Engineering (B.S.E.E. and B.S.T.E.)

The school offers two engineering programs: Electrical Engineering and Telecommunications Engineering. The Electrical Engineering program offers students an opportunity to acquire a solid foundation in the broad areas of electrical engineering and emphasizes advanced study in digital systems, telecommunications, and microelectronics.

The Electrical Engineering program offers students a solid educational foundation in the areas of electrical networks, electronics, electromagnetics, computers, digital systems, and communications and is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET). Mastery of these areas provides students with the ability to adapt and maintain leadership roles in their post-baccalaureate pursuits through the application of fundamental principles to a rapidly changing and growing discipline.

Students in the Electrical Engineering program take either the general program or specialize in microelectronics or telecommunications, and can take advanced courses in computer hardware and software; the analysis and design of analog and digital communication systems; analog and digital signal processing; the analysis, design, and fabrication of microelectronic components and systems; and guided and unguided wave propagation. A broad choice of electives (within and external to electrical engineering) allows students to broaden their education as well as develop expertise in areas of particular interest. In keeping with the role of a professional, students are expected to develop communication skills and an awareness of the relationship between technology and society.

The Telecommunications Engineering program is interdisciplinary. Telecommunications Engineering requires a blend of knowledge from the areas of Electrical Engineering, Computer Science, and Economics/Policy.

The Electrical Engineering and Telecommunications Engineering programs are based on a solid foundation of science and mathematics coursework. Students in these programs are given an opportunity to learn to extend their abilities to analyze and solve complex problems and to design new uses of technology to serve today's society. The engineering programs provide an integrated educational experience directed toward the development of the ability to apply pertinent knowledge to the identification and solution of practical problems in electrical and telecommunications engineering. These programs ensure that the design experience, which includes both analytical and experimental studies, is integrated throughout the curriculum in a sequential development leading to advanced work. Design problems are frequently assigned in both lecture and laboratory courses. Each student is required to complete a major design project during the senior year. In addition, established cooperative education programs with area industry further supplement design experiences.

High School Preparation

Engineering education requires a strong high school preparation. Pre-engineering students should have high school preparation of at least one-half year in trigonometry and at least one year each in elementary algebra, intermediate and advanced algebra, plane geometry, chemistry, and physics, thus developing their competencies to the highest possible levels and preparing to move immediately into demanding college courses in calculus, calculus-based physics, and chemistry for science majors. It is also essential that pre-engineering students have the competence to read rapidly and with comprehension, and to write clearly and correctly.

Lower-Division Study

All lower-division students in either Electrical Engineering or Telecommunications Engineering concentrate on mathematics, science and introductory engineering courses, building competence in these cornerstone areas for future application in upper-division engineering courses. The following requirements apply both to students seeking to transfer to U.T. Dallas from other institutions as well as to those currently enrolled at U.T. Dallas, whether in another school or in the Erik Jonsson School of Engineering and Computer Science.

ABET Requirements

All engineering degree plans must satisfy the requirements specified by the Accreditation Board for Engineering and Technology (ABET). The course work must include at least:
1) One year (32 SCH) of an appropriate combination of mathematics and basic sciences,
2) One-half year (16 SCH) of humanities and social sciences,
3) One and one-half years (48 SCH) of engineering topics.

Although the electrical engineering and telecommunications engineering curricula that follow have been designed to meet
these criteria, students have the responsibility, in consultation with an advisor, to monitor their own choice of courses
carefully to be certain that all academic requirements for graduation are being satisfied. Students are strongly encouraged
to take courses in such subjects as accounting, industrial management, finance, personnel administration, and engineering
economy.

Bachelor of Science in Electrical Engineering Degree Requirements (125 hours)
I. Core Curriculum Requirements¹: 42 hours

A. Communication (6 hours)
   3 hours Communication (RHET 1302)
   3 hours Communication Elective (fulfilled by EE 438x2)
B. Social and Behavioral Sciences (15 hours)
   6 hours Government (GOVT 2305 and 2306)
   6 hours History (HST 1301 and 2301)
   3 hours Social and Behavioral Science elective
C. Humanities and Fine Arts (6 hours)
   3 hours Fine Arts (AP 1301)
   3 hours Humanities (A&H 1301)
D. Mathematics and Quantitative Reasoning (6 hours)
   6 hours Calculus (Math 2417 and 2419)³
E. Science (9 hours)
   8 hours Physics (PHYS 2325, 2125, 2326 and 2126)
   4 hours Chemistry (CHM 1311and 1111)⁴

¹ Curriculum Requirements can be fulfilled by other approved courses from accredited institutions of higher education. The courses listed in
parentheses are recommended as the most efficient way to satisfy both Core Curriculum and Major Requirements at U.T. Dallas.

II. Major Requirements: 71 hours⁵

Major Preparatory Courses (21 hours beyond Core Curriculum)
   MATH 2417 Calculus I³
   MATH 2419 Calculus II³
   MATH 2420 Differential Equations
   CS 1315 Computer Science I
   CHM 1311 General Chemistry I⁴
   CHM 1111 General Chemistry Laboratory I⁴
   One three-hour Mathematics or Science Elective⁶
   EE 2305 Fundamentals of Electrical Engineering
   EE 2310 Computer Organization and Design

Major Core Courses (41 hours beyond Core Curriculum)
   EE 3300 Advanced Engineering Mathematics I
   EE 3301 Electrical Network Analysis
   EE 3201 Electrical Network Analysis Laboratory
   EE 3302 Signals and Systems
   EE 3310 Electronic Devices
   EE 3210 Electronic Devices Laboratory
   EE 3311 Electronic Circuits
EE 3211 Electronic Circuits Laboratory
EE 4190 Seminar in Industrial Practice
EE 4300 Advanced Engineering Mathematics II
EE 4301 Electromagnetic Engineering I
EE 4320 Digital Circuits
EE 4220 Digital Circuits Laboratory
EE 4350 Communication Systems
EE 4250 Communication Systems Laboratory
EE 438x2 Senior Design Project
ENGS 3302 Engineering Dynamics

Major Guided Electives (9 hours)

Students pursuing the general program take 9 semester hours from either list below.

Students pursuing a concentration in Microelectronics take 3 of the following courses:
- EE 4325 Introduction to VLSI Design
- EE 4330 Integrated Circuit Technology
- EE 4340 Analog Integrated Circuit Analysis and Design
- EE 4341 Digital Integrated Circuit Analysis and Design
- EE 4382 Individually Supervised Design Project (Microelectronics)

Students pursuing a concentration in Telecommunications take 3 of the following courses:
- EE 4360 Digital Communications
- EE 4361 Introduction to Digital Signal Processing
- EE 4365 Introduction to Wireless Communication
- EE 4367 Telecommunications Switching and Transmission
- EE 4381 Mobile Communications System Design Project

2 See an EE advisor for appropriate options. Hours fulfill the communication elective of the Core Curriculum.
3 Six hours of Calculus are counted under Mathematics Core, and two hours of Calculus are counted as Major Preparatory Courses.
4 One hour of Chemistry is counted under Science core, and three hours are counted as Major Preparatory Courses.
5 Students must pass each of the EE, CS, Math and Science courses listed in this degree plan and each of their prerequisites, with a grade of C or better.
6 CHM 1312/1112 or approved Mathematics or Physics course.

III. Elective Requirements: 12 hours

Advanced Electives (6 hours)

All students are required to take at least six hours of advanced electives outside their major field of study. These must be either upper-division classes or lower-division classes that have prerequisites.

Free Electives (6 hours)

Both lower- and upper-division courses may count as free electives but students must complete at least 51 hours of upper-division credit to qualify for graduation.

Specified Course Descriptions

A&H 1301 (HUMA 1301) Exploration of the Humanities (3 semester hours) An introduction to the concept of cultural tradition through the study of selected works of literature, philosophy, music, and visual art. Emphasis on the relations among various forms of cultural expression and developing students' ability to interpret complex artistic works in their historical, cultural, and intellectual contexts. General education core course. (3-0) S

AP 1301 (ARTS 1301) Exploration of the Arts (3 semester hours) This course introduces students to the physical and intellectual demands required of the author, the performer, and the visual artist. This introduction includes, but is not limited to, the student's production of a creative project as well as written assessments of art and performance. (3-0) Y

CHM 1111 (CHEM 1111) General Chemistry Laboratory I (1 semester hour) Introduction to the chemistry laboratory. Experiments are designed to demonstrate concepts covered in CHM 1311; including properties and reactions of inorganic substances, and elementary qualitative and quantitative analysis. (0-3) S
CHM 1311 (CHEM 1311) General Chemistry I (3 semester hours) Introduction to elementary concepts of chemistry theory. The course emphasizes chemical reactions, the mole concept and its applications, and molecular structure and bonding. (3-0) S

CS 1315 (COSC 1315) Computer Science I (3 semester hours) Computer programming in a high-level, block structured language. Algorithmic thinking and the history and utility of machines which automate it. Basic data types and variables, memory usage, control structures (sequential, selection, repetition), functions and parameter passing, recursion, console and file input/output. Prerequisite: Basic computer literacy/programming skills (see CS 1115 description) or concurrent enrollment in CS 1115. (3-0) S

EE 2305 (ENGR 2305) Fundamentals of Electrical Engineering (3 semester hours) An introduction to some of the unifying concepts in electrical engineering; analysis and synthesis of signal waveforms; modification of waveforms by electrical systems; current-voltage relationships for common components; DC circuit analysis. Corequisites or Prerequisites: PHYS 2326, MATH 2420. (3-0) S

EE 2310 Computer Organization and Design (3 semester hours) Introduction to hardware structures that form the basis of the design of modern computer systems. Internal data representation and arithmetic operations in a computer. Components of memory and Input/Output systems. Assembly language programming is used to demonstrate the effects of hardware alternatives. Prerequisite: CS 1315. (3-0) S

EE 3201 Electrical Network Analysis Laboratory (2 semester hours) Laboratory to accompany EE 3301. Design, assembly and testing of linear electrical networks and systems. Use of computers to control electrical equipment and acquire data. Corequisite: EE 3301. (0-3) S

EE 3210 Electronic Devices Laboratory (2 semester hours) Laboratory to accompany EE 3310. Experimental determination and illustration of properties of carriers in semiconductors including carrier drift, photoconductivity, carrier diffusion; p-n junctions including forward and reverse bias effects, transient effects, photodiodes, and light emitting diodes; bipolar transistors including the Ebers-Moll model and secondary effects; field effect transistors including biasing effects, MOS capacitance and threshold voltage. Corequisite: EE 3310. (0-3) S

EE 3211 Electronic Circuits Laboratory (2 semester hours) Laboratory to accompany EE 3311. Design, assembly and testing of electronic circuits that use diodes, transistors and operational amplifiers in configurations typically encountered in practical applications. Prerequisite: EE 3201. Corequisite: EE 3311. (0-3) S

EE 3300 Advanced Engineering Mathematics I (3 semester hours) Survey of advanced mathematics topics needed in the study of engineering. Topics include linear algebra, vector calculus, complex variables, numerical methods. Examples are provided from microelectronics and communications. Prerequisite: MATH 2420. (3-0) S

EE 3301 Electrical Network Analysis (3 semester hours) Analysis and design of RC, RL, and RLC electrical networks. Sinusoidal steady state analysis of passive networks using phasor representation; mesh and nodal analyses. Introduction to the concept of impulse response and frequency analysis using the Laplace transform. Prerequisites: EE 2305, MATH 2420. Corequisite: EE 3301. (3-0) S


EE 3310 Electronic Devices (3 semester hours) Theory and application of solid state electronic devices. Physical principles of carrier motion in semiconductors leading to operating principles and circuit models for diodes, bipolar transistors, and field effect transistors. Introduction to integrated circuits. Prerequisites: MATH 2420, PHYS 2326, EE 3301. Corequisite: EE 3310. (3-0) S

EE 3311 Electronic Circuits (3 semester hours) Analysis and design of electronic circuits using diodes, transistors and operational amplifiers with feedback. Gain and stability of basic amplifier circuits usingBJT's, JFET's and MOSFET's; classes of amplifiers; performance of ideal and non-ideal operational amplifiers. Prerequisites: EE 3301, EE 3310. Corequisite: EE 3311. (3-0) S

EE 4190 Seminar in Industrial Practice (1 semester hour) Seminar on current issues of industrial practice, corporate structure and technology issues. Prerequisite: senior standing. (1-0) Y

EE 4220 Digital Circuits Laboratory (2 semester hours) Laboratory to accompany EE 4320. Design, assembly, and testing of logic circuits. Corequisite: EE 4320. (0-3) S

EE 4250 Communication Systems Laboratory (2 semester hours) Laboratory to accompany EE 4350. Fundamental elements of communications systems hardware; use of spectrum analyzers and other measurement instruments typically
encountered in communication systems; design of active filters in communications systems; analog frequency and amplitude modulators and demodulators; data communication systems. Corequisite: EE 4350. (0-3) S

EE 4300 Advanced Engineering Mathematics II (3 semester hours) Continuing survey of advanced mathematics topics needed in the study of engineering. Topics include Fourier analysis, partial differential equations, probability, statistics, numerical methods. Examples are provided from communications and microelectronics. Prerequisite: EE 3300. (3-0) S

EE 4301 Electromagnetic Engineering I (3 semester hours) Introduction to the general characteristics of wave propagation. Physical interpretation of Maxwell’s equations. Propagation of plane electromagnetic waves and energy. Transmission lines. Antenna fundamentals. Prerequisites: PHYS 2326, EE 4300. (3-0) S

EE 4320 Digital Circuits (3 semester hours) Boolean logic. Design and analysis of combinational logic circuits using SSI and MSI. Design and analysis of synchronous state machines. Use of programmable logic devices and simple CAD tools. Prerequisite: CS 2325 or EE 2310. Corequisite: EE 4220. (3-0) S

EE 4325 Introduction to VLSI Design (3 semester hours) Introduction to CMOS digital IC design using semi-custom and full-custom design techniques with an emphasis on techniques for rapid prototyping and use of various VLSI design tools. FPGA’s, standard cell and full-custom design styles. Introduction to a wide variety of CAD tools. Prerequisite: EE 4320 (or, for CS majors, CS 4340). (3-0) T

EE 4330 Integrated Circuit Technology (3 semester hours) Principles of design and fabrication of integrated circuits. Bipolar and MOS technologies. Passive and active component performance, fabrication techniques including epitaxial growth, photolithography, oxidation, diffusion, ion-implantation, thin and thick film components. Design and layout of integrated devices. Relations between layout and fabrication technique. Prerequisites: EE 3310, EE 4300. (3-0) T

EE 4340 Analog Integrated Circuit Analysis and Design (3 semester hours) Analog integrated circuits and systems. Analysis and design of linear amplifiers, including operational, high-frequency, broad-band and feedback amplifiers. Use of monolithic silicon systems. Prerequisite: EE 3311. (3-0) T

EE 4341 Digital Integrated Circuit Analysis and Design (3 semester hours) Digital integrated circuits. Large signal model for bipolar and MOS transistors. MOS inverters and gates. Propagation delay and noise margin. Dynamic logic concepts. Bipolar transistor inverters and gates, regenerative logic circuits, memories. Prerequisites: EE 3311, EE 4320. (3-0) T

EE 4350 Communications Systems (3 semester hours) Fundamentals of communications systems. Review of probability theory and Fourier transforms. Filtering and noise. Modulation and demodulation techniques, including amplitude, phase, pulse code, pulse position, and pulse width modulation concepts. Time division multiplexing. Prerequisites: EE 3302, EE 4300. (3-0) S

EE 4360 Digital Communications (3 semester hours) Information, digital transmission, channel capacity, delta modulation, and differential pulse code modulation are discussed. Principles of coding and digital modulation techniques such as Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), and Continuous Phase Frequency Shift Keying (CPFSK) are introduced. M-ary signaling such as Quadrature amplitude and phase shift keying, and M-ary PSK and FSK are also discussed. Prerequisite: EE 4350. (3-0) T

EE 4361 Introduction to Digital Signal Processing (3 semester hours) An introduction to the analysis and design of discrete linear systems, and to the processing of digital signals. Topics include time and frequency domain approaches to discrete signals and systems, the Discrete Fourier Transform and its computation, and the design of digital filters. Prerequisites: EE 3302, EE 4300. (3-0) T

EE 4365 Introduction to Wireless Communication (3 semester hours) Introduction to the basic system concepts of cellular telephony. Mobile standards, mobile system architecture, design, performance and operation. Voice digitization and modulation techniques; PCS technologies. Prerequisite: EE 4350. (3-0) Y

EE 4367 Telecommunications Switching and Transmission (3 semester hours) Trunking and queuing, switching technologies: voice, data, video, circuit switching and packet switching, transmission technologies and protocols, transmission media - copper, fiber, microwave, satellite, protocols - bipolar formats, digital hierarchy, optical hierarchy, synchronization, advanced switching protocols and architectures; frame relay, ATM, HDTV, SONET. Prerequisite or Corequisite: EE 4350. (3-0) Y

EE 4381 Mobile Communications System Design Project (3 semester hours) Radio frequency system design, propagation, antennas, traffic and trunking, technology issues, channel modeling, link budget, cell design principles, demographics and capacity analysis, project management, and regulatory issues. This can be used to satisfy Senior Design Project. All students must submit a written report and make an oral presentation at the culmination of the project. Prerequisites: senior standing, EE 4365. (3-0) Y
EE 4382 Individually Supervised Senior Design Project (3 semester hours) Detailed design assembly and testing of a system or component under the guidance of a faculty member. Specific technical requirements will be set by the faculty member. All students must submit a written report and make an oral presentation of the culmination of the project. Prerequisite: senior standing. (3-0) R

ENGS 3302 Dynamics in Electrical Engineering Systems (3 semester hours) Fundamentals of particle, rigid-body, and continuum dynamics. Motion of charged particles in electric and magnetic fields. Micromechanical devices. Heat transfer. Computer solutions of linear and nonlinear models. Prerequisites: PHYS 2325, EE 3300. (3-0) S

GOVT 2305 (GOVT 2305) Constitutional Foundations and Political Behavior in the U.S. and Texas (3 semester hours) This course examines the evolution and current state of political behavior and public policy making in the U.S. and Texas. Topics discussed will include the constitutions, federalism, intergovernmental relations, voting, elections, political parties, public opinion, and interest groups. (Fulfills one-half of the legislative requirement of 6 hours of American government.) (3-0) S

GOVT 2306 (GOVT 2306) Political Institutions in the U.S. and Texas (3 semester hours) This course explores the primary institutions of U.S. and Texas government. It examines the bureaucracy as well as the executive, legislative, and judicial branches of government at the state and federal level. (Fulfills one-half of the legislative requirement of 6 hours of American government.) (3-0) S

HST 1301 Themes and Ideas in American History (3 semester hours) An introduction to the methods of historical inquiry through the study of selected main themes in American history. A course designed to offer students an understanding of the historical and cultural context of America in the contemporary world. Fulfills one-half of the Texas legislative requirement for six hours in American history. (3-0) S

HST 2301 Issues in American History (3 semester hours) Readings, commentary, and discussion aimed at varying aspects of history and culture. Fulfills one-half of the Texas legislative requirement for six hours in American history. (3-0) Y

MATH 2417 (MATH 2417) Calculus I (4 semester hours) Functions, limits, continuity, differentiation; integration of function of one variable; logarithmic, exponential, and inverse trigonometric functions; techniques of integration, and applications. Three lecture hours and two discussion hours a week. Prerequisite: MATH 2312 or equivalent. (4-0) S

MATH 2419 Calculus II (MATH 2419) (4 semester hours) Continuation of MATH 2417. Improper integrals, sequences, infinite series, power series, parametric equations and polar coordinates, vectors, vector-valued functions, functions of several variables, partial derivatives and applications, multiple integration. Three lecture hours and two discussion hours a week. Prerequisite: MATH 2417. (4-0) S

MATH 2420 (MATH 2420) Differential Equations with Applications (4 semester hours) Topics covered will be drawn from the following list: First order differential equations, ordinary differential equations, system of linear differential equations, stability, series solutions, special functions, Sturm-Liouville problem, Laplace transforms and linear differential equations, numerical solutions and applications in physical sciences and engineering using computers. Three lecture hours and two discussion hours per week. Prerequisite: MATH 2419. (4-0) S

PHYS 2125 (PHYS 2125) Physics Laboratory I (1 semester hour) Laboratory course to accompany PHYS 2325. Personal computer-based data presentation and curve fitting. Basic measurement concepts such as experimental uncertainty, mean, standard deviation, standard error, and error propagation will be covered. Corequisite: PHYS 2325. (0-3) Y

PHYS 2126 (PHYS 2126) Physics Laboratory II (1 semester hour) Laboratory course to accompany PHYS 2326. Builds on concepts of Physics Lab I. Will emphasize the use of an oscilloscope and measurements using simple circuits constructed in class. Corequisite: PHYS 2326. (0-3) Y

PHYS 2325 (PHYS 2325) Mechanics and Heat (3 semester hours) Calculus based. Basic physics including a study of space and time, kinematics, forces, energy and momentum, conservation laws, rotational motion, torques, harmonic oscillation, temperature and heat. Two lectures and one recitation session per week. Prerequisite: MATH 2417. Corequisite: PHYS 2125. (3-0) Y

PHYS 2326 (PHYS 2326) Electromagnetism and Waves (3 semester hours) Continuation of PHYS 2325. Topics include electrostatics and electromagnetics, electric field and potential, electric currents, magnetic fields, laws of Coulomb, Ampere, and Faraday, Maxwell's theory of propagation and optics. Two lectures and one recitation session per week. Prerequisites: PHYS 2325 and MATH 2419. Corequisite: PHYS 2126. (3-0) Y

RHET 1302 (ENGL 1302) Rhetoric (3 semester hours) The course presents an integrated approach to writing, reading, and critical thinking by developing the grammatical, logical, and rhetorical skills necessary for university writing. All classes work in a computerized learning environment. Students are taught basic computer literacy and submit all work electronically and on paper. (3-0) S