Electrical and Computer Engineering

Master of Science in Engineering
Doctor of Philosophy

For More Information

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Objective

The objective of the faculty of the Chandra Department of Electrical and
Computer Engineering and its Graduate Studies Committee is to provide
a graduate program that continues to produce exceptional graduates
via an education that is both broad and deep and access to world-class
research facilities while advancing the state of the art within diverse
subfields spanning electrical and computer engineering.

Facilities for Graduate Work

Factories are available for graduate work in almost all areas of study
within electrical and computer engineering, and for both experimental
and theoretical/computational research. Graduate activities of the
department are housed in the Engineering Education and Research
Center, and in several special-purpose laboratories located in the
Peter O’Donnell Jr. building and on the J. J. Pickle Research Campus.
Numerous facilities for experimental research are provided within these
well-equipped research laboratories. Among the resources available for
computationally intensive research is the Texas Advanced Computing
Center, also housed on the J. J. Pickle Research campus. In addition, The
University of Texas Libraries provide a rich source of literature to support
graduate activities in electrical and computer engineering, including free
online access to essentially all important journals.

Faculties of the Chandra Department of Electrical and Computer
Engineering also participate in several widely-recognized centers for
research including: the Center for Advanced Research in Software
Engineering, the Center for Electromechanics, the Center for Identity,
the Center for Perceptual Systems, the Center for Transportation
Engineering, the Center for Electromechanics, the Center for Identity,
and the Wireless Networking and Communications Group.

Areas of Study

There are eight named academic tracks spanning electrical and
computer engineering which admissions, course offerings, and advising
are organized, as listed below. However, the interests and work of
students and faculty alike may overlap more than one track.

architecture is at the interface of computer hardware and software. Its
practitioners are responsible for specifying, designing, and implementing
at the architecture level the hardware structures that carry out the
work specified by computer software. Computer architects share the
responsibility for providing mechanisms that algorithms, compilers,
and operating systems can use to enhance the performance and/or
energy requirements of running applications. Computer architecture
spans many dimensions, such as the scope of a processor (embedded
processors, desktop systems, servers, and supercomputers); the target
application (general-purpose versus domain-specific); the characteristics
of the design objectives (speed, power consumption, cost, reliability,
availability, and reconfigurability); and the measurement and analysis of
resulting designs.

bioECE. Understanding, engineering, and interfacing with biological
systems are among humanity’s most important challenges, impacting
numerous fields from basic science to health. Motivated by this
larger vision, the bioECE track is focused on the intersection of
electrical and computer engineering with biology and medicine. It
includes biomedical instrumentation, biophotonics, health informatics,
bioinformatics, neural engineering, computational neuroscience,
and synthetic biology. Associated faculty have expertise in diverse
topics: cardiovascular instrumentation, neuroscience, neural
engineering and the machine-brain interface, image and signal
processing (feature extraction and diagnostic interpretation), health
information technologies (data mining, electronic medical records
analysis), VLSI biomedical circuits (biosensing, lab-on-a-chip), algorithms
for large-scale genomic analysis, and molecular programming
(engineering molecules that compute).

Decision, Information, and Communications Engineering. This track
involves research and design in the following fields: (1) Communications
and networking: all aspects of transmission of data, including: wireless
communications, communication theory, information theory, networking,
queueing theory, stochastic processes, sensor networks; (2) Data
science and machine learning: all aspects of extraction of knowledge
from data, including: algorithms, data mining, optimization, statistics,
pattern recognition, predictive analytics, artificial intelligence; and (3)
Controls, signals, and systems: estimation and detection, signal, image
and video processing; linear and nonlinear systems.

Electromagnetics and Acoustics. This track includes the study of
electromagnetic and acoustic phenomena ranging from ultralow
frequencies to the visible spectrum. The activities in electromagnetics
involve research in antenna design, radar scattering, computational
methods, wave-matter interaction, bioelectromagnetics, wave
manipulation using artificial materials, wireless propagation channels,
microwave and millimeter-wave integrated circuits, guided wave devices
and systems, electromagnetic forces (including electrostrictive and
magnetostrictive forces), and Maxwell’s stress tensor. The activities
in acoustics involve research in transducers, microelectromechanical
systems, atmospheric and underwater acoustics, and noise and vibration
control.

Electronics, Photonics, and Quantum Systems. This track focuses on the
development and improvement of electronic, photonic, optoelectronic,
spintronic and micro-electromechanical (MEMS) materials, devices
and systems for a variety of applications. Electronic device examples
include transistors for nano-CMOS, back-end-of-the-line silicon, power
transistors and post-CMOS logic, memory, analog, and mixed-signal
applications based on quantum mechanical tunneling and electron spin.
Photonic devices include photodetectors, LEDs and lasers, including
topological photonics, metamaterials, metasurfaces, and other novel
nanophotonic structures, optical interconnects for short and long-range
communication, displays and solar cells. There is research on acoustic,
chemical and biological sensors, as well as quantum transport devices
such as Josephson junctions. Material systems include unstrained and
strained column IV and III-V semiconductors grown by molecular beam
epitaxy or various types of chemical vapor deposition, organics and
polymers, thin-film and novel 0D, 1D and 2D materials such as quantum
dots, nanowires, graphene and other 2D layered materials such as
transition metal dichalcogenides, as well as insulators such as high-dielectric-constant materials. Research in systems includes those for quantum information processing, optical systems for signal processing and very-high-speed communications, and electronic systems such as compute-in-memory and neuromorphic computing.

**Integrated Circuits and Systems.** This track involves all aspects of analysis, design, synthesis, and implementation of digital, analog, mixed-signal, and radio frequency (RF) integrated circuits and systems for applications in computing, sensing, and communications. Research in the area spans levels of abstraction from devices to systems-on-chip (SoC), and involves transceiver architectures, data converters, memory technologies, signal processing systems, integrated bio-chips, neuromorphic computing, high-performance and low-power design, fault tolerance, design for manufacturability (DFM), design for test (DFT), verification, computer-aided design (CAD) and electronic design automation (EDA).

**Power Electronics and Power Systems.** This track involves research in the generation, transmission, distribution, conversion, storage, and management of electric energy. Research activities include but are not limited to advanced power semiconductor devices; high-frequency-power-electronic conversion systems; high-frequency magnetics; medium voltage power electronics for applications in renewable energy, energy storage and smart grid systems; dc power grids; power system analyses; modeling and simulation of power systems; grid data analytics; security and resiliency of power grid infrastructures; microgrids; protection systems; energy system economics and optimization; electricity markets; power system harmonics; power quality; and distributed generation.

**Software Engineering and Systems.** This track involves all aspects of engineering software systems. In addition to the problem of requirements, research and study in the area addresses architecting, designing, building, testing, analyzing, evaluating, deploying, maintaining, and evolving software systems. Problems investigated include theory, techniques, methods, processes, tools, middleware, and environments for all types of software systems in all types of domains and applications. This area of study also is available to working professionals through the Alternatively Scheduled MSE program with a concentration in Software Engineering administered by Texas Engineering Executive Education (TxEEE).

### Graduate Studies Committee

The following faculty members served on the Graduate Studies Committee (GSC) in the spring 2023 semester.

- Jacob A Abraham
- Deji Akinwande
- Andrea Aliu
- Jeffrey G Andrews
- Chandrajit L Bajaj
- Sanjay K Banerjee
- Seth Robert Bank
- Suzanne Barber
- Adela Ben-Yakar
- Alan C Bovik
- Constantine Caramanis
- Ray T Chen
- Sandeep Chinchali
- Derek Chiou
- Shwetadwip Chowdhury
- Michael Arthur Cullinan
- Gustavo A De Veciana
- Inderjit S Dhillon
- Georgios-Alex Dimakis
- Ananth Dodabalapur
- Andrew K Dunn
- Mattan Erez
- Brian L Evans
- Donald S Fussell
- Vijay K Garg
- Andreas Gerstlauer
- Joydeep Ghosh
- Milos Gligoric
- John B Goodenough
- Kristen L Grauman
- Neal Hall
- Mark F Hamilton
- Alex Hanson
- Robert W Heath Jr
- Qin Huang
- Todd E Humphreys
- Warren A Hunt Jr
- Jean Incorvia
- Yao Yao Jia
- Lizy K John
- Brian Johnson
- Christine L Julien
- Sarfraz Khurshid
- Heyji Kim
- Jaydeep Prakash Kulkarni
- Jack C Lee
- Xiuling Li
- Calvin Lin
- Nanshu Lu
- Ruochen Lu
- Diana Marculescu
- Radu Marculescu
- Mia K Markey
- Jose del R Millan
- Aryan Mokhtari
- Evdokia Nikolova
- Michael E Orshansky
- Zhiqiang Pan
- Yale N Patt
- Keshav K Pingali
- Emily Porter
- Lili Qiu
- Leonard F Register
- Christopher J Rossbach
- Sujay Sanghavi
- Samantha Rose Santacruz
- Surya Santoso
- Sanjay Shakkottai
- Shyam Shankar
- August Wang Shi
- David Soloveichik
- S V Sreenivasan
- Peter H Stone
- Earl E Swartzlander Jr
- Jon I Tamir
- Ahmed Hossam Tewfik
- Edison Thomaz Jr
- Mohit Tiwari
- Ufuk Topcu
- Nur A Touba
- James W Tunnell
- Emanuel Tutuc
- Jonathan W Valvano
- Haris Vikalo
- Srimat Vishwanath
- Atlas Wang
- Jun Wang
- Rachel A Ward
- Daniel M Wasserman
- Preston S Wilson
- Neeraja Jayant Yadwadkar
- Ali E Yilmaz
- Edward T Yu
- Amy Zhang
- Yuebing Zheng
- Mingyuan Zhou
- Hao Zhu

### Admission Requirements

Admission to the graduate programs in ECE is highly competitive and based on a holistic review of all application materials by the chosen academic track’s admission committee, which is composed of faculty within that track. Standards for admission generally exceed the minimum standards established by the University. The Chandra Department of ECE neither requires nor considers GRE scores in the selection of students for admission.

Applicants to the graduate program of the Chandra Department of Electrical and Computer Engineering normally will have an undergraduate degree in this field. Applicants with a degree in another field also may be considered if their background is appropriate for the chosen area of specialization. However, if admitted, the student may be required...
to complete additional coursework (outside their Program of Work, discussed below) to address any academic deficiencies. Another exception exists for students in the Integrated BSECE/MSE program who receive their BSECE and MSE degrees simultaneously.

Graduate students in the Chandra Department of Electrical and Computer Engineering are expected to be proficient in English. An applicant who does not meet the English proficiency standards of the University may be admitted, but then may be required to complete a three-hour English course. The course is counted toward the student’s course load for the semester but is not counted toward the fulfillment of course requirements for the graduate degree.