Electrical and Computer Engineering (BSECE/MSE)

The Integrated BSECE/MSE program is designed to provide a smooth and accelerated connection between the Bachelor of Science in Electrical and Computer Engineering (BSECE) degree and the MSE degree and it results in the simultaneous awarding of both degrees. However, the course options and requirements of the MSE portion of the Integrated BSECE/MSE program are identical to those of the Traditional MSE program, and students in the Integrated BSECE/MSE program attend classes with those in the Traditional MSE program and the PhD program and also have access to upper-division undergraduate courses and courses taught outside the Chandra Family Department of ECE.

There are eight named academic concentrations spanning electrical and computer engineering around 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 concentration.

Architecture, Computer Systems, and Embedded Systems. Computer 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, ranging from small embedded IoT devices, autonomous systems, emerging quantum computing systems, to large cloud-based machine learning clusters. 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 and sensing, neural engineering and interfaces, computational biology and bioinformatics, biophotonics and medical imaging, synthetic biology, biomimetic electronics, human-AI teaming, and other areas. Associated faculty have expertise in diverse topics: brain-machine interfaces and neuroprosthetics, neural engineering and neuromodulation, medical and computational imaging, contact tracing and disease-aware navigation, optical biosensing, wearable and flexible bioelectronics, health monitoring and activity recognition, digital biomarkers for disease detection, biomedical instrumentation and embedded systems, bioinformatics and computational genomics, molecular programming and synthetic biology, nanoscale manipulation and drug delivery, and soft robotics for biomedical applications

Decision, Information, and Communications Engineering. This concentration 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, sensor networks; (2) Artificial Intelligence and Machine Learning: all aspects of extraction of knowledge from data, including: algorithms, data mining, optimization, statistics, pattern recognition, predictive analytics, data science and engineering, generative AI, reinforcement learning; and (3) Controls, Signals, and Systems: estimation and detection; signal, image and video processing; computer vision.

Electromagnetics and Acoustics. This concentration includes the study of electromagnetic and acoustic phenomena ranging from ultralow frequencies to the visible spectrum. The activities in electromagnetics involve research in computational methods, microwave and millimeter-wave components and integrated circuits, guided wave devices and systems, wave-matter interactions, antenna design, radar scattering, bioelectromagnetics, wave manipulation using artificial materials, wireless propagation channels, electromagnetic forces and Maxwell's stress tensor. The activities in acoustics involve research in transducers, microelectromechanical systems, radio-frequency and millimeter-wave piezoelectric resonators and filters, atmospheric and underwater acoustics, and noise and vibration control.

Electronics, Photonics, and Quantum Systems. This concentration focuses on the development and improvement of electronic, photonic, optoelectronic, spintronic, and micro-electromechanical (MEMS) materials, devices, and systems for a variety of applications including digital, neuromorphic and quantum computing, high-speed communications, displays, sensors, and power applications. Electronic devices include nano-scaled CMOS transistors and, post-CMOS devices, memory, and compute-in-memory devices including memristors and magnetic and ferroelectric tunnel junctions. Photonic devices include photodetectors, solar cells, optical interconnects, LEDs, and lasers, including those incorporating semiconductor heterostructures, and topological photonic, metamaterials, metasurfaces, and other novel nanophotonic structures. Sensors include those for acoustic, chemical, and biological applications. Material systems include unstrained and strained column-IV and III-V- materials in bulk and quantum-well heterostructures, intrinsically low-dimensional systems including carbon nanotubes (1D) and mono-layer or few-layer graphene or transition metal dichalcogenides structures (2D), and organic and polymer thin films. Thin layers and heterostructures can be created through molecular beam epitaxy or various forms of chemical vapor deposition. Naturally 2D material layers also can be pulled from the layer stacks and manipulated by methods including novel methods developed in-house.

Integrated Circuits and Systems. This concentration 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 concentration 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; GPU/accelerator power delivery and management; 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 across all times scales; grid data analytics; applications of AI to power systems; security and

resilience of power grid infrastructures; protection systems; power system harmonics and power quality.

Software Engineering and Systems. This concentration 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 Handbook

Graduate handbook information is updated and maintained by each program. Graduate handbooks are available within each program's office and online. Please contact the program with concerns or questions.

Objective

The objective of the faculty of the Chandra Family 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.

Admission

Admission to the Integrated BSECE/MSE program is open only to students within the undergraduate program within the Chandra Family Department of Electrical and Computer Engineering at The University of Texas at Austin. Admission requirements and procedures for the graduate portion of the Integrated BSECE/MSE program also are much the same as for the Traditional MSE program, except that students are expected to have taken and reserved for graduate credit two graduate courses prior to entering the graduate portion of the Integrated BSECE/MSE program.

In addition, ECE students in the Integrated BSECE/MSE program start graduate study without the award of a bachelor's degree, and receive their BSECE and MASE simultaneously after successfully completing the program.

Total Hours Required: 150

Undergraduate: 120

Graduate: 30

Plan of Study

The Plan of Study is a suggested four-year course sequence to support academic planning and serves as a helpful guide. Currently enrolled students should meet with their academic advisor to tailor their course selections and timelines to their individual goals and circumstances.

Course	Title	Hours
Year 1		
Semester 1		
ECE 302	Introduction to Electrical Engineering	3
ECE 306	Introduction to Computing	3
RHE 306	Rhetoric and Writing	3
M 408C	Differential and Integral Calculus	4
First-Year Signature Course (090)		3
	Hours	**16**
Semester 2		
ECE 319K	Introduction to Embedded Systems	3
M 408D	Sequences, Series, and Multivariable Calculus	4
PHY 303K	Engineering Physics I	3
PHY 105M	Laboratory For Physics 302K, 303K, and 317K	1
Visual and Performing Arts (050)		3
	Hours	**14**
Year 2		
Semester 1		
ECE 411	Circuit Theory	4
M 427J	Differential Equations with Linear Algebra	4
PHY 303L	Engineering Physics II	3
PHY 105N	Laboratory For Physics 302L, 303L, and 317L	1
Social and Behavioral Sciences (080)		3
	Hours	**15**
Semester 2		
ECE 312	Software Design and Implementation I	3
ECE 313	Linear Systems and Signals	3
M 340L	Matrices and Matrix Calculations	3
Humanities (040)		3
Free Elective		2
	Hours	**14**
Year 3		
Semester 1		
ECE 333T	Engineering Communication	3
ECE 351K	Probability and Random Processes	3
Advanced technical Math component		4
Advanced technical component requirement		3
American and Texas Government (070)		3
	Hours	**16**
Semester 2		
ECE 316	Digital Logic Design	3
Advanced technical component requirement		3
Advanced technical component elective		3
Advanced technical component laboratory		4
Free elective (mathematics or basic science)		4
	Hours	**17**
Year 4		
Semester 1		
ECE 364D	Introduction to Engineering Design	3
Advanced technical component electives		6
U.S. History (060)		3
Free Elective		3
Graduate Coursework		3
	Hours	**18**
Semester 2		
ECE 464C	Corporate Senior Design Project	4
U.S. History (060)		3
American and Texas Government (070)		3
Free Elective		3
Graduate Coursework		3
	Hours	**16**
Year 5		
Semester 1		
Graduate Coursework		9
	Hours	**9**
Semester 2		
Graduate Coursework		9
	Hours	**9**

Semester 3	
Graduate Coursework	6
Hours	**6**
Total Hours	**150**

Requirements

All requirements are listed below, starting with the most specialized moving to the most general. Additional requirements may follow the table, so be sure to read the entire page. Some required courses listed below may also satisfy General Education requirements, including Core Curriculum.

Code	Title	Hours
Undergraduate		
Concentration		
One of the following concentrations:		21
	Electrical and Computer Engineering, Computer Architecture and Embedded Systems	
	Electrical and Computer Engineering, Communications, Signal Processing, Networks, and Systems	
	Electrical and Computer Engineering, Data Science and Information Processing	
	Electrical and Computer Engineering, Electronics and Integrated Circuits	
	Electrical and Computer Engineering, Energy Systems and Renewable Energy	
	Electrical and Computer Engineering, Fields, Waves, and Electromagnetic Systems	
	Electrical and Computer Engineering, Nanoelectronics and Nanotechnology	
	Electrical and Computer Engineering, Software Engineering and Design	
Subtotal		*21*
Degree (see details below)		
Bachelor of Science in Electrical and Computer Engineering		61
Free electives: Additional coursework to reach total hours required.		14
Subtotal		*75*
General Education		
Remaining Core Curriculum (42 hours total)		24
Foreign Language other than English, Beginning Proficiency		
Subtotal		*24*
College Requirements - Engineering		
General University Requirements		
Graduate		**30**
Total Hours		**150**

Additional Requirements and Policies

The integrated program requires 120 semester credit hours (SCH) for the BSECE portion of the integrated program, as opposed to the 125 SCH minimum required for the BSECE degree alone. Students in the integrated program begin taking graduate courses as seniors. Students admitted to the integrated program will normally take and reserve for graduate credit two graduate courses in place of approved electives from the advanced technical coursework that would *otherwise* be required in the regular/standalone BSECE program. However, precisely which BSECE electives are to be replaced by the graduate courses can be adjusted as approved by technical core faculty advisors.

Students in this program will receive the BSECE and MSE degrees simultaneously after successfully completing a minimum total of 150 semester credit hours, 30 of which must qualify for the MSE program of work in electrical and computer engineering. Students unable to successfully complete the integrated program may obtain a BSECE degree by satisfying all of the requirements for the standalone BSECE degree. Since the regular BSECE degree requirements are a subset of the Integrated BSECE/MSE Program degree requirements, an undergraduate student should still be on a trajectory to graduate with the regular BSECE degree in the same timeframe that the student was on when applying to the Integrated BSECE/MSE Program. A student dismissed from the integrated program while a graduate student should already meet the degree requirements for the regular BSECE degree.

Graduate Requirements

The Integrated BSECE/MSE program has the same academic track advisors as the traditional MSE program. Students in each of these MSE programs are expected to meet the same academic standards.

The Integrated MSE program offers thesis, report, and coursework-only options. The thesis option requires original research and satisfactory completion of a written thesis and two associated three-hour *Thesis* courses taken on the credit/no credit basis within the 30-hour MSE Program of Work. The report option requires satisfactory completion of a written report and one associated three-hour *Report* course taken on the credit/no credit basis within the 30-hour MSE Program of Work. Otherwise, all other courses that count toward the MSE Program of Work must be classroom courses and taken for a letter grade. Up to six semester hours (two semester-long courses) or the quarter system equivalent of graduate coursework taken elsewhere but not used for a prior degree may be used for the Program of Work with approval. A minimum grade point average of 3.00 (B) is required within the MSE Program of Work for coursework taken at The University of Texas at Austin as a Graduate student. The MSE Program of Work including graduate coursework taken at other institutions and taken at The University of Texas at Austin as an undergraduate and reserved for graduate credit should meet this standard also. Moreover, only one course with a grade less than B−, no course with a grade less than C, and no course with a grade of less than B taken at another institution may be counted within the MSE Program of Work. The student's MSE Program of Work must be approved by the student's academic track advisor or by the student's individual supervisor, then by the graduate advisor of the Chandra Family Department of ECE, and finally by the Office of Graduate and Postdoctoral Studies of The University of Texas at Austin.

Code	Title	Hours
Please see the following links for more information about degree requirements and policies:		
Graduate Engineering Requirements		
Graduate University Requirements		

Consult departments/programs regarding the Graduate University Requirements as some departments/programs have stricter degree requirements.