

Erik Jonsson School of Engineering and Computer Science

Department of Electrical and Computer Engineering

Objectives

The program leading to the [MSEE degree](#) provides intensive preparation for professional practice in a broad spectrum of high-technology areas of electrical engineering. It is designed to serve the needs of engineers who wish to continue their education. Courses are offered at a time and location convenient for the student who is employed on a full-time basis.

The objective of the doctoral program in electrical engineering is to prepare individuals to perform original, leading edge research in the broad areas of communications and signal processing; mixed-signal IC design; digital systems; power electronics; microelectronics and nanoelectronics, optics and photonics; optical communication devices and systems; power electronics and energy systems, and wireless communications. Because of our strong collaborative programs with Dallas-area high-technology companies, special emphasis is placed on preparation for research and development positions in these high-technology industries.

Facilities

The Erik Jonsson School of Engineering and Computer Science has developed a state-of-the-art information infrastructure consisting of a wireless network in all buildings and an extensive fiber-optic and copper Ethernet. Through the Texas Higher Education Network, students and faculty have direct access to most major national and international networks. UT Dallas has an Internet 2 connection. In addition, many personal computers and UNIX workstations are available for student use.

The Engineering and Computer Science Building and the new Natural Science and Engineering Research Laboratory provide extensive facilities for research in microelectronics, telecommunications, and computer science. A Class 10000 microelectronics clean room facility, including e-beam lithography, sputter deposition, PECVD, LPCVD, etch, ash and evaporation, is available for student projects and research. The Plasma Applications and Science Laboratories have state-of-the-art facilities for mass spectrometry, microwave interferometry, optical spectroscopy, optical detection, in situ ellipsometry and FTIR spectroscopy. In addition, a modified Gaseous Electronics Conference Reference Reactor has been installed for plasma processing and particulate generation studies. Research in characterization and fabrication of nanoscale materials and devices is performed in the Nanoelectronics Laboratory. The Optical Communications

Laboratory includes attenuators, optical power meters, lasers, APD/p-i-n photodetectors, optical tables, and couplers and is available to support system level research in optical communications.

Tissue optics research is also supported in this laboratory. The Photonic Testbed Laboratory supports research in photonics and optical communications with current-generation optical networking test equipment. The Electronic Materials Processing Laboratory has extensive facilities for fabricating and characterizing semiconductor and optical devices. The Photonic Devices and Systems Laboratory houses graduate research projects centered on optical instrumentation and photonic integrated circuits.

The Renewable Energy and Vehicular Technology Laboratory (REVT-Lab) is equipped with various sources of renewable energy such as wind and solar, a micro-grid formed by a network of multi-port power electronic converters, a stationary plug in hybrid vehicle testbed, a stationary DFIG-based wind energy emulator, a series of adjustable speed motor drive technologies including PMSM, SRM and induction motor drives. All of the testbeds are equipped with digital control, state-of-the-art measurement and protection devices. REVT laboratory is also equipped with a cold plasma chamber for hydrogen harvesting and battery testing facilities. The main focus of the REVT Lab is to improve reliability and security of the power electronic-driven technologies as applied to utility and vehicular industries.

The Power Electronics and Drives Laboratory (PEDL) is focused on advanced power electronics, electric drives systems, and energy management technologies for efficiency improvements in industrial, transportation, and renewable energy applications. The facilities include a real-time simulation lab and a hardware experimental lab. The simulation lab is an innovative digital signal processor based power electronics and motor drives hand-on teaching platform, tailored for graduate and undergraduate students as well as for practicing engineers. This new platform enables students to rapidly and efficiently learn to program DSP and configure the peripherals for real-time applications and control/manage the power digitally. The hardware experimental lab is equipped with state-of-the-art power testing equipment, dynamometers, prototype PWB manufacturing equipment, an environmental test chamber, and a mechanical shop. The lab is equipped with state-of-the-art tools and instrumentation necessary for development of power electronic circuits and systems for high power applications.

The Texas Analog Center of Excellence (TxACE) at The University of Texas at Dallas (UT Dallas) has the mission of leading the country in analog research and education. TxACE research seeks to create fundamental analog, mixed signal and RF design innovations in integrated circuits and systems that improve energy efficiency, healthcare, and public safety and security. The center is supported by Semiconductor Research Corporation, Texas Emerging Technology Fund, Texas Instruments Inc., the UT System, and UT Dallas. TxACE is the largest analog technology center in the world on the basis of funding and the number of principal investigators. The center funds ~70 directed research projects led by ~65 principal and co-principal investigators from 31 academic institutions including three international institutions.

The Multimedia Communications Laboratory has a dedicated network of PC's, Linux stations, and multi-processor, high performance workstations for analysis, design and simulation of image and

video processing systems. The Embedded Machine Learning (EML) Laboratory conducts research in machine learning and deep learning solutions and their implementation on embedded processors (ARM, GPU, FPGA, DSP). The research thrust of the EML Lab are: (i) Development of machine learning and deep learning solutions for signal and image processing applications, and (ii) real-time implementation of machine learning and deep learning algorithms on embedded processors, in particular on smartphones. The Statistical Signal Processing Laboratory is dedicated to research in statistical and acoustic signal processing for biomedical and non-biomedical applications. It is equipped with high-performance computers and powerful textual and graphical software platforms to analyze advanced signal processing methods, develop new algorithms, and perform system designs and simulations. The Acoustic Research Laboratory provides number of test-beds and associated equipment for signal measurements, system modeling, real-time implementation and testing of algorithms related to audio/ acoustic/speech signal processing applications such as active noise control, speech enhancement, dereverberation, echo cancellation, sensor arrays, psychoacoustic signal processing, etc.

The Center for Robust Speech Systems (CRSS) is focused on a wide range of research in the area of speech signal processing, speech and speaker recognition, machine learning, acoustics and hearing research, Cochlear implants and hearing aid technology, speech/language technology, and multi-modal signal processing involving facial/speech modalities. CRSS collaborates extensively with faculty and programs across UT Dallas on speech and language research. CRSS supports an extensive network of workstations, as well as a network of High-Performance Compute Clusters with 36 Node GPU Cluster connected with a 420 CPU ROCS multi-processor and data server with over 50TB of disk storage. The center also is equipped with two ASHA certified sound booths for perceptual/listening based studies and for speech data collection, as well as Perceptual Auditory 3D sound lab. CRSS supports mobile speech interactive systems through the UT-Drive program for in-vehicle driver-behavior systems, and multi-modal based interaction systems via image-video-speech research.

The Sensing, Robotics, Vision, Control and Estimation (SeRViCE) Lab focuses on topics of control and estimation with applications in robotics, autonomous vehicles and sensor management. Primary expertise is in vision-based control and estimation and nonlinear control, that is, using cameras as the primary sensor to control robots or other complex systems. Robotics resources in the lab currently include two Pioneer 3-DX mobile robots from Mobile Robots Inc. and a Stubli TX90 robot manipulator, with six degrees of freedom, 7kg nominal payload and capable of torque level control. Camera resources include multiple web cameras, three high-quality, firewire, color, digital video cameras, and an 18Mp digital SLR camera. The SeRViCE Lab also features general support equipment, including desktop and mobile work stations DLP projectors, power tools, hand tools, oscilloscopes, and other electronic measurement equipment.

The Laboratory for Autonomous Robotics and Systems (LARS) focuses on the development of novel control theory to support autonomous and teleoperation of general robotic systems. Active research projects include: (a) human-in-the-loop multi-robot telemanipulation, (b) autonomous networked robotics, and (c) control of bipedal walking robots. The LARS is equipped with high speed high resolution 8-camera Vicon motion capture system for general purpose motion tracking. The LARS possesses various mobile robots to supported multi-robot research, including six

gumstix controlled iRobot Create and a Quanser QBall quadrotor UAV. The LARS also possesses various force feedback user interface devices, including Logitech force feedback joystick and driving wheel, and Novint Falcon, a 3-translational degree-of-freedom Delta- structure desktop haptic device.

The Broadband Communication Laboratory has design and modeling tools for fiber and wireless transmission systems and networks, and all-optical packet routing and switching. The Advanced Communications Technologies (ACT) Laboratory provides a design and evaluation environment for the study of telecommunication systems and wireless and optical networks. ACT has facilities for designing network hardware, software, components, and applications.

The Wireless Information Systems (WISLAB) and Antenna Measurement Laboratories have wireless experimental equipment with a unique multiple antenna testbed to integrate and to demonstrate radio functions (i.e. WiFi and WiMAX) under different frequency usage characteristics. With the aid of the Antenna Measurement Lab located in the Waterview Science and Technology Center (WSTC), the researchers can design, build, and test many types of antennas.

The Quality of Life Technology Laboratory is a multidisciplinary engineering education, research and developmental laboratory aimed at improving Quality of Life of people through technological advancements, innovations, and intelligent system designs. It has design, modeling and simulation tools for medical devices and systems.

The Integrated Design, Engineering, and Algorithmics (IDEA) Lab promotes education and research in the following areas: digital, analog and mixed-signal integrated circuit design and test; power electronics and energy systems; embedded and IoT systems; DSP and communication circuits and systems; rapid-prototyping; CAD algorithms. This lab is equipped with a network of workstations, personal computers, FPGA development systems, prototyping equipment, and a wide spectrum of state-of-the-art commercial and academic design tools to support graduate research.

In addition to the facilities on campus, cooperative arrangements have been established with many local industries to make their facilities available to UT Dallas graduate engineering students.

Master of Science in Electrical Engineering

30 semester credit hours minimum

Department Faculty

FACG> ecs-electrical-engineering-msee

Professors: Bilal Akin, Naofal Al-Dhahir, Poras T. Balsara, Dinesh Bhatia, Yun Chiu, Babak Fahimi, John P. Fonseka, Andrea Fumagalli, John H. L. Hansen, Rashaunda Henderson, Nasser Kehtarnavaz, Kamran Kiasaleh, Gil S. Lee, Hoi Lee, Jin Liu, Dongsheng (Brian) Ma, Giorgos (Yiorgos) Makris, Hlaing Minn, Aria Nosratinia, Mehrdad Nourani, Kenneth K. O, Lawrence J. Overzet, Issa M. S. Panahi,

Siavash Pourkamali, Mohammad Saquib, Carl Sechen, Lakshman Tamil, Murat Torlak

Associate Professors: Benjamin Carrion Schafer, Joseph Friedman, Mona Ghassemi, Chadwin D. Young

Assistant Professors: Kanad Basu, Sourav Dutta, Matthew Gardner, Ifana Mahbub, Jae Mo Park, Kaveh Shamsi

Associate Professor Emeritus: Gerald O. Burnham

Research Professors: Andrew Marshall, Hisashi (Sam) Shichijo

Professors of Instruction: James Florence, Jung Lee, Randall E. Lehmann, Tooraj Nikoubin, Miguel Razo-Razo, Ricardo E. Saad, William (Bill) Swartz, Marco Tacca

Associate Professors of Instruction: Md Ali, Diana Cogan, Matthew Heins, Rabah Mezenner, Neal Skinner

UT Dallas Affiliated Faculty: Larry Ammann, Leonidas Bleris, Fabiano Da Silveira Rodrigues, Massimo V. Fischetti, Matthew J. Goeckner, Zygmunt Haas, Kenneth Hoyt, Russell A. Hulse, Jiyoung Kim, Moon J. Kim, David J. Lary, Yaoyu Li, S.O. Reza Moheimani, Wooram Park, Robert L. Rennaker II, Mario A. Rotea, Justin Ruths, Mark W. Spong, Tyler Summers, Yonas Tadesse, William Vandenberghe, Amy V. Walker, Robert M. Wallace, Steve Yurkovich, Jie Zhang

NOTE> Please be advised, the admissions section below feeds in from a separate page. Any changes made to the admissions section below will not be retained. Please contact catalog@utdallas.edu with any questions.

Admission Requirements

The University's general admission requirements are discussed on the [Graduate Admission](#) page.

A student lacking undergraduate prerequisites for graduate courses in electrical engineering must complete these prerequisites or receive approval from the graduate advisor and the course instructor.

A diagnostic exam may be required. Specific admission requirements follow.

The student entering the MSEE program should meet the following guidelines:

- An undergraduate preparation equivalent to a baccalaureate in electrical engineering from an accredited engineering program.
- A grade point average in upper-division quantitative coursework of 3.0 or better on a 4.0 point scale, and
- GRE revised scores of 154, 156, and 4 for the verbal, quantitative, and analytical writing components, respectively, are advisable based on our experience with student success in the

program.

Applicants must submit three letters of recommendation from individuals who are able to judge the candidate's probability of success in pursuing a program of study leading to the master's degree. Applicants must also submit an essay outlining the candidate's background, education, and professional goals.

Students from other engineering disciplines or from other science and math areas may be considered for admission to the program; however, some additional coursework may be necessary before starting the master's program.

Degree Requirements

The University's general degree requirements are discussed on the [Graduate Policies and Procedures](#) page.

The MSEE requires a minimum of 30 semester credit hours.

All students must have an academic advisor and an approved degree plan. These are based upon the student's choice of concentration (Circuits; Computing Systems; Devices; Power Electronics and Energy; Signals and Systems). Courses taken without advisor approval will not count toward the 30 semester credit hour requirement. Successful completion of the approved course of studies leads to the MSEE degree.

The MSEE program has both a thesis and a non-thesis option. All part-time MSEE students will be assigned initially to the non-thesis option. Those wishing to elect the thesis option may do so by obtaining the approval of a faculty thesis supervisor. With the prior approval of an academic advisor, non-thesis students may count no more than 3 semester credit hours of research or individual instruction courses towards the 30 semester credit hour degree requirement.

All full-time, supported students are required to participate in the thesis option. The thesis option requires twelve semester credit hours of research (of which at least three must be thesis semester credit hours), a written thesis submitted to the graduate school, and a formal public defense of the thesis. The supervising committee administers this defense and is chosen in consultation with the student's thesis advisor prior to enrolling for thesis credit. Research and thesis semester credit hours cannot be counted in an MSEE degree plan unless a thesis is written and successfully defended.

Department of Electrical and Computer Engineering will not accept any course that does not count towards degrees in the offering department.

Concentrations

One of the five concentrations listed below, subject to approval by a graduate advisor, must be

used to fulfill the requirements of the MSEE program. Each concentration is defined by three core courses. A student must complete remaining courses from department and school wide electives. Students must achieve an overall GPA (grade point average) of 3.0 or better, a GPA of 3.0 or better in their core MSEE classes, and a grade of B- or better in all their core MSEE classes in order to satisfy their degree requirements. One 5000 EExx course or one 6000-level ECS elective course can be counted towards the graduate semester credit hours.

Circuits

The goal of the curriculum is to educate students about issues arising in design and analysis of advanced electronic circuits. This area covers application and theory of modern electronic devices, circuits, and systems in the digital, analog, and radio frequency and microwave regime. The courses in this curriculum emphasize core design principles around digital, analog, and RF circuits.

Required courses:

[EECT 6325](#) VLSI Design

[EECT 6326](#) Analog Integrated Circuit Design

[EERF 6311](#) RF and Microwave Circuits

Approved electives must be taken to make a total of 30 semester credit hours.

Computing Systems

The goal of the curriculum is to educate students about issues arising in the design and analysis of computing systems, an area relevant to a variety of high-technology industries. Because the emphasis is on systems, coursework focuses on three areas: hardware design, software design, and analysis and modeling.

Required courses:

[EEDG 6301](#) Advanced Digital Logic

[EEDG 6302](#) Embedded Systems

[EEDG 6304](#) Computer Architecture

Approved electives must be taken to make a total of 30 semester credit hours.

Devices

The goal of the curriculum is to educate students about issues related to the fundamental principles, design, fabrication and analysis of solid-state devices and associated micro systems,

application and theory of modern optical devices, materials, and systems.

Required courses:

[EEGR 6316](#) Fields and Waves

[EEMF 6319](#) Quantum Physical Electronics

[EEMF 6322](#) Semiconductor Processing Technology

Approved electives must be taken to make a total of 30 semester credit hours.

Power Electronics and Energy Systems

The goal of the curriculum is to prepare students to address growing needs in contemporary power electronics and energy related areas. The coursework focuses on fundamentals of power electronics, design and control of motor drives, power management, and energy systems.

Required courses:

[EEPE 6354](#) Power Electronics

[EEPE 6398](#) General Theory of Electric Machines

[EEPE 6357](#) Control, Modeling and Simulation in Power Electronics

Approved electives must be taken to make a total of 30 semester credit hours

Signals and Systems

This curriculum emphasizes the application and theory of signal processing, modern communication theory and applications, and control systems that emphasize on methods to predict, estimate, and regulate the behavior of electrical, mechanical, or other systems including robotics.

This concentration has one required course and allows a choice of two out of three core courses.

Required course:

[EEEC 6349](#) Probability, Random Variables, and Statistics

Choose two of the following three courses:

[EEEC 6352](#) Digital Communication Systems

[EECS 6331](#) Linear Systems

Approved electives must be taken to make a total of 30 semester credit hours.

Doctor of Philosophy in Electrical Engineering

75 semester credit hours minimum beyond the baccalaureate degree

Department Faculty

FACG> [ecs-electrical-engineering-msee](#),[ecs-electrical-engineering-phd](#)

Professors: Bilal Akin, Naofal Al-Dhahir, Poras T. Balsara, Dinesh Bhatia, Yun Chiu, Babak Fahimi, John P. Fonseka, Andrea Fumagalli, John H. L. Hansen, Rashaunda Henderson, Nasser Kehtarnavaz, Kamran Kiasaleh, Gil S. Lee, Hoi Lee, Jin Liu, Dongsheng (Brian) Ma, Giorgos (Yiorgos) Makris, Hlaing Minn, Aria Nosratinia, Mehrdad Nourani, Kenneth K. O, Lawrence J. Overzet, Issa M. S. Panahi, Siavash Pourkamali, Mohammad Saquib, Carl Sechen, Lakshman Tamil, Murat Torlak

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The PhD in Electrical Engineering is awarded primarily to acknowledge the student's success in an original research project, the description of which is a significant contribution to the literature of the discipline. Applicants for the doctoral program are therefore selected by the Electrical Engineering Program Graduate Committee on the basis of research aptitude, as well as academic record. Applications for the doctoral program are considered on an individual basis.

The following are guidelines for admission to the PhD program in Electrical Engineering:

- A master's degree in electrical engineering or a closely associated discipline from an institution of higher education in the U.S. or from an acceptable foreign university. Consideration will be given to highly qualified students wishing to pursue the doctorate without satisfying all of the requirements for a master's degree. A grade point average (GPA) in graduate coursework of 3.5 or better on a 4.0 point scale
- GRE revised scores of 154, 156, and 4 for the verbal, quantitative, and analytical writing components, respectively, are advisable based on our experience with student success in the program.

Applicants must submit three letters of recommendation on official school or business letterhead or the UT Dallas Letter of Recommendation Form from individuals who are familiar with the student's record and able to judge the candidate's probability of success in pursuing doctoral study in electrical engineering.

Applicants must also submit a narrative describing their motivation for doctoral study and how it relates to their professional goals.

For students who are interested in a PhD but are unable to attend school full-time, there is a part-time option. The guidelines for admission to the program and the degree requirements are the same as for full-time PhD students. All students must have an academic advisor and an approved plan of study.

Degree Requirements

The University's general degree requirements are discussed on the [Graduate Policies and Procedures](#) page.

Each program for doctoral study is individually tailored to the student's background and research objectives by the student's supervisory committee. The program will require a minimum of 75 semester credit hours beyond the baccalaureate degree. These credits must include at least 30

semester credit hours of graduate level courses beyond the baccalaureate level in the major concentration. All PhD students must demonstrate competence in the master's level core courses in their research area. All students must have an academic advisor and an approved plan of study.

Also required are:

- A qualifying examination (QE), as approved by the EE graduate committee, demonstrating competence in the PhD candidate's research area. A student entering the PhD program with a MS degree must pass this exam within three (3) long semesters, and a student entering without a MS degree must pass this exam within four (4) long semesters. A student has, at most, two attempts at this qualifying exam. The exam will be given during the fall and spring semesters. Details of the QE policy can be found on the ECE department website.
- A comprehensive exam consists of a written dissertation proposal, a public seminar, and a private oral examination conducted by the PhD candidate's supervising committee.

Areas of Research

The principal concentration areas for the MSEE program are: Circuits and Systems; Communications; Control Systems; Digital Systems; Photonic Devices and Systems; Power Electronics and Energy Systems, RF and Microwave Engineering; Signal Processing; Solid State Devices and Micro Systems Fabrication. Besides courses required for each concentration, a comprehensive set of electives is available in each area.

Doctoral level research opportunities include: VLSI design and test, analog and mixed-signal circuits and systems, RF and microwave engineering, biomedical applications of electrical engineering, power electronics, renewable energy, motors and drives, vehicular technology, computer architecture, embedded systems, computer aided design (CAD), ASIC design methodologies, high speed system-on chip design and test, reconfigurable computing, network processor design, interconnection networks, nonlinear signal- processing, smart antennas and array processing, statistical and adaptive signal processing, multimedia signal processing, image processing, real-time imaging, medical image analysis, pattern recognition, speech processing and recognition, control theory, robotics, digital communications, modulation and coding, electromagnetic-wave propagation, diffractive structures, fiber and integrated photonics, nonlinear optics, optical transmission systems, all-optical networks, optical investigation of material properties (reflectometry and ellipsometry), optical instrumentation, lasers, quantum-well optical devices, theory and experiments in semiconductor-heterostructure devices, advanced heterogeneous system integration and electronic packaging technologies, plasma deposition and etching, nanoelectronics, wireless communication, network protocols and evaluation, mobile computing and networking, and optical networking.

Interdisciplinary Opportunities

In keeping with the established tradition of research at UT Dallas, the Electrical Engineering Program encourages students to interact with researchers in the strong basic sciences and

mathematics. Cross disciplinary collaborations have been established with faculty across various departments (e.g. Computer Science, Bioengineering, Mechanical Engineering) and schools (e.g. Management; Natural Sciences and Mathematics; and Brain and Behavioral Sciences).

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