Electrical Engineering - Graduate Programs

Objective

The course offerings provide the student with an opportunity to broaden as well as to intensify his or her knowledge in a number of areas of electrical engineering.

Graduate study and research are offered in the areas of:

1. Communication and signal processing: Communication and signal processing are enabling technologies that make our world digital and connected. This field uses fundamental theory in signal and information processing, designs spectrum and energy efficient communications system or sensor networks for data gathering and transmission, and keeps pushing the scientific discovery boundaries. Recent examples include 5G mobile wireless communications, Internet of Things, Machine Learning, Big Data, Virtual Reality, etc.
2. Computer and digital circuit: Computer and digital circuit engineering is the area to integrate digital electronics with computer sciences, involving hardware and software in a wide range of industry sectors and consumer's daily life. Many of our household and commercial items make use of digital electronics include computers, smartphones, vehicles, airplanes, televisions, remote controls, and other entertainment systems. Computer hardware engineers, including digital circuit designers, work on developing microprocessors, memory chips, data storage, and computer networking devices while computer software engineers develop operating systems, computer programs, computer networks, and software securities. Examples of Local Employers: Texas Instruments, TSMC, Facebook, Lockheed Martin, Intel, Mathworks, Boeing.
3. Control Systems: Control Systems Engineering studies the design and implementation of Feedback Control Systems which are responsible for the safe and efficient automatic operation of all human engineered systems. Examples include aircraft autopilots, automobile speed control, automated drug delivery, and industrial process control. The theoretical basis for Modern control systems was developed during the Industrial Revolution in the 18th century for the steam engine, steam locomotive, and automated windmills.
4. Photonics and Electronics: Photonics is the science of using light to generate energy, detect information, or transmit information. The main purpose of the photonics engineering field is to develop new and innovative products for medicine, telecommunications, manufacturing, and construction. From light that can connect all electronic devices, to ultra-performance lasers used in data centers and autonomous cars, photonics engineers are responsible for significant scientific discoveries and smart societies.
5. Power and Energy: Power Systems engineers work on the design, develop, and operate of the electrical power system that delivers electricity customers with high reliability and quality. The field is broad and is becoming broader with the move of deregulation, smart grid development, decarbonization, and inverter-based resources. Future power systems engineers will have to implement more intelligent control, low environmental impacted resources, battery storage systems, and power electronic converters for global power system transformation.

The program is designed to satisfy the needs of students pursuing master's and doctoral degrees and to provide for the student seeking to increase knowledge in areas of electrical engineering related to engineering practice. The courses offered will provide practicing engineers with advanced, up-to-date education in electrical engineering.

Continuation

The Electrical Engineering Graduate Program, in fulfillment of its responsibility to graduate highly qualified engineers, has established certain policies and procedures. In addition to the requirements of the Graduate School listed elsewhere, to continue in the program each electrical engineering graduate student must maintain at least a B (3.0) GPA in all electrical engineering coursework and at least a B (3.0) GPA in all coursework for M.S. students. A student working toward a Ph.D. must maintain a 3.5 GPA in all electrical engineering coursework and at least a 3.5 GPA in all coursework.

Admission Criteria

The admission process considers all of the application material including official transcripts, GRE and TOEFL or IELTS scores. No single objective factor is used to finalize the decision for admission or to deny admission. It is expected that an applicant have background in such areas as linear systems, dc and ac electronics circuits, static and dynamic electromagnetic fields, microprocessors, among the courses completed in a typical electrical engineering curriculum. Students with a BS in other fields are encouraged to apply, but they may be required to remedy a lack of required EE courses by taking some undergraduate EE courses. An attempt will be made to match the technical aspirations of the potential graduate students with the departmental resources in order to provide a stimulating academic environment for the students and their graduate education.

Criteria concerning (1) unconditional admission, (2) provisional admission, (3) probationary admission, (4) deferred admission, (5) denial of admission, and (6) fellowship, are given below.

1. Admission with Unconditional Status: The Department has two alternative sets of conditions that allow applicants to be unconditionally admitted to the MS program. The Departmental Graduate Advisor(s) reviews all applications and determines if they qualify for admission under one of these two sets of criteria. Applicants who are not unconditionally admitted may be admitted with provisional or probationary status, their admission may be deferred or admission may be denied.

Unconditional Admission Set #1: GRE Condition

A typical MS applicant who is "admitted" will have met the following admission requirements.

• The minimum undergraduate GPA requirement - For MSEE admission 3.25 (on a 4.0 scale) based on upper division coursework (junior and senior level or equivalent)
• Relevance of the student's undergraduate degree(background) to the EE curriculum.
• Rigor of the student's Bachelor's degree.
• Reputation of the University/College that the student received his/her previous degrees
• GRE scores of at least the following:
Quantitative score
= 720 (new scale: 156) for M.S.
or
= 750 (new scale: 159) for Ph.D.
Verbal score = 400 (new scale: 146)
Analytical Writing = 3 for M.S. or =3.5 for Ph.D
• For an International student, an additional requirement beyond those stated above: The applicant must meet the minimum university English language requirements as detailed in the general admission requirements section of the catalog.

Unconditional Admission Set #2: GRE Waiver A typical applicant who is "admitted" will have met the following admission requirements.
• The student must have graduated from or be in the final year of the EE bachelor's degree program*:
• at UT Arlington
• at another reputable ABET-accredited EE bachelor's degree program

or

• at other select universities.**

*Students admitted during the final year of undergraduate study must demonstrate successful completion of the bachelor's degree.

**Subject to Graduate Advisor approval.
• The student's undergraduate grade-point average must equal or exceed 3.25 in the following calculations:

• as calculated for admission to the Graduate School;
• overall;
• in the major field; and
in all upper-division work

2. Admission with Provisional status: An applicant unable to supply all required official documentation prior to the admission deadline, but whose available documentation otherwise appears to meet admission requirements may be granted provisional admission.

3. Admission with Probationary status: An applicant whose undergraduate courses do not cover the breadth required for a MS student.

4. Deferred status: A deferred decision may be granted when a file is incomplete.

5. Denied Status: An applicant that does not meet categories 1, 2, 3 or 4 above will be denied admission.

6. Fellowships: Award of a fellowship will be based on the criteria required by the sponsor agency (including the graduate school) on a competitive basis.

Master's Degree Requirements

Master's degree requirements are described in the general catalog section titled Requirements for the Master's Degree/Degree Plans and Hours Required. The MSEE degree options available are thesis option and non-thesis option. The MSEE program of work in electrical engineering may include up to nine graduate level semester hours of supporting courses outside the Electrical Engineering Department in math, science and engineering. The Graduate Advisor must approve supporting courses that are permitted on a degree plan. The thesis option requires 24 semester hours plus six semester hours of thesis (30 semester hours), and the student's thesis supervisory committee shall consist of at least two members of the Graduate Faculty, and the Committee Chair must be in Electrical Engineering. The non-thesis option requires 30 semester hours.

The EE department also offers a MS Fast Track option. Information about this option can be obtained from the EE Graduate and Undergraduate Advisors.

Admission Criteria

The admission process considers all of the application material including official transcripts, GRE scores, letters of recommendation, and the statement of purpose. No single objective factor is used to finalize the decision for admission or to deny admission. It is expected that an applicant have background in such areas as linear systems, dc and ac electronics circuits, static and dynamic electromagnetic fields, microprocessors, among the courses completed in a typical electrical engineering curriculum. Students with a BS in other fields are encouraged to apply, but they may be required to remedy a lack of required EE courses by taking some undergraduate EE courses. An attempt will be made to match the technical aspirations of the

potential graduate students with the departmental resources in order to provide a stimulating academic environment for the students and their graduate education.

Criteria concerning (1) unconditional admission, (2) provisional admission, (3) deferred admission, (4) denial of admission, and (5) fellowship, are given below.

1. Admission with Unconditional Status: A typical applicant who is "admitted" will have met the following admission requirements.
   - The minimum undergraduate GPA requirement
     i. For Ph.D. admission 3.5 based on MSEE or equivalent
   - Relevance of the student's undergraduate degree (background) to the EE curriculum.
   - Rigor of the student's Bachelor's degree.
   - Reputation of the University/College that the student received his/her previous degrees
   - The publications in scholarly conferences/journals are optional but will improve both a student's chances of securing admission and receiving financial support.
   - Three recommendation letters from individuals who can judge the probability of success of the student's graduate study.
   - GRE scores of at least the following:
   - Quantitative score
     = 720 (new scale: 156) for M.S.
     or
     = 750 (new scale: 159) for Ph.D.
   - Verbal score = 400 (new scale: 146)
   - Analytical Writing = 3 for M.S. or =3.5 for Ph.D
   - For an International student, an additional requirement beyond those stated above:

     The applicant must meet the minimum university English language requirements as detailed in the general admission requirements section of the catalog. However, meeting the minimum requirement does not guarantee admission. The program will give preference to students with a TOEFL score of 79 for the internet-based test with a minimum of writing 22, speaking 21, reading 20, listening 16 in each of the four categories. Alternatively, IELTS scores of 6.5 in all categories will be viewed similarly.
2. Admission with Provisional status: An applicant unable to supply all required official documentation prior to the admission deadline, but whose available documentation otherwise appears to meet admission requirements may be granted provisional admission.
3. Deferred status: A deferred decision may be granted when a file is incomplete.
4. Denied Status: An applicant that does not meet categories 1, 2 or 3 above will be denied admission.
5. Fellowships: Award of a fellowship will be based on the criteria required by the sponsor agency (including the graduate school) on a competitive basis.

Doctoral Degree Requirements

The Ph.D. is a degree with emphasis on research. Requirements for the doctoral degree are described elsewhere in the general catalog section on Degree Offerings/Requirements. Permission to continue beyond the master's degree will be based on the grade point average and GRE scores as described above. Approval to continue in the doctoral program is given by satisfactory completion of the following procedure:

1. Obtaining the approval of a dissertation adviser, and
2. Passing the Diagnostic Examination. This exam will be over the three Technical Proficiency areas selected by the student.

Review courses for the Diagnostic Examination should be completed during the M.S. degree or during the first 30 graduate hours required for entrance into the Ph.D. program.

This procedure must be completed within the year of coursework toward the Ph.D. A student not having attempted the Diagnostic Examination by this time will be allowed one more opportunity to take the examination during the next full semester.

The program of work is expected to include a minimum of 15 semester hours of advanced graduate level coursework beyond the master's degree and sufficient dissertation semester hours as required to complete the dissertation. All graduate level courses are counted in the 15 hour minimum. Among the 15 hour minimum, a minimum of 6 semester hours of advanced graduate level coursework is required. The supervising professor may require additional coursework beyond the 15 hour minimum if deemed necessary to accomplish the research required for the dissertation. These courses may include graduate level mathematics, science, or engineering relevant to the student's dissertation program, but only with approval of the Graduate Advisor.

For the direct PhD program, the program of work is expected to include a minimum of 30 semester hours of graduate level coursework beyond the bachelor's degree and sufficient dissertation semester hours as required to complete the dissertation. Among the 30 hour minimum, a minimum of 6 semester hours of advanced graduate level coursework is required.

The status of a doctoral candidate is approved for students who have passed an oral Comprehensive Examination (a comprehensive dissertation proposal) and submitted a Final Program of Work. The Comprehensive Examination will be required by the time the student has completed the required coursework. If the student fails the examination, he/she would be given one more chance to pass it no later than during the following semester. Upon completion of the Comprehensive Examination, the candidate should enroll in the dissertation course EE 6699 DISSERTATION or EE 7399. The student can only enroll in EE 7399 DOCTORAL DEGREE COMPLETION one time. If the student does not graduate in the semester EE 7399 is used, all future semesters the student must enroll in EE 6699 until the dissertation is defended. 9 semester hours of Dissertation is required to graduate.

Ph.D. Supervisory Committee

A doctoral student's committee shall consist of at least three members of the Graduate Faculty, a majority of whom must be in Electrical Engineering.

NOTE: Please see the MID-YEAR CATALOG ADDENDUM **(**https://catalog.uta.edu/midyearaddendum/**) for information about new *Graduate Certificates in Cyber-physical Systems and Electric Propulsion.***

Graduate Certificate in Power System Management

PROGRAM OBJECTIVE

The certificate program will emphasize the common aspects of Power System Management (PSM) including renewable energy, utility deregulation, distributed energy resources, and smart grid development, while also providing training in traditional power system operation and control. This program aims at the dual goal of providing the utility industry with a knowledgeable, locally available workforce and offering career advancement opportunities for their employees. This will also enhance employment opportunities of the participants in industry, government, and service sectors.

Upon completion, students will be able to:

- Model the transmission lines, distribution lines, generators, transformers, and loads.
- Perform Power Flow, Short Circuit, and Stability Analyses.
- Understand the principles and operation of deregulated market.
- Understand and analyze the operation of the distribution networks.
- Design operation and control strategies of Microgrid, Virtual Power Plants, and Distributed Energy Resources.
- Perform study on renewable energies integration.
- Understand main techniques on converter and inverter design. Use power electronic devices for grid following and grid forming.
- Utilize the Programmable Logic Controllers (PLC) in industrial automation and energy systems monitoring and control.
- Apply transducers and Intelligent Electronic Devices (IED) on Supervisory Control and Data Acquisition (SCADA) systems, and Distributed Control Systems (DCS).
- Understand the impact of power quality on the operation of the power system and develop strategies for power quality improvement.

ADMISSION REQUIREMENTS

Unconditional Admission is granted if all of the following conditions are met:

Stand-alone certificate

- A Bachelor's degree in an engineering discipline with a minimum GPA of 3.0.
- Those who desire to complete the certificate program without enrolling in graduate degree program must be admitted to UTA as a non#degree seeking student.
- An essay detailing the applicant's background and skills as pertaining to PSM, his/her interest in a specific domain and his/her expected benefit from completing this program.

Concurrent certificate

- A Bachelor's degree in an engineering discipline with a minimum GPA of 3.25 (junior and senior level or equivalent) or a current enrollment in an engineering Master's program at UTA with a minimum GPA of 3.0.
- An essay detailing the applicant's background and skills as pertaining to PSM, his/her interest in a specific domain and his/her expected benefit from completing this program.
- GRE Quantitative and Verbal sections scores should meet the EE admission requirement for new applicants.
- If English is not the applicant's native language, he/she should meet the EE admission requirement on TOEFL iBT, or IELTS. International applicants who have successfully completed a BS or MS from an institution in the United States and are not seeking funding as a Graduate Teaching Assistant, are not required to meet this requirement.
- Performance on the GRE will not be the sole criterion for admitting applicants or denying admission to the master's program. In cases where GRE performance does not meet the minimum requirements, all other qualifications presented by the applicant will be carefully evaluated for evidence of potential for success.

ACADEMIC REQUIREMENTS

Students must complete one (1) required/Core course and two (2) elective courses as outlined above. All courses used to satisfy the certificate requirements must be passed with a grade of B or better. The time limit for completion of the Certificate Program is 6 years.

Students who successfully complete the non-degree certificate program will be eligible to apply for admission to the MS in Electrical Engineering and count course credit from the certificate toward completion of non-degree certificate.

Required/Core Courses		
EE 5308	POWER SYSTEM MODELING AND ANALYSIS	3
Elective Courses		
EE 5371	POWER SYSTEM PLANNING, OPERATION, AND CONTROL IN A DEREGULATED ENVIRONMENT	3
EE 5374	POWER SYSTEM PROTECTIVE RELAYING	3
EE 5375	POWER SYSTEM DISTRIBUTION	3
EE 5377	PROGRAMMABLE LOGIC CONTROLLERS IN INDUSTRIAL AUTOMATION	3
EE 5378	POWER QUALITY	3
EE 6353	CONVEX OPTIMIZATION FOR ENGINEERS	3
EE 6373	RENEWABLE ENERGY SYSTEMS	3
EE 6375	POWER ELECTRONICS ENGINEERING	3

Graduate Certificate in Photonic Devices and Systems

PROGRAM OBJECTIVE

Students completing this certificate program will gain both fundamental and practical understanding of the Photonics technology, including the optical systems, lasers, photonic devices and sub-systems, and methods widely employed in the industry. They will be prepared to take part in developing and operating various photonic devices, sub-systems, and systems for optical communications / information technology, chemical and biomedical sensing, solar-energy conversion, as well as space and defense applications. The knowledge and skills acquired by the students will facilitate the next steps in their careers and enhance their employment potential in industrial and government sectors.

Upon completion, students will be able to:

- Describe propagation of light in free space, at dielectric interfaces, in birefringent and semiconducting materials, and in waveguides;
- Design and analyze simple imaging systems consisting of lenses and mirrors;
- Understand principles of operation and design trade-offs of key photonic devices and instruments: lasers, optical amplifiers, modulators, filters, couplers, polarizers, waveplates, interferometers, spectrometers, detectors, solar cells, optical sensors, etc.;
- List important applications of second- and third-order nonlinear effects in classical and quantum optics.
- Describe principles and key features of second harmonic generation, optical parametric amplification, self- and cross-phase modulation, four-wave mixing, and Raman amplification.
- Identify the main components of modern WDM communication systems, make simple estimates of system’s performance under various conditions, and design a system with appropriate parameters for given application.
- Understand modern biological and chemical sensing techniques and their applications;
- List basic principles, applications, and latest advances in the area of nanophotonics;
- Understand main techniques used in nano- and micro-fabrication;
- Perform basic fabrication and processing steps for simple electronic / photonic devices.

ADMISSION REQUIREMENTS

Unconditional Admission is granted if all of the following conditions are met:

Stand-alone certificate

- A Bachelor’s or Master’s degree in a STEM discipline is required.
- Those who desire to complete the certificate program without enrolling in graduate degree program must be admitted to UTA as a non#degree seeking student.
- A personal statement detailing the applicant’s background and skills pertaining to photonics, his/her interest in specific topics, and his/her expected benefit from completing this program.

Concurrent certificate

The unconditional admission criteria are the same as those to the MSEE program, which are currently as follows:

- A Bachelor’s degree in an engineering discipline with a minimum GPA of 3.25 (junior and senior level or equivalent) or a current enrollment in an engineering Master’s program at UTA with a minimum GPA of 3.0.
- GRE Quantitative and Verbal sections scores should meet the EE admission requirement for new applicants.
- If English is not the applicant's native language, he/she should meet the EE admission requirement on TOEFL iBT, or IELTS. International applicants who have successfully completed a BS or MS from an institution in the United States and are not seeking funding as a Graduate Teaching Assistant, are not required to meet this requirement.
- Performance on the GRE will not be the sole criterion for admitting applicants or denying admission to the master's program. In cases where GRE performance does not meet the minimum requirements, all other qualifications presented by the applicant will be carefully evaluated for evidence of potential for success.

ACADEMIC REQUIREMENTS

The certificate consists of 12 hours of graduate work with at least a 3.0 GPA at UTA. The time limit for completion of the Certificate Program is 6 years.

Students who successfully complete the non-degree certificate program will be eligible to apply for admission to the MS in Electrical Engineering and count course credit from the certificate toward completion of non-degree certificate

Required/Core Courses		
EE 5380	PRINCIPLES OF PHOTONICS AND OPTICAL ENGINEERING	3
EE 5384	OPTOELECTRONIC DEVICES FOR COMMUNICATION	3
Elective Courses		
Select two courses from the following list:		
EE 5343	SILICON INTEGRATED CIRCUIT FABRICATION TECHNOLOGY	3
EE 5385	NONLINEAR OPTICS	3
EE 5388	LASERS	3
EE 5389	TOPICS IN OPTICS (Nanophotonic Device Engineering)	3
EE 5389	TOPICS IN OPTICS (Silicon Photonics)	3
EE 6365	ADVANCED FIBER OPTICS SYSTEMS	3
EE 6381	NANOPHOTONICS	3
EE 6382	OPTICAL BIOSENSORS: INSTRUMENTATION AND TECHNIQUES	3

CSE/EE Graduate Certificate in Embedded Systems

PROGRAM OBJECTIVE

The Graduate Certificate in Embedded Systems is offered through the Computer Science and Engineering Department and Electrical Engineering Department. The certificate will educate graduate students in the knowledge and skills required to design and test embedded systems, using microcontrollers, system-on-chip, and FPGA devices. Topics include multi-threaded programming on bare-metal, custom real-time operating systems, and embedded Linux systems; implementation of IP stacks for computer networking; network and wireless protocol development for Internet of Things devices; design of real-time operating systems; implementation of RISC processors in FPGA devices; design of advanced digital logic systems; and control of systems with electromechanical actuators and sensors.

Our Embedded Systems Certificate is intended to educate students in the knowledge and skills required to:

- Design and test embedded systems
- Use microcontrollers, system-on-chip, and FPGA devices
- Understand multi-threaded programming on bare-metal, custom real-time operating systems, and embedded Linux systems
- Implement IP stacks for computer networking
- Develop network and wireless protocols for Internet of Things devices
- Design real-time operating systems
- Implement RISC processors in FPGA devices
- Design advanced digital logic systems
- Design control systems with electromechanical actuators and sensors

ADMISSION REQUIREMENTS

The certificate can be taken by current UTA graduate students or by persons not currently enrolled in UTA who hold at least a BS degree or equivalent. The admission criterion is the successful completion of CSE 3442 (Embedded Systems I), CSE 5400 (Fundamentals of Computer Engineering), or EE 5314 (Embedded Microcontrollers).

The program consists of 4 graduate-level classes. Current students need only take the courses listed for the certificate and then submit a Request for Certificate form to the Office of Records. At the end of each term, the Office of Records will evaluate the requests.

ACADEMIC REQUIREMENTS

A grade of C or better and an overall GPA of 3.0 or higher is required in all courses counted towards the completion of the certificate. Students enrolled in the certificate program will take courses with students studying for master's and/or PhD programs in the CSE or EE Department.

Required/Core Courses		
CSE 5342	EMBEDDED SYSTEMS II	3
3 of the following Elective Courses		
CSE 5352	IoT AND NETWORKING	3
CSE 5354	REAL-TIME OPERATING SYSTEMS	3
or EE 6314	ADVANCED EMBEDDED MICROCONTROLLER SYSTEMS	
CSE 5355	ELECTROMECHANICAL SYSTEMS AND SENSORS	3
EE 5315	SYSTEM ON CHIP (SOC) DESIGN	3
or CSE 5356	SYSTEM ON CHIP (SoC) DESIGN	
CSE 5357	ADVANCED DIGITAL LOGIC DESIGN	3
CSE 5372	RISC PROCESSOR DESIGN	3