (3)
UNDERGRADUATE PROJECT

an emphasis on Internet, software, databases, and digital transmission technologies. The open source and creative commons alternatives for disseminating intellectual property are investigated. Examines the engineer's, scientist's, manager's, and creative artist's professional and ethical responsibilities and opportunities regarding intellectual property. Also, investigates the rapid change in types and uses of intellectual property spawned by computers, digital media, e-commerce, and biotechnology.

CSE 5190 (1), 5191 (1), 5192 (1), 5193 (1), 5194 (1)
SPECIAL TOPICS
Individual or group study of selected topics in computer science. *Prerequisite:* Permission of instructor.

CSE 5196 (1), 5296 (2)
SENIOR THESIS
Variable credit. This course is part of the departmental distinction program. *Prerequisite:* Admission to the departmental distinction program.

CSE 5290 (2), 5291 (2), 5292 (2), 5293 (2), 5294 (2)
SPECIAL TOPICS
Individual or group study of selected topics in computer science. *Prerequisite:* Permission of instructor.

CSE 5314 (3)
SOFTWARE TESTNG 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. *Prerequisite:* It is strongly recommended that students have software engineering experience in industry. C- or better in all previous CSE courses and senior standing.

CSE 5316 (3)
SOFTWARE REQUIREMENTS
This course focuses on defining and specifying software requirements that can be used as the basis for designing and testing software. Topics include use-case4s7.1(s)-6.9(e)-007 Tw[Tc2.8(IREM4.1(n)-18es

CSE 5342 (3)

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. *Prerequisite:* C- or better in CSE 3342 or permission of instructor.

CSE 5343 (3)

OPERATING SYSTEMS AND SYSTEMS SOFTWARE

Theoretical and practical aspects of operating systems: overview of system software, timesharing and multiprogramming operating systems, network operating systems and the Internet, virtual memory management, interprocess communication and synchronization, file organization, and case studies. *Prerequisites:* C- or better in CSE 2240, 3353.

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CSE 5382 (3)
COMPUTER GRAPHICS
Hardware and software components of computer graphics systems: display files, 2-D and 3-D transformations, clipping and windowing, perspective, hidden-line elimination and shaping, interactive graphics, and applications. *Prerequisite:* C- or better in CSE 3353.

CSE 5385/EE 5385 (3)
MICROCONTROLLER ARCHITECTURE AND INTERFACING
Emphasizes the design of microcontroller-based computer systems. Starts with the presentation of microcontroller architecture and continues with the design of computer systems with hierarchical memory, input-output peripherals, and industry-standard bus interfaces. Includes a required laboratory with design projects in which students learn to use state-of-the-art CAD tools and laboratory instruments for hardware design, simulation, implementation, and debugging. *Prerequisite(s):* CSE 3381 or both EE 3381, 3181.

CSE 5387/EE 5387 (3)
DIGITAL SYSTEMS DESIGN
Modern topics in digital systems design including the use of HDLs for circuit specification and automated synthesis tools for realization. Programmable logic devices are emphasized and used throughout the course. This course has heavy laboratory assignment content and a design project. *Prerequisite:* C- or better in CSE 3381 or C- or better in EE 2381.

CSE 5390 (3), 5391 (3), 5392 (3), 5393 (3), 5394 (3)
SPECIAL TOPICS
Individual or group study of selected topics in computer science. *Prerequisite:* Permission of instructor.

CSE 5396 (3)
SENIOR THESIS
Variable credit. This course is part of the departmental distinction program. *Prerequisite:* Admission to the departmental distinction program.

Electrical Engineering

Professors: Jerome K. Butler, Marc P. Christensen, Scott C. Douglas, Delores M. Etter, Gary A. Evans, W. Milton Gosney, Alireza Khotanzad, Sukumaran V.S. Nair (Computer Science and

The mission of the department is as follows:

Through quality instruction and scholarly research, to engage each student in a challenging electrical engineering education that prepares graduates for the full range of career opportunities in the high-technology marketplace and enables them to reach their fullest potential as a professional and as a member of society.

Departmental goals include the following:

- Becoming one of the nation's leading electrical engineering departments by building peaks of excellence in the fields of communications/signal processing and micro/optoelectronics and by being a leader in innovative educational programs.
- Offering undergraduate curricula that equips graduates for careers that require ingenuity, integrity, logical thinking, and the ability to work and communicate in teams, and for the pursuit of graduate degrees in engineering or other fields such as business, medicine and law.
- Offering world-class Ph.D. programs that prepare graduates for academic careers, for research careers in the high-technology industry or for technical entrepreneurship.
- Promoting lifelong learning animated by a passion for the never-ending advance of technology.

The educational objectives of the Electrical Engineering Department undergraduate program are to enable graduates to do the following:

- Be successful in understanding, formulating, analyzing and solving a variety of electrical engineering problems.
- Be successful in designing a variety of engineering systems, products or experiments.
- Be successful in careers and/or graduate study in engineering or other areas such as business, medicine and law.
- Have the ability to assume leadership and entrepreneurial positions.
- Successfully function and effectively communicate, both individually and in multidisciplinary teams.
- Understand the importance of lifelong learning, ethics and professional accountability.

The Electrical Engineering Department undergraduate student outcomes as related to the above educational objectives are as follows:

All graduates of the electrical engineering program are expected to have the following:

i) A recognition of the need for, and an ability to engage in, lifelong learning.
j) A knowledge of contemporary issues.
k) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

The Electrical Engineering Department is engaged in an ongoing assessment process that evaluates the success in meeting the educational objectives and outcomes and enhances the development of the program.

The undergraduate program in electrical engineering is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.oerwww, UNIX mail, Exchange mail, firewall, UNIX authentication, NT authentication, printer management, lab image download, classroom-specific software, X windows service, news, domain name service, computational resources and general use. This primary file server allows a user's files to be used as a resource in both the UNIX and Microsoft PC environments. Almost all computing equipment within the Lyle School be used in these activities to develop data sets for use in classroom experiments and laboratory projects for students to complete.

Wireless Systems Laboratory. The laboratory provides a multi-tier wireless network test bed that consists of multiple modes and frequency bands for research and fibers with a circularly symmetric index of refraction profiles). Additional software is under development to model the modulation characteristics of photonic devices.

Photonic Architectures Laboratory. This laboratory is a fully equipped opto-mechanical and electrical prototyping facility, supporting the activities of faculty and graduate students in experimental and analytical tasks. The lab is ideally suited for the packaging, integration and testing of devices, modules and prototypes of optical systems. It has three large vibration isolated tables, a variety of visible and infrared lasers, single element 1-D and 2-D detector arrays, and a large complement of optical and opto-mechanical components and mounting devices. In addition, the laboratory has extensive data acquisition and analysis equipment, including an IEEE 1394 Fire-Wire-capable image capture and processing workstation, specifically designed to evaluate the electrical and optical characteristics of smart pixel devices and FSOI fiber-optic modules. Support electronics hardware includes various test instrumentation, such as arbitrary waveform generators and a variety of CAD tools for optical and electronic design, including optical ray trace and finite difference time domain software.

The Departmental Distinction program offers students the opportunity to engage in an advanced undergraduate research experience project with a member of the department faculty. Electrical engineering students can opt to pursue this program during their junior and senior years. A request to participate in the program must be submitted to the departmental undergraduate adviser during the junior year. The program is designed and intended for students with superior academic records. To earn departmental distinction with a major from the Department of Electrical Engineering, a student must fulfill the school requirements. Upon successful completion and approval by the department chair, the appropriate B.S. degree will be awarded with departmental distinction.

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

Due to the extensive latitude in course selection and to the wide variety of courses

Curriculum Notes. In addition to the University-Wide Requirements, the term credit hours within the electrical engineering curriculum are distributed as follows:

Requirements for the Major	*Credit Hours*
Mathematics and Science:	28
MATH 1337, 1338, 2339, 2343	
One of MATH 3308, 3315, 3337, 3353; CSE 3365	
CHEM 1303	
PHYS 1303, 1304; 1105 *or* 1106	
One elective from PHYS 3305, 3344, 3374; CHEM 1304	
Economics:	3
ECO 1311	
Computer Science:	6
CSE 1341, 1342	
Engineering Leadership:	3
One of EMIS 3308, 3309; CEE 3302; CSE 4360	
Engineering Elective:	3
One of ME 2310, 2320, 2331, 2342; CSE 2341, 2353; *or* any 5000-level EE course approved by adviser	
Core Electrical Engineering:	24
EE 1322, 1382, 2322/2122, 2350, 2370/2170, 2381/2181, 3360	
Junior Electrical Engineering Courses:	17
EE 3322/3122, 3381/3181, 3311, 3330, 3372	
Advanced Electrical Engineering Electives:	

Curriculum Notes. In addition to the University-Wide Requirements, the term credit hours within this curriculum are distributed as follows:

Requirements for the Specialization	*Credit Hours*
Mathematics and Science:	53
MATH 1337, 1338, 2339, 2343	
3-hour elective MATH course at the 3000 level or above	
BIOL 1401, 1402, 3304, 3350	
CHEM 1303/1113, 1304/1114, 3371/3117, 3372/3118	
PHYS 1303/1105, 1304/1106	

Requirements for the Specialization (continued)	*Credit Hours*
Computer Science:	15
CSE 1341, 1342, 2341, 2353, 3353	
Core Electrical Engineering:	24
EE 1322, 1382, 2322/2122, 2350, 2370/2170, 2381/2181, 3360	
Junior Electrical Engineering Courses:	17
EE 3311, 3322/3122, 3330, 3372, 3381/3181	
Advanced Electives:	12
EE 5381, 5385 and two of EE 5357, 5387 *or* CSE 5343	
Senior Design Sequence: EE 4311, 4312	6
	105

This specialization prepares graduates to be highly educated engineers with the appropriate interdisciplinary knowledge to assume important management and leadership positions and to become technical entrepreneurs in a globally competitive world.

Curriculum Notes. In addition to the University-Wide Requirements, the term credit hours within this curriculum are distributed as follows:

Requirements for the Specialization	*Credit Hours*
Mathematics and Science:	28
MATH 1337, 1338, 2339, 2343	
3-hour elective MATH course at the 3000 or above level	
CHEM 1303	
PHYS 1303, 1304; 1105 *or* 1106	
One elective from CHEM 1304; PHYS 3305, 3344, 3374	
Economics:	3
ECO 1311	
Computer Science:	6
CSE 1341, 1342	
Engineering Leadership:	9
Three of CEE 3302; EMIS 3308, 3309; CSE 4360	
Engineering Elective:	3
One of ME 2310, 2320, 2331, 2342; CSE 2341, 2353; *or* any EE 5000-level course approved by adviser	
Core Electrical Engineering:	24
EE 1322, 1382, 2322/2122, 2350, 2370/2170, 2381/2181, 3360	
Junior Electrical Engineering Courses:	17
EE 3311, 3322/3122, 3330, 3372, 3381/3181	
Advanced EE Electives: (approved by adviser)	
One of EE 5360, 5362, 5370, 5371, 5372, 5373, 5374, 5375, 5376, 5377, 5378	
One of EE 5356, 5357, 5381, 5385, 5387	

The electrical engineering curriculum is administered by the Department of Electrical Engineering.

Curriculum Notes. In addition to the University-Wide Requirements, the term credit hours within this curriculum are distributed as follows:

Requirements for the Specialization	*Credit Hours*
Mathematics and Science:	28
MATH 1337, 1338, 2339, 2343	
One of MATH 3315, 3337, 3353; CSE 3365	
CHEM 1303	
PHYS 1303, 1304; 1105 *or* 1106	
One elective from PHYS 3305, 3344, 3374; CHEM 1304	
Economics:	3
ECO 1311	
Computer Science:	12
CSE 1341, 1342, 2341, 2353	
Core Electrical Engineering:	24
EE 1322, 1382, 2322/2122, 2350, 2370/2170, 2381/2181, 3360	
Junior Electrical Engineering Courses:	17
EE 3322/3122, 3381/3181, 3311, 3330, 3372	
Advanced Electrical Engineering Electives:	

Requirements for the Major (continued)	*Credit Hours*
Junior Electrical Engineering Courses:	17
EE 3311, 3322/3122, 3330, 3372, 3381/3181	
Advanced Electives:	15
One of EE 5360, 5362, 5370, 5371, 5372, 5373, 5374, 5375, 5376, 5377, 5378	
One of EE 5356, 5357, 5381, 5385, 5387	
One of EE 5310, 5312, 5314, 5321, 5330, 5332, 5333	
6 hours from any EE or CSE 5000-level course approved by adviser	
Senior Design Sequence: EE 4311, 4312	6
	105

The Electrical Engineering Department and the Physics Department offer an integrated curriculum that enables a student to obtain both a B.S.E.E. degree and a B.S. degree with a major in physics.

Curriculum Notes. In addition to the University-Wide Requirements, the term credit hours within this curriculum are distributed as follows:

Requirements for the Major	*Credit Hours*
Mathematics and Science:	51
MATH 1337, 1338, 2339, 2343, 3315	
CHEM 1303	
PHYS 1303/1105, 1304, 3305, 3344, 3374, 4211, 4321, 5337, 5382, 5383	
Economics:	3
ECO 1311	

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The third digit in a course number designator represents the subject area of the course. The following designators are used:

- **XX1X** Electronic Materials
- **XX2X** Electronic Devices
- **XX3X** Quantum Electronics and Electromagnetic Theory
- **XX4X** Biomedical Science
- **XX5X** Network Theory and Circuits
- **XX6X** Systems
- **XX7X** Information Science and Communication Theory
- **XX8X** Computers and Digital Systems
- **XX9X** Individual Instruction, Research, Seminar and Special Project
- **EETS XX0X** Telecommunications

EE 1301 (3)
MODERN ELECTRONIC TECHNOLOGY
A lecture and laboratory course examining a number of topics of general interest including the fundamentals of electricity, household electricity and electrical safety, an overview of microelectronics, concepts of frequency and spectrum, the phonograph and the compact disc, bar codes, and communication by radio and television. The course is designed for nontechnical students

EE 2322 (3)
ELECTRONIC CIRCUITS I
An introduction to nonlinear devices used in electronic circuits. The course will cover the DC and AC analysis of circuits employing diodes, bipolar junction transistors (BJTs) and MOSFETs. Topics include device I–V characteristics, biasing, transfer characteristic, gain, power dissipation and the design of amplifier circuits and logic circuits. SPICE simulation will also be introduced in this course for DC and transient simulations. *Prerequisite:* EE 2350 (Grade of C- or better). Concurrent registration in EE 2122.

EE 2350 (3)
CIRCUIT ANALYSIS I
Analysis of resistive electrical circuits, basic theorems governing electrical circuits, power consideration, analysis of circuits with energy storage elements. Transient and sinusoidal steady-state analysis of circuits with inductors and capacitors. *Corequisite:* MATH 2343 and PHYS 1304.

EE 2370 (3)
DESIGN AND ANALYSIS OF SIGNALS AND SYSTEMS
This course introduces students to standard mathematical tools for analyzing and designing various continuous-time signals and systems. Frequency domain design and analysis techniques are studied as well as the Fourier and Laplace Transforms. Applications to be studied include modulation and demodulation in communications and processing of audio signals. *Prerequisite:*

EE 3330 (3)

credit. Students register for the course in the same manner as other SMU courses except that no tuition is charged. The course grade is determined by the grading of a written report by the student's advisor at the end of the term.

EE 5176 (1)
NETWORK SIMULATION LABORATORY
This is an introductory hands-on course in simulations of computer networks, intended to be taken simultaneously with EE 5376 or other networks courses. Lab exercises use OPNET and other simulation software to visualize network protocols and performance. Students run a number of simulation exercises to set up various network models, specify protocols, and collect statistics on network performance. These exercises will be designed to complement classroom instruction. General familiarity with PCs is recommended. *Corequisite:* EE 5376 and Senior Standing.

EE 5190 (1), 5290 (2)
SPECIAL TOPICS
This special-topics course must have a section number associated with a faculty member. The second digit corresponds to the number of TCH, which ranges from 1 to 3. The last digit ranges from 0 to 9 and represents courses with different topics.

EE 5310 (3)
INTRODUCTION TO SEMICONDUCTORS
The basic principles in physics and chemistry of semiconductors that have direct applications on device operation and fabrication are studied. Topics include basic semiconductor properties, elements of quantum mechanics, energy band theory, equilibrium carrier statistics, carrier transport, and generation-recombination processes. These physical principles are applied to semiconductor devices. Devices studied include metal-semiconductor junctions, p-n junctions, LEDs, semiconductor lasers, bipolar junction transistor, field-effect transistors, and integrated circuits. The emphasis will be on obtaining the governing equations of device operation based on physical properties. *Prerequisite:* EE 3311.

EE 5312 (3)
COMPOUND SEMICONDUCTOR DEVICES AND PROCESSING
This is a laboratory-oriented elective course for upper-level undergraduates and graduate

EE 5321 (3)
SEMICONDUCTOR DEVICES AND CIRCUITS
A study of the basics of CMOS integrated analog circuits design. Topics include MOSFET transistor characteristics, DC biasing, small-signal models, different amplifiers, current mirrors, single- and multi-stage electronic amplifiers, frequency response of electronic amplifiers, amplifiers with negative feedback and stability of amplifiers. Each student will complete one or more design projects by the end of the course. *Prerequisites:* EE 3122 and EE 3322.

EE 5330 (3)
ELECTROMAGNETICS: GUIDED WAVES
Application of Maxwell's equations to guided waves. Transmission lines, and plane wave propagation and reflection. Hollow waveguides and dielectric waveguides. Fiber optics. Cavity and dielectric resonators. *Prerequisite:* EE 3330.

EE 5332 (3)
ELECTROMAGNETICS: RADIATION AND ANTENNAS
Polarization, reflection, refraction, and diffraction of EM waves. Dipole, loop, and slot/reflector antennas. Array analysis and synthesis. Self and mutual impedance. Radiation resistance. *Prerequisite:* EE 3330.

EE 5333 (3)
ANTENNAS AND RADIOWAVE PROPAGATION FOR PERSONAL COMMUNICATION
Prerequisite: EE 3330.

EE 5336 (3)
INTRODUCTION TO INTEGRATED PHOTONICS
This course is directed at the issues of integrated photonics. Four major areas are covered: 1) fundamental principles of electromagnetic theory; 2) waveguides; 3) simulation of waveguide modes, and 4) photonic structures. The emphasis is slightly heavier into optical waveguides and numerical simulation techniques because advances in optical communications will be based on nanostructure waveguides coupled with new materials. Topics include: Maxwell's equations; slab, step index, rectangular and graded index wave guides; dispersion; attenuations; nonlinear effects; numerical methods; and coupled mode theory. Mathematical packages such as MATLAB and/or Mathematica will be used extensively in this class. *Prerequisites:* EE 3311 (Grade of C- or better) and EE 3330 (Grade of C- or better) or permission of instructor.

EE 5340 (3)
BIOMEDICAL INSTRUMENTATION
Application of engineering principles to solving problems encountered in biomedical research. Topics include transducer principles, electrophysiology, and cardiopulmonary measurement systems. *Prerequisite:* C- or better in EE 2322 and EE 2122. Junior Standing.

EE 5345 (3)
MEDICAL SIGNAL ANALYSIS
This course looks at the analysis of discrete-time medical signals and images. Topics include the design and of discrete-time filters, medical imaging and tomography, signal and image compression and spectrum estimation. The course project explores thEEapplication of (r)0(es th)-3.7T

EE 5356/CSE 5356 (3)
VLSI DESIGN AND LABORATORY
Explores the design aspects involved in the realization of CMOS integrated circuits from device up to the register/subsystem level. Addresses major design me(r)]TJ14.304 0 TD-.0117 Tc-.0615 Tw[odolog)
ll-custom design. Also, the MOS device, CMOS inverter static characteristics,
dynamic characteristics, CMOS transistor fabrication te2Gnology, combination
ernative static logic circuit, sequenhtial logic circuit, dynamic logic circuit,
ay and interconnect, power dissipation and design for low power, memory

description language will be discussed and used for behavioral and structural hardware modeling. Structured modeling and design will be emphasized. Design case studies include a pipelined processor, cache memory, UART, and a floppy disk controller. *Prerequisites:* C- or better in EE 2381, Junior Standing, or permission of instructor.

EE 5360 (3)
ANALOG AND DIGITAL CONTROL SYSTEMS
Feedback control of linear continuous and digital systems in the time and frequency domain. Topics include plant representation, frequency response, stability, root locus, linear state variable feedback, and design of compensators. *Prerequisite:* EE 3372.

EE 5370 (3)
COMMUNICATION AND INFOMATION SYSTEMS
An introduction to communication in modulation systems in discrete and continuous time, information content of signals, and the transition of signals in the presence of noise. Amplitude, frequency, phase and pulse modulation. Time and frequency division multiplexing. *Prerequisite:* EE 3360.

EE 5371 (3)
ANALOG AND DIGITAL FILTER DESIGN
Approximation and analog design of Butterworth, Chebyshey, and Bessel filters. Basic frequency transformations for designing low-pass, band-pass, band-reject, and high-pass filters. Concept of IIR digital filters using impulse-invariant and bilinear transformations. Design of FIR digital filters using frequency sampling and window methods. Canonical realization of IIR and FIR digital filters Wave digital filters. Introduction to two-dimensional filters. *Prerequisite:* EE 3372.

EE 5372 (3)
TOPICS IN DIGITAL SIGNAL PROCESSING
This course is intended to provide an extended coverage of processing of discrete-time signals. Discrete-time signals and the analysis of systems in both the time and frequency domains are reviewed. Other topics covered will include multi-rate signal processing, digital filter structures, filter design and power spectral estimation. *Prerequisite:* EE 3372.

EE 5373 (3)
DIGITAL SIGNAL PROCESSORS PROGRAMMING LABORATORY
Digital signal processors (DSPs) are programmable semiconductor devices used extensively in digital cellular phones, high-density disk drives, and high-speed modems. This laboratory course focuses on programming the Texas Instruments TMS320C50, a fixed-point processor. The emphasis is on assembly language programming, and the laboratories utilize a hands-on approach that will focus on the essentials of DSP programming while minimizing signal

Ethernet, Internet protocol (IP), TCP, and ATM. Assignments may include lab exercises involving computer simulations. *Corequisite:* EE 5176 and Senior Standing.

EE 5377 (3)

EMBEDDED WIRELESS DESIGN LABORATORY

A wide variety of real-world experiences in wireless communications and networking using FPGAs equipped with embedded microprocessors. Covers basic wireless concepts of scheduled

advanced analytics, telecommunications network design and management, supply-chain systems, systems engineering, logistics, quality control, reliability engineering, data science, information engineering, benchmarking, operations planning and management, network optimization, and mathematical programming.

The same systems-oriented, mathematical-model-based approach that is the cornerstone of engineering also has powerful application within organizations and their operations. This is the field of management science – also termed “the science of better” – the discipline of applying advanced analytical methods to help make better decisions.

Management science deals with the development of mathematically based models for planning, managing, operating and decision-making. In the EMIS curriculum, these methods are also applied to the design and management of efficient systems for producing goods and delivering services.

A management scientist at a major airline would be concerned with building mathematical models to decide the best flight schedules, plane routes, and assignments of pilots and crews to specific flights and of flights to specific gates, as well as the best number of planes to own and operate, cities to fly to, cities to use as major hubs, layout for an airport terminal, overbooking policy, and location to refuel aircraft. Optimal and good usable solutions for such issues can be uncovered through analysis with computer-based mathematical models. The management scientist develops an understanding of a practical decision problem, then designs and con-sytic Manopespwueo77ictignstice antiod4..4(aa)5.5(r fan)8.s ah.002 ntigveS-1.3(op(d)6(e

Requirements for the Major (continued)	*Credit Hours*
BIOL 1303, 1304, 1305, 1308, 1310, 1401, 1402	
CEE 1331	
CHEM 1303/1113, 1304/1114	
GEOL 1301, 1305, 1307, 1308, 1313, 1315, 2320	
PHYS 1303/1105, 1304/1106, 1307/1105, 1308/1106, 1320	
ANTH 2315, 2363	
CEE 1301, 1378	
CSE 1331	
EE 1301, 1382	
ME 1301, 1202/1102, 1303	
PHYS 1403, 1404	
Other courses in ANTH, ECO, PSYC, or SOCI	
Major Concentration:	42
EMIS 1360, 2360, 3308, 3309, 3340, 3360, 3361, 4395, 5362	
CEE 33052 0 0 8.52 36.9 353.16 T39.66 refBT8.52 0 0 8.64vpu1102, 1303	

More information on these and other options available to management science majors can be found on the EMIS Department's website: www.smu.edu/Lyle/Departments/EMIS. EMIS faculty and advisers are also available to answer questions about the program.

Students in the EMIS Department have access to a wide range of computing facilities and networking equipment. The department manages three PC-based computing labs, including the Enterprise Systems Design Laboratory created for students in the

EMIS 3308 (3)
ENGINEERING MANAGEMENT
This course examines planning, financial analysis, organizational structures, management of the corporation (including its products, services, and people), transfer of ideas to the marketplace, and leadership skills. Credit is not allowed for both EMIS 3308 and the same course offered by another department; credit is not allowed for both EMIS 3308 and EMIS 5351. *Prerequisite:* Junior standing.

EMIS 3309 (3)
INFORMATION ENGINEERING AND GLOBAL PERSPECTIVES
This course examines global and information aspects of technology-and information-based companies. Credit is not allowed for both EMIS 5309 and the same course offered by another department. *Prerequisite:* Junior standing.

EMIS 3340/CSE 4340/STAT 4340 (3)
STATISTICAL METHODS FOR ENGINEERING 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. Credit is not allowed for both EMIS 3340/STAT/CSE 4340 and EMIS 5370. *Prerequisite:* C- or better in MATH 1338.

EMIS 3360 (3)
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 EMIS 3360 and EMIS 8360. *Prerequisites:* EMIS 1360. (Must enroll in lab.)

EMIS 3361 (3)
STOCHASTIC MODELS IN OPERATIONS RESEARCH
This course covers the formulation, solution, and application of models for decision- making under uncertainty. Probabilistic and statistical methodologies – including decision analysis, queuing theory, stochastic process, Markov chains, and simulation models – address problems in the design, management, and usage of efficient systems for producing goods and delivering services. Specialized software and spreadsheet add-ins will be used for model-building and problem-solving. There is a weekly one-hour laboratory. *Prerequisite:* EMIS 3340.

EMIS 3375/CFB 3345 (3)
CULTURAL AND ETHICAL IMPLICATIONS OF TECHNOLOGY
This course explores the pervasive use of technology in today's society, the impact of technology on daily life, and the tie between technology and ethical responsibility. Students learn how their lives are being shaped by technology and how they in turn help shape technology.

EMIS 4390 (3)
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.

EMIS 4395 (3)
SENIOR DESIGN

operational system performance. Specific topics include probabilistic and statistical methods, Monte Carlo Simulation, optimization techniques, applications of utility and game theory and decision analysis.

EMIS 5301 (3)
SYSTMS ENGINEERNG PROCESS
The discipline, theory, economics, and methodology of systems engineering is examined. The historical evolution of the practice of systems engineering is reviewed, as are the principles that underpin modern systems methods. The economic benefits of investment in systems engineering and the risks of failure to adhere to sound principles are emphasized. An overview perspective distinct from the traditional design- and analytical-specific disciplines is developed.

EMIS 5303 (3)
INTEGRATED RISK MANAGEMNT
An introduction to risk management based upon integrated trade studies of program performance, cost, and schedule requirements. Topics include risk planning, risk identification and assessment, risk handling and abatement techniques, risk impact analysis, management of risk handling and abatement, and subcontractor risk management. Integrated risk management methods, procedures, and tools will be examined.

EMIS 5305 (3)
SYSTEMS RELIABILITY, SUPPORTABILITY AND AVAILABILITY ANALYSIS
This course is an introduction to systems reliability, maintainability, supportability and availability (RMS/A) modeling and analysis with an application to systems requirements definition and systems design and development. Both deterministic and stochastic models are covered. Emphasis is placed on RMS/A analyses to establish a baseline for systems performance and to provide a quantitative basis for systems trade-offs. *Prerequisite:* EMIS 5300.

EMIS 5307 (3)
SYSTEMS INTEGRATION/TEST
The process of successively synthesizing and validating larger and larger segments of a partitioned system within a controlled and instrumented framework is examined. System integration and test is the structured process of building a complete system from its individual elements and is the final step in the development of a fully functional system. The significance of structuring and controlling integration and test activities is stressed. Formal methodologies for describing and measuring test coverage, as well as sufficiency and logical closure for test completeness, are presented. Interactions with system modeling techniques and risk management techniques are discussed. The subject material is based upon principles of specific engineering disciplines and best practices, which form a comprehensive basis for organizing, analyzing, and conducting integration and test activities.

EMIS 5310 (3)
SYSTEMS ENGINEERING DESIGN
This course is an introduction to system design of complex hardware and software systems. Specific topics include design concept, design characterization, design elements, reviews, verification and validation, threads and incremental design, unknowns, performance, management of design, design metrics, and teams. The class will center on the development of real-world examples.

EMIS 5315 (3)
SYSTEMS ARCHITECTURE DEVELOPMENT
A design-based methodological approach to system architecture development using emerging and current enterprise architecture frameworks. Topics: structured analysis and object-oriented analysis and design approaches are covered; enterprise architecture frameworks, including the

process design, and leadership integrate into an effective leadership system. *Prerequisite:* EMIS 5301.

EMIS 5330 (3)
SYSTEMS RELIABILITY ENGINEERING
An in-depth coverage of tasks, processes, methods and techniques for achieving and maintaining the required level of system reliability considering operational performance, Customer satisfaction and affordability. Specific topics include: Establishing System Reliability requirements, reliability program planning, system reliability modeling and analysis, system reliability design guidelines and analysis, system reliability test and evaluation, and maintaining inherent system reliability during production and operation.

EMIS 5335 (3)
HUMAN-SYSTEMS INTEGRATION (HSI)
This course advances the understanding and application of cognitive-science principles, analysis-of-alternatives methods and engineering best practices for addressing the role of humans within the design of high-technology systems. In addition, HSI-specific processes (e.g.,

The Mechanical Engineering Department at SMU has a long tradition of offering a superb engineering education within an environment fostering creativity and innovation. Small classes, a trademark of the program, not only provide for strong mentoring but also help achieve academic excellence through cooperation and team-

3. Will have entrepreneurial and leadership roles in industry, government and academia.

The Mechanical Engineering Undergraduate Program Outcomes and their relationships to the discipline-specific criteria are as follows:

Laboratory for Porous Materials Applications. This laboratory is concerned with modeling; numerical simulation; and experimental testing of mass, energy and momentum transport in heterogeneous and porous media.

Nano-Scale Electro-Thermal Sciences Laboratory. This facility focuses on non-invasive characterization of the thermal properties of thin-film materials.

Laser Micromachining Laboratory. This laboratory conducts studies of laser-assisted microfabrication, including high-power laser ablation and laser micro-machining.

Experimental Fluid Mechanics Laboratory. This facility focuses on pulsed jet micropropulsion and flow-through porous media.

Micro, Nano, and Biomechanics of Materials Laboratory. This laboratory supports research primarily in the area of solid mechanics and materials engineering, with a focus on the combined experimental characterization as well as the computational analysis of mechanical properties, stress/strain, and microstructure of engineering and biological materials. Applications in advancing manufacturing and materials processing technologies, engineering design analyses, and biomedical sciences and engineering are also studied in this facility.

Systems, Measurement, and Control Laboratory. This facility is equipped for instruction in the design and analysis of analog and digital instrumentation and control systems. Modern measurement and instrumentation equipment is used for experimental control engineering, system identification, harmonic analysis, simulation and real-time control applications. Equipment also exists or microprocessor interfacing for control and instrumentation.

Micro-Sensor Laboratory. This laboratory focuses on research in the development of micro-optical sensors for a wide range of aerospace and mechanical engineering applications, including temperature, pressure, force, acceleration and concentration. A major research component in this lab is concentrated on the study of the optical phenomenon called the “whispering gallery modes” and its exploitation for sensor development in the micro-size level with a nano-level measurement sensitivity.

Systems Laboratory. This facility is dedicated to analysis and modeling of bipedal gait dynamics, rigid body impact mechanics and the pneumatically operated haptic interface system.

Research Center for Advanced Manufacturing.

Research focuses on small-scale materials (nanomaterials) to improve energy conversion efficiency in those systems based on atomic-scale and continuum approaches.

Biomedical Instrumentation and Robotics Laboratory. This laboratory's research activities promote strong interdisciplinary collaboration between several branches of engineering and biomedical sciences. The research interests are centered on two areas:

- Medical robotics, especially novel robotic applications in minimally invasive, natural orifice, and image-guided and haptic-assisted surgery.
- In vivo measurement of mechanical properties of biological tissue.

These areas of concentration touch upon fundamentals in analytical dynamics, nonlinear control of mechanical systems, computer-aided design and virtual prototyping, applied mathematics, data acquisition, signal processing, and highsition. A partial list of the equipment in this lab includes a refrigeration training unit, heat transfer test unit with water boiler, airflow bench, kinematic viscosity bath, forced convection heat transfer experiment bench, low-pressure board, dead weight tester, vortex tube, free and forced heat transfer unit, hydraulic trainer and pneumatic trainer.

Laboratories shared with the Civil and Environmental Engineering Department include the following:

Hydraulics/Hydrology, Thermal and Fluids Laboratory
CAD Computer Laboratory
Structural and Mechanics of Materials Laboratory
Project construction area
Engineering Design Studio

Mechanical engineering offers the broadest curriculum in engineering to reflect the wide range of mechanical engineering job opportunities in government and industry. The mechanical engineer is concerned with creation, research, design, analysis, production and marketing of devices for providing and using energy and materials.

viscosity, thermal conductivity, electrical conductivity and many others. The study of materials proceeds from the characteristics of individual atoms of a material, through the cooperative behavior of small groups of atoms, up to the behavior and properties of the bulk material. Because all mechanical equipment is composed of materials, works in a material environment and is controlled by other material devices, it is clear that the materials sciences lie at the heart of the design synthesis process.

Control Systems. Provides necessary background for engineers in the dynamics of systems. In the study of controls, both the transient and steady-state behavior of the system are of interest. The transient behavior is particularly important in the starting and stopping of propulsion systems and in maneuvering flight, whereas the steady-state behavior describes the normal operating state. Some familiar examples of control systems include the flight controls of an airplane or space vehicle and the thermostat on a heating or cooling system.

Design Synthesis. The process by which practical engineering solutions are created to satisfy a need of society in an efficient, economical and practical way. This synthesis process is the culmination of the study of mechanical engineering and deals with all elements of science, mathematics and engineering.

Curriculum Notes. In addition to the University-Wide Requirements, the term credit hours within the mechanical engineering curriculum are distributed as follows:

Requirements for the Major	*Credit Hours*
Mathematics and Science:	31
MATH 1337, 1338, 2339, 2343, 3353	
STAT 4340 *or* equivalent	
CHEM 1303	
PHYS 1303/1105, 1304	
One from the following:	
BIOL 1401, 1402	
CHEM 1304	
GEOL 1301, 1305, 1307, 1308, 1313	
PHYS 3305, 3340, 4321	
3000-level *or* higher math course approved by adviser	
Engineering:	56
ME 1202/1102, 1305, 2310, 2320, 2331/2131, 2340/2140, 2342/2142, 3332/3132, 3340, 3370, 4338, 4360/4160 4370, 4380, 4381, 5322; EE 2350	
Advanced Major Electives:	12
3000-level or higher ME courses approved by adviser	
Engineering Leadership:	3
One from EMIS 3308, 3309; CEE 3302; CSE 4360	
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Any deviation from the mechanical engineering curriculum requires approval of a petition submitted by the student to the Mechanical Engineering faculty prior to the beginning of the term during which the student expects to complete the requirements for graduation.

The Mechanical Engineering Department and the Mathematics Department offer a curriculum that enables a student to obtain both a B.S.M.E. degree and B.S. with a major in mathematics.

Curriculum Notes. In addition to the University-Wide Requirements, the term credit hours within this curriculum are distributed as follows:

Requirements for the Major	*Credit Hours*
Mathematics and Science:	40
MATH 1337, 1338, 2339, 2343, 3315, 3337, 3353	
STAT 4340 *or* equivalent	
One advanced elective as defined in the description of the mathematics major	
CHEM 1303	
PHYS 1303/1105, 1304	
Engineering:	53
ME 1202/1102, 2310, 2320, 2331/2131, 2340/2140, 2342/2142, 3332/3132, 3340, 3370, 4338, 4360/4160, 4370, 4380, 4381, 5322; CSE 1341; EE 2350	dT

beginning of the term during which the student expects to complete the requirements for graduation.

Curriculum Notes. In addition to the University-Wide Requirements, the term credit hours within this curriculum are distributed as follows:

Requirements for the Minor	*Credit Hours*

The Mechanical Engineering Department offers a B.S.M.E. degree with a premedical/biomedical specialization. This program enables students to satisfy the premedical or predental requirements for admission to medical or dental school, while at the same time satisfying the requirements for an accredited degree in mechanical engineering.

Curriculum Notes. In addition to the University-Wide Requirements, the term credit hours within this curriculum are distributed as follows:

Requirements for the Specialization	*Credit Hours*
Mathematics and Science:	56
MATH 1337, 1338, 2339, 2343, 3353	
STAT 4340 *or* equivalent	
BIOL 1401, 1402, 3304, 3350	
CHEM 1303/1113, 1304/1114, 3371/3117, 3372/3118	

Requirements for the Specialization (continued)	*Credit Hours*
One from the following:	
BIOL 1401, 1402	
CHEM 1304	
GEOL 1301, 1305, 1307, 1308, 1313	
PHYS 3305, 3340, 4321	
3000-level or higher math course approved by adviser	
Engineering:	56
ME 1202/1102, 1305, 2310, 2320, 2331/2131, 2340/2140, 2342/2142, 3332/3132, 3340, 3370, 4338, 4360/4160, 4370, 4380, 4381, 5322; EE 2350	
Specialization:	12
CEE 3302	
CSE 4360	
EMIS 3308, 3309	
Advanced Major Electives:	6
3000-level or higher ME courses approved by adviser	
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Any deviation from the mechanical engineering curriculum requires approval of a petition submitted by the student to the Mechanical Engineering faculty prior to the beginning of the term during which the student expects to complete the requirements for graduation.

For approval of a minor in mechanical engineering, the student should consult the department. A total of 15 term hours in mechanical engineering courses are required: **ME 1202/1102, 2310, 2320, 2331, 2340, 2342, 3340, 3370**. A choice of five of these courses represents a minor that provides a broad introduction to mechanical engineering. Based on the student's interests and background, other sets of mechanical engineering courses may be substituted with the department's approval.

ME 1102 (1)
INTRODUCTION TO ENGINEERING LABORATORY
Companion laboratory to ME 1202; introduction to machine shop operations; mechanical measurement; basic research skills; the design process including group projects. *Corequisite:* ME 1202.

ME 1202 (2)
INTRODUCTION TO ENGINEERING
Introduction to mechanical engineering and the engineering profession; the design process; sketching; forces in structures and fluids; conservation laws and thermal systems; motion of machinery. *Corequisite:* ME 1102.

ME 1301 (3)

ME 1303 (3)
ENERGY, TECHNOLOGY, AND THE ENVIRONMENT
An elementary introduction to how energy is produced and distributed, energy resources, electrical power, heating and cooling, solar energy applications, and other topics related to people and the environment.

ME 1304 (3)
GREEN ENGINEERING: DESIGNING TOMORROW TODAY
Presents how design choices for materials, manufacturing processes, energy usage, and end-of-life disposal affect economic and natural environments. Also, case studies in design for the environment for various industries. In lab, students use computer modeling to create designs and then analyze and compare the designs' total lifecycle impact through eco-audits of energy and carbon footprints. Students also use software to compare and select materials best suited for a particular design and its constraints.

ME 1305 (3)
INFORMATION TECHNOLOGY AND SOCIETY

systems and casting their responses in prescribed forms. Topics covered include state representation of linear systems, controllability, observability, and minimal representation, linear state variable feedback, observers, and quadratic regulator theory. 1 TCH Design.

ME 5303 (3)
ORGANIZATIONAL LEADERSHIP
This is a course in personnel and organizational leadership. You will learn the scientific structure of organizations and methods used to improve the productivity and quality of life of people working in the organization. You will be introduced to industrial-organizational (I/O) psychology, as applied to the manufacturing organization. This course will focus on understanding individual behavior and experiences in industrial and organizational settings. You will be introduced to industrial psychology as it address the human resource functions of analyzing jobs, and appraising, selecting, placing, and training people. The organizational psychology portion of the course addresses the psychology of work, including employee attitudes, behavior, emotions, health, motivation, and well-being, as well as the social aspects of the workplace.

ME 5314 (3)
INTRODUCTION TO MICROELECTROMECHANICAL SYSTEMS (MEMS) AND DEVICES
This course develops the basics for microelectromechanical devices and systems, including microactuators, microsensors, and micromotors; principles of operation; micromachining techniques (surface and bulk micromachining); IC-derived microfabrication techniques; and thin lm technologies as they apply to MEMS.

ME 5319 (3)
ADVANCED MECHANICAL BEHAVIOR OF MATERIALS
A senior-graduate course that relates mechanical behavior on a macro and microscopic level to design. Topics include macroscopic elasticity and plasticity, viscoelasticity, yielding, yield surfaces, work hardening, geometric dislocation theory, creep, temperature-dependent and environment-dependent mechanical properties. 2 TCH Design. *Prerequisites:* ME 2340, 3340.

ME 5320 (3)
INTERMEDIATE DYNAMICS
Emphasizes methods of formulation and solution of the kinematical, dynamical, and motion constraint equations for three-dimensional, lumped-parameter, dynamical systems. Detailed discussions on differentiation of vectors, kinematics, inertia properties, momentum and energy principles, generalized forces, holonomic and nonholonomic constraints, constrained generalized coordinates, and Newton-Euler and Lagrange formulations of the equations of motion. The symbolic software Mathematica is used to reduce the time and effort required to derive the kinematical and dynamical equations. Practical examples of detailed motion analysis of mechanisms using CAD software augment the theoretical formulations. *Prerequisite:* ME 2320; MATH 2339, 2343.

ME 5321 (3)
FAILURE ANALYSIS
A senior-graduate course in the evaluation of the failure of structural materials and components. Topics include: site examination, macroscopic examination, optical microscopy, transmission electron and SEM interpretation, examination and interpretation of failure surfaces, failure modes, causes of failure. 2 TCH Design.

ME 5322 (3)
VIBRATIONS
Review of fundamentals of vibrations with application of simple machine and structural members. Topics include harmonic motion, free and forced vibration, resonance, damping, isolation, and transmissibility. Single, multiple and infinite degree-of-free

ME 5324 (3)
FATIGUE THEORY AND DESIGN
A senior-graduate course. Includes continuum, statistical, and fracture mechanics treatments of fatigue, stress concentrators, planning and analysis of probit, SNP and response tests, mechanisms of fatigue design, fail safe vs. safe life design, crack propagation. Emphasizes engineering design aspects of fatigue rather than theoretical mechanisms. 2 TCH Design. *Prerequisite:* ME 3340.

ME 5326 (3)
VEHICLE DYNAMICS
Modeling of wheeled vehicles to predict performance, handling, and ride. Effects of vehicle center of mass, tire-characteristic traction and slip, engine characteristics, and gear ratios of performance. Suspension design and steady-state handling models of four-wheeled vehicles and car-trailer systems to determine oversteer and understeer characteristics, critical speeds, and stability. Multi-degree-of-freedom ride models including tire and suspension compliance. Computer animation and simulations. *Prerequisite:* ME 2320 or permission of instructor.

ME 5329 (3)
FLUID POWER SYSTEMS
This course will develop the fundamentals of a fluid power system design by introducing the basic building blocks such as pumps, motors, hydraulic cylinders, accumulators, multi-position directional valves, and other related components. Properties of the common hydraulic fluids

ME 5344 (3)
CONDUCTIVE COOLING OF ELECTRONICS
This course will begin with a review of the fundamental concepts of conduction heat transfer, followed by applications of these principals to

ME 5358 (3)
DESIGN OF ELECTRONIC PACKAGING
A focus on thermal and mechanical design of electronic packaging. Fundamentals of heat transfer and fluid flow are applied to electronic packages and systems, including selection of fans, heat sinks, and other hardware important to good design. Mechanical designs of equipment that operates in more severe shock and vibration environments are developed using classical methods, with consideration given to selecting appropriate hardware. *Prerequisites:* ME 2320; MATH 2343, 3339.

ME 5359 (3)
ANALYSIS AND DESIGN OF OPTOELECTRONIC PACKAGING
Provides an overview of optical fiber interconnections in telephone networks, packaging for high-density optical back planes, selection of fiber technologies; semi-conductor laser and optical amplifier packaging, optical characteristics and requirements, electrical properties, mechanical properties, waveguide technologies, optical alignment and packaging approaches, passive device fabrication and packaging, array device packaging; hybrid technology for optoelectronic packaging, and flip-chip assembly for smart pixel arrays.

ME 5360 (3)
ELECTRONIC PRODUCT DESIGN AND RELIABILITY
This course will investigate the failures, failure modes, and failure mechanisms in electronic systems. It will cover the following subjects: failure detection, electrical simulation, and environmental stress tests. Failure analysis will be covered, including the use of X-rays, thermal imaging/infrared microscopy, acoustical imaging, scanning laser acoustic microscopy, infrared spectroscopy, differential scanning calorimeter, thermo-mechanical analyzer, and other testing procedures. In addition, solder joint reliability of balls grid array (BGA) assemblies, plastic ball grid array (PBGA) assemblies, flip-chip assemblies, chip-scale package (CSP) assemblies, and fine pitch, surface mount technology (SMT) assemblies will be discussed. In addition, this course will cover temperature as a reliability factor, an overview of high temperature electronics, the use of silicon devices at high temperatures, and selection of passive devices for use at high temperatures. *Prerequisite:* ME 3340 or graduate student standing.

ME 5361/CEE 5361 (3)
MATRIX STRUCTURE ANALYSIS
A systematic approach to formulation of force and displacement method of analysis; representation of structures as assemblages of elements; computer solution of structural systems.

ME 5362 (3)
ENGINEERING ANALYSIS WITH NUMERICAL METHODS
Application of numerical and approximate methods in solving a variety of engineering problems. Examples include equilibrium, buckling, vibration, fluid mechanics, thermal science, and surveying problems. *Prerequisite:* Senior standing.

ME 5363 (3)
ELECTRONIC MANUFACTURING TECHNOLOGY
Covers the complete field of electronics manufacturing. Topics include an introduction to the electronics industry; electronic components; the theory and methods of manufacture of solid-state devices; packaging techniques such as wire bonding, flip chip, and TAB; printed wiring board; soldering and solderability; leaded and surface-mounted components; electromagnetic interference; electrostatic discharge prevention; testability; and electronic stress screening. In each area, current technology as well as leading-edge tools are discussed.

ME 5364 (3)
INTRODUCTION TO STRUCTURAL DYNAMICS
Dynamic responses of structures and behavior of structural components to dynamic loads and foundation excitations; single- and multi-degree-of-freedom systems response and its applications to analysis of framed structures; introduction to systems with distributed mass and

The focus of the course is to integrate risk assessment with managerial decision-making. Examples and case studies are emphasized.

ME 5371 (3)

Center for Special Studies

The Special Studies designation accommodates academic programs and courses that do not typically fit within the departments of the Lyle School of Engineering. Included under this section are courses designed for Engineering Cooperative Education Program students and first-year students exploring engineering degree programs.

SS 1110 (1)
INTRODUCTION TO DESIGN LABORATORY
Students participate in a term-long, multidisciplinary project composed of students working on various engineering systems to gain firsthand experience with the engineering design process. Throughout the term, students document and present their work, from initial concept and requirements analysis, to design, development, and test. A competition is held between teams at the end of the term. *Corequisites or prerequisites:* MATH 1337 and one of the following: CEE 1302, CSE 1341, EE 1382, ME 1202, or permission of instructor.

SS 2099 (0)
ENGINEERING INTERNSHIP
Each of these courses represents a term of industrial work activity in connection with the Engineering Cooperative Program. The courses are taken in numerical sequence and carry no credit. Students register for these courses in the same manner as other SMU courses except that no tuition is charged. Each course grade is determined by a written report by the student and from the scoring of the employer's evaluation form.

SS 2315 (3)
ENGINEERING AND DESIGN FOR THE DEVELOPING WORLD
Engineering design in the developed world takes for granted the availability of several key resources such as construction material, water, and electricity. This course examines engineering design in the absence of these resources, with a focus on the development of shelter and

SS 5190 (1), 5191 (1), 5192 (1), 5193 (1), 5194 (1)
SPECIAL TOPICS
Individual or group study of selected topics in applied science. These are areas that do not belong strictly to any department, but nevertheless are meaningful to the Lyle School of Engineering. *Prerequisite:* Permission of instructor.

SS 5290 (2), 5291 (2), 5292 (2), 5293 (2), 5294 (2)
SPECIAL TOPICS
Individual or group study of selected topics in applied science. These are areas that do not belong strictly to any department, but nevertheless are meaningful to the Lyle School of Engineering. *Prerequisite:* Permission of instructor.

SS 5390 (3), 5391 (3), 5392 (3), 5393 (3), 5394 (3)
SPECIAL TOPICS
Individual or group study of selected topics in applied science. These are areas that do not belong strictly to any department, but nevertheless are meaningful to the Lyle School of Engineering. *Prerequisite:* Permission of instructor.

SS 5490 (4), 5491 (4), 5492 (4), 5493 (4), 5494 (4)
SPECIAL TOPICS
Individual or group study of selected topics in applied science. These are areas that do not belong strictly to any department, but nevertheless are meaningful to the Lyle School of Engineering. *Prerequisite:* Permission of instructor.

Reserve Officers' Training Corps

Army ROTC. While Army ROTC courses are not offered on the SMU campus, students can participate in the Army ROTC program at the University of Texas at Arlington by enrolling as they enroll for other SMU courses. Further program information and application procedures may be obtained by contacting the UTA Department of Military Science at 817-272-3281. Students who participate in the UTA Army ROTC program are responsible for their own travel and other physical arrangements.

Army ROTC offers students the opportunity to graduate as officers and serve in the U.S. Army, the Army National Guard or the U.S. Army Reserve. Army ROTC scholarships are awarded on a competitive basis. Each scholarship pays for tuition and required educational fees and provides a specified amount for textbooks, supplies and equipment. Each scholarship also includes a subsistence allowance of up to $1,000 for every year the scholarship is in effect.

Students can enroll in the Army ROTC on-campus program as they enroll for other SMU courses. Army ROTC courses are listed under ROTC in the Access.SMU schedule of classes, and permission to enroll must be obtained from Karen Coleman at ment in ROTC 1180 leadership lab and mandatory participation in individual physical fitness training, plus optional participation in a weekend field training exercise.

ROTC 1143 (1)
ARMY ROTC INTRODUCTION TO LEADERSHIP I
Provides introduction to basic military skills to include principles of emergency first aid and evacuation of casualties, map and compass reading, terrain association, and cross-country navigation. Principles of physical fitness training. Introduction to military inspections. Concurrent enrollment in SSR 1180 is mandatory.

ROTC 1180 (1)
LEADERSHIP LABORATORY
A practical laboratory of applied leadership and skills. Student-planned, -organized and -conducted training, oriented toward leadership development. Laboratory topics include marksmanship, small unit tactics, multi-tiered programs focused on individual skill levels. Uniform and equipment provided. May be repeated for credit.

ROTC 2248 (2)
EVOLUTION OF CONTEMPORARY MILITARY STRATEGY
A review of contemporary military conflicts. Selected battles from World War II, Korea, Vietnam, and the Yom Kippur War are examined for impact upon current U.S. military doctrine, strategy, and weapons systems. All military science students must enroll or participate in ROTC 1180 concurrently with this course unless exception is given by the PMS.

ROTC 2251 (2)
INDIVIDUAL AND TEAM DEVELOPMENT
Application of ethics-based leadership skills and fundamentals of ROTC's Leadership Development Program. Develop skills in oral presentations, concise writing, event planning, coordination of group efforts, advanced first aid, land navigation, and military tactics. Concurrent enrollment in ROTC 1180 leadership lab and mandatory participation in individual physical fitness training, plus optional participation in a weekend field training exercise.

ROTC 2252 (2)
INDIVIDUAL AND TEAM MILITARY TACTICS
Introduction to individual and team aspects of military tactics in small unit operations. Includes use of radio communications, making safety assessments, movement techniques, planning for team safety/security, and pre-execution checks. Concurrent enrollment in ROTC 1180 leadership lab and mandatory participation in individual physical fitness training, plus optional participation in a weekend field training exercise.

ROTC 2291 (2)
CONFERENCE COURSE
Independent study. Designed to supplement the military science curricula by a student's concentrated study in a narrower field of military skill or subject matter. May be repeated for credit. Does not count for PE credit. *Prerequisite:* permission of the PMS.

ROTC 2343 (3)
LEADERSHIP TRAINING CAMP (LTC)
A rigorous five-week summer camp conducted at an Army post, stresses leadership, initiative and self-discipline. No military obligation incurred. Completion of ROTC 2343 qualifies a student for entry into the Advanced Course. Three different cycles offered during the summer, but spaces are limited by the Army. Candidates can apply for a space any time during the school year prior to the summer. Open only to students who have not taken all four of ROTC 1141, 1142, 2251, and 2252, and who pass an ROTC physical examination. P/F grade only.

ROTC 3341 (3)
LEADERSHIP I
Development of ability to evaluate situations, plan and organize training, learn military tactics, review case studies in leadership management and develop teaching and briefing skills. Concurrent enrollment in ROTC 1180 mandatory. *Prerequisite:* permission of PMS.

ROTC 3342 (3)
LEADERSHIP II
Practical application of squad and platoon leadership in tactical situations; operation of small unit communications systems. Development of the leaders' ability to express themselves, analyze military problems, and prepare and deliver logical solutions. Demanding physical

fitness training and performance-oriented instruction, in preparation for Summer Field Training. Concurrent enrollment in ROTC 1180 mandatory. *Prerequisite:* permission of PMS.

ROTC 3443 (4)
NATIONAL ADVANCED LEADERSHIP CAMP
A five-week off-campus field training course stressing the practical application of leadership management, with emphasis on tactical and technical military field skills. Open only to students who have successfully completed ROTC 3341 and 3342, P/F grade only.

ROTC 3495 (4)
NURSING ADVANCED SUMMER TRAINING
Seven-week off-campus internship at a major U.S. Army hospital for ROTC nursing students. A nursing practicum with the focus on providing the student with hands-on experience which integrates clinical, interpersonal, and leadership knowledge and skills. Practical experience and familiarization with Army nursing in a variety of clinical tasks in the areas of medical-surgical nursing, pediatrics, obstetrics, and, in some cases, intensive eDVAcs, ob.