Program Overview

The Master of Science (M.S.) degree with a major in Electrical Engineering provides a practical, industry-driven focus via a long-term, targeted thesis or courses related to real-world electrical or computer engineering applications. The degree requires a thesis or relevant additional courses because the abilities to solve problems, innovate and make immediate contributions to industry are best developed by having students confront a substantial, open-ended problem; perform detailed research on the problem; develop various solutions; choose and implement the best solution; validate their choice; and effectively communicate the process to professional colleagues, executives, and customers.

- completed online application
- $55 nonrefundable application fee

  or

- $90 nonrefundable application fee for applications with international credentials
- baccalaureate degree in engineering, computer science, physics, technology, or a closely related field from a regionally accredited university (Non-U.S. degrees must be equivalent to a four-year U.S. Bachelor's degree. In most cases, three-year degrees are not considered. Visit our International FAQs (https://www.gradcollege.txst.edu/international/faqs.html) for more information.)
- official transcripts from **each institution** where course credit was granted
- 2.75 overall GPA or a 2.75 GPA in the last 60 hours of undergraduate course work (plus any completed graduate courses)
- official GRE (general test only) with competitive scores in the verbal reasoning and quantitative reasoning and writing sections will be required. Texas State University students are exempt from this requirement
- resume/CV detailing prior work experience, research experience, awards, scholarships, and other related qualifications
- statement of purpose (two pages) conveying research interests, plans for graduate study, and professional aspirations
- two letters of recommendation from non-related individuals familiar with the student's scholarly work and/or relevant work experience

Approved English Proficiency Exam Scores

Applicants are required to submit an approved English proficiency exam score that meets the minimum program requirements below unless they have earned a bachelor's degree or higher from a regionally accredited U.S. institution or the equivalent from a country on our exempt countries list (http://www.gradcollege.txstate.edu/international/language.html#waiver).

- official TOEFL iBT scores required with a 78 overall
- official PTE scores required with a 52 overall
- official IELTS (academic) scores required with a 6.5 overall and minimum individual module scores of 6.0
- official Duolingo Scores required with a 110 overall
- official TOEFL Essentials scores required with an 8.5 overall

This program does **not** offer admission if the scores above are not met.

Additional Information

Non-credit (leveling) course work may be required prior to admission into the program if the student lacks sufficient background course work. Any required leveling course work must be completed with grades of B or better prior to admission.

Degree Requirements

The Master of Science (M.S.) degree with a major in Electrical Engineering requires 31 semester credit hours, including a thesis.

Non-credit (leveling) course work may be required prior to admission into the program if you lack sufficient background course work. Any required leveling course work must be completed with grades of B or better prior to admission.

All students will have a faculty advisor and a graduate committee composed of a minimum of three graduate faculty members (including the faculty advisor). The faculty advisor will provide technical direction for the student's thesis, and the graduate committee will be responsible for approving the thesis proposal, receiving thesis progress reports, and approving the final thesis presentation and written report. The oral project presentation will serve as the comprehensive examination.

Course Requirements

Code	Title	Hours
Required Courses		
ENGR 5310	Probability, Random Variables, & Stochastic Processes for Engineers	3
ENGR 5100	Seminar in Engineering	1
EE 5351	Analog CMOS Integrated Circuit Design	3
Prescribed Electives		**6**
Machine Learning, AI, Computer and Digital Design		
EE 5320	Advanced Computer Architecture and Arithmetic	
EE 5377	Statistical Signal Processing	
EE 5321	Computer-Aided Engineering Simulations on HPC Systems	
Machine Learning, AI, Computer and Digital Design		
EE 5353	Fundamentals of Advanced Semiconductor Technology	
EE 5355	Electronic Materials and Devices	
EE 5351	Analog CMOS Integrated Circuit Design	
Smart Energy, Power and Mobility Systems		
EE 5375	Smart Grid: an Application Development Platform	
EE 5357	Power Systems for Engineering	
EE 5382	Advanced Power Systems Analysis	
Engineering Electives		**12**
EE 5320	Advanced Computer Architecture and Arithmetic	
EE 5321	Computer-Aided Engineering Simulations on HPC Systems	
EE 5323	Digital Image Processing	
EE 5330	Embedded and Real-Time Computing	
EE 5350	Advanced Electronic Circuit Design	
EE 5353	Fundamentals of Advanced Semiconductor Technology	
EE 5354	Flexible Electronics	
EE 5355	Electronic Materials and Devices	

EE 5357	Power Systems for Engineering	
EE 5360	Thin Film Technology	
EE 5361	Nanofabrication Technology for Semiconductor Device Processing	
EE 5372	Advanced Networking	
EE 5374	Advanced Wireless Communication	
EE 5375	Smart Grid: an Application Development Platform	
EE 5377	Statistical Signal Processing	
EE 5398A	Antenna Theory, Design and Applications	
EE 5398B	Electronic Materials and Beyond for Sustainable Energy	
IE 5310	Advanced Statistical Design of Experiments for Engineers	
PHYS 5322	Semiconductor Device Microfabrication	
PHYS 5324	Thin Film Synthesis and Characterization Laboratory	
PHYS 5332	Materials Characterization	
CS 5310	Network and Communication Systems	
CS 5318	Principles of Programming Languages	
CS 5329	Algorithm Design and Analysis	
CS 5332	Data Base Theory and Design	
CS 5341	Advanced Network Programming	
CS 5343	Wireless Communications and Networks	
CS 5346	Advanced Artificial Intelligence	
CS 5351	Parallel Processing	
CS 5352	Distributed Computing	
EE 7300	Research Methods and Technical Writing in Electrical and Computer Engineering	
EE 7301	Advanced Digital System Design	
EE 7305	Energy Storage and Sustainability	
EE 7306	Artificial Intelligence in Smart Grids	
EE 7308	High and Medium Voltage Power Transmission	
EE 7374	Smart Data Networks	
Thesis		
ENGR 5399A	Thesis	3
Choose a minimum of 3 hours from the following:		3
ENGR 5199B	Thesis	
ENGR 5299B	Thesis	
ENGR 5399B	Thesis	
ENGR 5599B	Thesis	
ENGR 5999B	Thesis	
Total Hours		**31**

Comprehensive Examination Requirement

An oral thesis defense is required. This oral defense will serve as the comprehensive examination requirement. If the thesis committee is not satisfied with a graduate student's oral defense, they specify all deficiencies the student must resolve. The thesis committee will not sign the Master's Comprehensive Examination Report Form and the Thesis Submission Approval Form until all specified deficiencies have been resolved. Should the thesis committee decide to hold a second oral defense, the chair of the thesis committee shall not schedule the second defense until the student has resolved all specified deficiencies. Students who do not successfully complete the requirements for the degree within the timelines specified will be dismissed from the program.

If a student elects to follow the thesis option for the degree, a committee to direct the written thesis will be established. The thesis must demonstrate the student's capability for research and independent thought. Preparation of the thesis must be in conformity with the *Graduate College Guide to Preparing and Submitting a Thesis or Dissertation*.

Thesis Proposal (http://www.gradcollege.txstate.edu/docs/Thesis_Diss_Guide.pdf)

The student must submit an official Thesis Proposal Form (http://www.gradcollege.txstate.edu/forms.html) and proposal to his or her thesis committee. Thesis proposals vary by department and discipline. Please see your department for proposal guidelines and requirements. After signing the form and obtaining committee members' signatures, the graduate advisor's signature if required by the program and the department chair's signature, the student must submit the Thesis Proposal Form with one copy of the proposal attached to the dean of The Graduate College for approval before proceeding with research on the thesis. If the thesis research involves human subjects, the student must obtain exemption or approval from the Texas State Institutional Review Board prior to submitting the proposal form to The Graduate College. The IRB approval letter should be included with the proposal form. If the thesis research involves vertebrate animals, the proposal form must include the Texas State IACUC approval code. It is recommended that the thesis proposal form be submitted to the dean of The Graduate College by the end of the student's enrollment in 5399A. Failure to submit the thesis proposal in a timely fashion may result in delayed graduation.

Thesis Committee

The thesis committee must be composed of a minimum of three approved graduate faculty members.

Thesis Enrollment and Credit

The completion of a minimum of six hours of thesis enrollment is required. For a student's initial thesis course enrollment, the student will need to register for thesis course number 5399A. After that, the student will enroll in thesis B courses, in each subsequent semester until the thesis is defended with the department and approved by The Graduate College. Preliminary discussions regarding the selection of a topic and assignment to a research supervisor will not require enrollment for the thesis course.

Students must be enrolled in thesis credits if they are receiving supervision and/or are using university resources related to their thesis work. The number of thesis credit hours students enroll in must reflect the amount of work being done on the thesis that semester. It is the responsibility of the committee chair to ensure that students are making adequate progress toward their degree throughout the thesis process. Failure to register for the thesis course during a term in which supervision is received may result in postponement of graduation. After initial enrollment in 5399A, the student will continue to enroll in a thesis B course as long as it takes to complete the thesis. Thesis projects are by definition original and individualized projects. As such, depending on the topic, methodology, and other factors, some projects may take longer than others to complete. If the thesis requires work beyond the minimum number of thesis credits needed for the degree, the student may enroll in

additional thesis credits at the committee chair's discretion. In the rare case when a student has not previously enrolled in thesis and plans to work on and complete the thesis in one term, the student will enroll in both 5399A and 5399B.

The only grades assigned for thesis courses are PR (progress), CR (credit), W (withdrew), and F (failing). If acceptable progress is not being made in a thesis course, the instructor may issue a grade of F. If the student is making acceptable progress, a grade of PR is assigned until the thesis is completed. The minimum number of hours of thesis credit ("CR") will be awarded only after the thesis has been both approved by The Graduate College and released to Alkek Library.

A student who has selected the thesis option must be registered for the thesis course during the term or Summer I (during the summer, the thesis course runs ten weeks for both sessions) in which the degree will be conferred.

Thesis Deadlines and Approval Process

Thesis deadlines are posted on The Graduate College (http://www.gradcollege.txstate.edu/) website under "Current Students." The completed thesis must be submitted to the chair of the thesis committee on or before the deadlines listed on The Graduate College website.

The following must be submitted to The Graduate College by the thesis deadline listed on The Graduate College website:

1. The Thesis Submission Approval Form bearing original (wet) and/or electronic signatures of the student and all committee members.
2. One (1) PDF of the thesis in final form, approved by all committee members, uploaded in the online Vireo submission system.

After the dean of The Graduate College approves the thesis, Alkek Library will harvest the document from the Vireo submission system for publishing in the Digital Collections database (according to the student's embargo selection). **NOTE: MFA Creative Writing theses will have a permanent embargo and will never be published to Digital Collections.**

While original (wet) signatures are preferred, there may be situations as determined by the chair of the committee in which obtaining original signatures is inefficient or has the potential to delay the student's progress. In those situations, the following methods of signing are acceptable:

- signing and faxing the form
- signing, scanning, and emailing the form
- notifying the department in an email from their university's or institution's email account that the committee chair can sign the form on their behalf
- electronically signing the form using the university's licensed signature platform.

If this process results in more than one document with signatures, all documents need to be submitted to The Graduate College together.

No copies are required to be submitted to Alkek Library. However, the library will bind copies submitted that the student wants bound for personal use. Personal copies are not required to be printed on archival quality paper. The student will take the personal copies to Alkek Library and pay the binding fee for personal copies.

Master's level courses in Electrical Engineering:

EE

Courses Offered

Electrical Engineering (p. 3)

EE 2100. Circuits I Lab.
This course accompanies EE2300 Circuits I. It includes the lab component, focusing on practical circuit analysis and measurement of DC and voltage. Students will explore resistive, capacitive, and inductive circuits through basic techniques to understand circuit behaviors and effects. It covers practical skills, experiment design, analysis, and computer-aided implementation. The course ensures a foundational understanding of electrical system principles and analytic skills for electronic systems. Prerequisite: MATH 2471 with a grade "C" or better. Corequisite: EE 2300 with a grade "C" or better.
1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.
Grade Mode: Standard Letter

EE 2120. Digital Logic Lab.
This course is an introduction to fundamental computer technologies, including Boolean logic design, logic circuits and devices, and basic computer hardware are studied. Laboratories provide hands-on experience with electricity, combinational and sequential digital circuits, and computer hardware Corequisite: CS 1428 and EE 2320 with a grade of "C" or better.
1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.
Grade Mode: Standard Letter

EE 2300. Circuits I.
This course provides an introduction to the profession of Electrical Engineering and its specialties. Fundamental DC and sinusoidal steady-state circuit analysis techniques include Ohm's law, power, Kirchoff's laws, and Thevenin and Norton equivalent circuits. Prerequisites: MATH 2471 with a grade of "C" or better. Corequisites: EE 2100 with a grade "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

EE 2320. Digital Logic.
This course is an introduction to fundamental computer technologies, including Boolean logic design, logic circuits and devices, and basic computer hardware are studied. Laboratories provide hands-on experience with electricity, combinational and sequential digital circuits, and computer hardware. Corequisites: CS 1428 and EE 2120 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

EE 2400. Circuits I.
This course provides an introduction to the profession of Electrical Engineering and its specialties. Fundamental DC and sinusoidal steady-state circuit analysis techniques include Ohm's law, power, Kirchoff's laws, and Thevenin and Norton equivalent circuits. Prerequisites: MATH 2471 with a grade of "C" or better.
4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 2420. Digital Logic.
An introduction to fundamental computer technologies, including Boolean logic design, logic circuits and devices, and basic computer hardware are studied. Laboratories provide hands-on experience with electricity, combinational and sequential digital circuits, and computer hardware. Corequisite: CS 1428 with a grade of "C" or better.
4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter

EE 3100. Instrumentation Laboratory.
This course provides the student with proficiency in the use of lab instrumentation and circuit simulation. Prerequisite: EE 2300 and MATH 3323 both with grades of "C" or better. Corequisite: EE 3300 with grade of "C" or better.
1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.
Grade Mode: Standard Letter

EE 3120. Microprocessors Lab.
The course is an introduction to microprocessors, their programming, and interfaces to peripherals. Prerequisite: EE 2320 and EE 2120 with grades of "C" or better. Corequisite: EE 3320 with a grade of "C" or better.
1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.
Grade Mode: Standard Letter

EE 3150. Microelectronics Laboratory.
This laboratory course provides training in the analysis and characterization of analog circuits. Prerequisite: EE 3300 and EE 3100 with grades of "C" or better. Corequisite: EE 3350 with a grade of "C" or better.
1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.
Grade Mode: Standard Letter

EE 3300. Circuits II.
This course discusses transient analysis, application of Laplace transforms, Bode plots, and network principles. Prerequisites: EE 2300 and EE 2100 and MATH 3323 with grades of "C" or better. Corequisites: EE 3100 with grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Lab Required
Grade Mode: Standard Letter

EE 3320. Microprocessors.
This course is an introduction to microprocessors, principles of operation, assembly language programming, timing analysis, and I/O interfacing. Prerequisites: EE 2320 and EE 2120 with a grade of "C" or better. Corequisites: EE 3120 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Lab Required|Writing Intensive
Grade Mode: Standard Letter

EE 3326. Numerical and Scientific Data Analysis Using Python.
This course introduces Python programming for engineers. Topics include basics of Python programming, introduction to numerical Python (NumPy), scientific programming using Python (SciPy), data visualization using Matplotlib, data processing using Pandas and introduction to Object Oriented Programming using Python. Prerequisite: CS 1342 or CS 1428 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 3340. Electromagnetics.
This course covers wave propagation, Maxwell's equations, transmission lines, wave guides, and antennas. Prerequisite: [EE 3300 or EE 3400] and MATH 2393 and PHYS 2326 and PHYS 2335 all with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 3350. Microelectronics.
This course focuses on analysis and design of active device equivalent circuits with emphasis on transistors, switching circuits, operational amplifiers, integrated circuits, feedback, and frequency response. Prerequisites: EE 3300 or EE 3400 with a grade of "C" or better. Corequisite: EE 3150 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter

EE 3355. Solid State Devices.
This course covers semiconductor materials, principles of carrier motion, operating principles and circuit models for diodes, bipolar transistors and field-effect transistors, and an introduction to integrated circuits. Prerequisite: [EE 3300 or EE3400] and PHYS 2326 both with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter

EE 3370. Signals and Systems.
This course covers frequency domain representation of signals and systems and frequency domain concepts for circuit analysis and design. Other topics include transfer function and frequency response, Laplace and z-transforms, Fourier series, Fourier transform, and sampling. Prerequisite: EE 3300 or EE3400 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 3400. Circuits II.
This course includes a brief review of EE 2400, transient analysis, application of Laplace transforms, Bode plots, and network principles. Materials learning in EE 2400 is extended and applied here. Prerequisites: EE 2400 and MATH 3323 both with grades of "C" or better.
4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 3420. Microprocessors.
Introduction to microprocessors, principles of operation, assembly language programming, timing analysis, and I/O interfacing. Prerequisites: EE 2420 with a grade of "C" or better.
4 Credit Hours. 3 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Writing Intensive
Grade Mode: Standard Letter

EE 4152. Introduction to VLSI Design Lab.
This course is an introduction to CAD tools for VLSI design and verification. Prerequisite: EE 3350 and [CS 2420 or EE 2320] both with grades of "C" or better. Corequisite: EE 4252 with grade of "C" or better.
1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.
Grade Mode: Standard Letter

EE 4155. Analog and Mixed-Signal Lab.
This course explores operational amplifier design applications, feedback, offset, stability, compensation, random signals and noise, discrete time circuitry analog-to-digital converters, and digital-to-analog converters. Prerequisite: EE 3370 and [EE 4350 or [EE 3350 and EE 3150]] with grades of "C" or better. Corequisite: EE 4255 with a grade of "C" or better.
1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.
Grade Mode: Standard Letter

EE 4180. Electric Machines Lab.
This course is the lab component of EE 4380 Electric Machines and consists of the hands-on exploration and analysis of various electric machines and their controllers. Prerequisite: EE 3340 with a grade of "C" or better. Corequisite: EE 4380 with a grade of "C" or better.
1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4192. Microelectronics Manufacturing I Laboratory.
This course introduces students to the various process modules related to semiconductor fabrication, including oxidation, diffusion, thin film deposition, lithography and etching. Prerequisite: [CHEM 1341 or CHEM 1335] with a grade of "C" or better. Corequisite: EE 4392 with a grade of "C" or better.
1 Credit Hour. 0 Lecture Contact Hours. 3 Lab Contact Hours.
Grade Mode: Standard Letter

EE 4252. Introduction to VLSI Design.
This course addresses the analysis and design of CMOS integrated circuits, and includes an introduction to CAD tools for VLSI design. Prerequisite: EE 3350 and [CS 2420 or EE 2320] both with grades of "C" or better. Corequisite: EE 4152 with grade of "C" or better.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 4255. Analog and Mixed-Signal Design.
This course focuses on operational amplifier design applications, feedback, offset, stability, and compensation. Introduction to random signals and noise, discrete time circuitry analog-to-digital converters, and digital-to-analog converters. Prerequisite: EE 3370 and [EE 4350 or [EE 3350 and EE 3150]] with grades of C or better. Corequisite: EE 4155 with a grade of "C" or better.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 4290. Electrical Engineering Design I.
Senior Design is the culmination of the Texas State University engineering experience. This course is a team-based design of a system or component using design processes as practiced in industry. The team will design, implement and verify their project, while documenting the project definition, design decisions, and implementation details. The outcomes will include oral presentations, written reports, and project demonstrations. Prerequisite: EE 3320 and EE 3120 and EE 3350 and EE 3370 and IE 3320 with grades of "C" or better. Corequisite: EE 4252 or EE 4356 or EE 4360 or EE 4370 with a grade of "C" or better.
2 Credit Hours. 1 Lecture Contact Hour. 3 Lab Contact Hours.
Course Attribute(s): Writing Intensive
Grade Mode: Standard Letter

EE 4291. Electrical Engineering Design II.
Senior Design is the culmination of the Texas State University engineering experience. This course is a team-based design of a system or component using design processes as practiced in industry. The team will design, implement and verify their project, while documenting the project definition, design decisions, and implementation details. The outcomes will include oral presentations, written reports, and project demonstrations. Prerequisite: EE 4290 with a grade of "C" or better. Corequisite: EE 4252 or EE 4370 with a grade of "C" or better.
2 Credit Hours. 1 Lecture Contact Hour. 3 Lab Contact Hours.
Course Attribute(s): Writing Intensive
Grade Mode: Standard Letter

EE 4321. Digital Systems Design Using HDL.
This course will cover the design of digital systems using HDL including implementation of custom microprocessor and peripheral architectures. Prerequisite: [EE 3320 or EE 3420] with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4323. Digital Image Processing.
This course provides the necessary fundamental techniques to analyze and process digital images. It covers principles, concepts, and techniques of digital image processing and computer vision. Prerequisite: EE 3370 and [EE 3320 or EE 3420] with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4331. Introduction to Machine Learning for Engineering Applications.
This course covers an introduction to machine learning focused on deep learning techniques using engineering applications with Python. Topics include model characteristics, neural network theory, classifiers for network and signal processing applications, regression and convolutional modeling for object-detection, time-series and forecasting machine learning models for Smart City concepts. Prerequisite: CS 1428 or CS 1342 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4332. Introduction to Computer-Aided Engineering Simulation on HPC Systems.
This course covers the introductory development of simulations for engineering applications that are solved using High-Performance Computing environments. Topics include programming techniques for multicore processors, processor and memory architecture, computation for dense and sparse linear algebra applications, computational temperature analysis, fluid dynamics, stencil, stochastic algorithms, and other applications. Prerequisite: CS 1428 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4350. Electronics II.
Analysis and design of integrated circuits, feedback, and frequency response. Prerequisites: EE 3350 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required| Multicultural Perspective
Grade Mode: Standard Letter

EE 4351. Fundamentals of Electroceramics.
Introduction to binary and ternary phase diagrams, non-centro-symmetric crystal structures and symmetry groups, nonlinear dielectrics (including ferroelectricity, piezoelectricity, pyroelectricity), nonlinear magnetics, oxide wideband gap semiconductors, detectors and sensors, brief introduction to MEMS, radhard electronics, and spintronics technology. Research oriented labs related to materials processing, characterization, fabrication, and testing. Prerequisite: ENGR 2300 with a grade of "C" or better and a minimum 2.25 Overall GPA. Corequisite: EE 3355 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4352. Introduction to VLSI Design.
Analysis of design of CMOS integrated circuits. Introduction to CAD tools for VLSI design. Prerequisites: EE 3350 and [CS 2420 or EE 2420] both with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 1 Lab Contact Hour.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter

EE 4353. Fundamentals of Advanced Semiconductor Technology.
Key concepts of advanced semiconductor technology including Moore's law, MOSFETs and CMOS, CMOS scaling, high-K gate dielectrics, new channel materials replacing silicon, three dimensional device structures, compound semiconductor MESFET, HEMT, LED, Lasers and solar cells. Prerequisite: EE 3355 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4354. Flexible Electronics.
This course will cover the materials systems, processes, device physics and applications of flexible electronics. The materials range from amorphous and nanocrystalline silicon, organic and polymeric semiconductors to solution cast films of carbon nanotubes. Real device discussions include high speed transistors, photovoltaics, flexible flat-panel displays, medical image sensors, etc. Prerequisites: EE 3350 and EE 3355 and EE 4350 all with grades of "C" or better or instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4355. Analog and Mixed Signal Design.
Operational amplifier design applications, feedback, offset, stability, and compensation. Introduction to random signals and noise, discrete time circuitry analog-to-digital converters, and digital-to-analog converters. Prerequisites: EE 3370 and EE 4350 both with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter

EE 4356. Power Electronics.
This course provides an introduction to power electronics and the use of such circuits for the control and conversion of electric power. Topics include semiconductor power devices and characteristics, DC-DC and multilevel converters, power inverters, and AC voltage controllers. Prerequisite: [EE 4350 or [EE 3350 and EE 3150]] with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4357. Introduction to Power Systems.
This course introduces the analysis of various elements of power systems, including power generation, transformer action, transmission line modeling, symmetrical components, power factor correction, real and quadrature power calculations, load flow analysis, and economic considerations in operating systems. Prerequisite: [EE 3300 or EE 3400 or ENGR 3373] with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4359. Advanced Electronic Materials and Devices.
This course introduces students to modern fabrication techniques, properties, and applications of conventional and emerging electronic materials. Topics include thin film deposition techniques and modern fabrication concepts, heterointerfaces, and structural, electronic, thermal, magnetic, and optical properties of electronic materials. The course includes discussions about practical devices, including solar cells, light-emitting devices, display devices, and emerging flexible electronic devices. Prerequisite: EE 3350 with a grade "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4360. Linear Control Systems.
This course provides an introduction to linear continuous-time and discrete-time automatic control systems. Topics include time and frequency domain modeling and analysis, state variable analysis, feedback, transient and steady state response, stability, and sensitivity. Prerequisite: EE 3370 and MATH 3376 both with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4370. Communication Systems.
This course covers transmission of signals through linear systems, analog and digital modulation, filtering, and noise. Prerequisites: EE 3370 and IE 3320 both with grades of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter

EE 4372. Communication Networks.
This course covers data communication concepts, protocols, algorithms, 7-layer OSI model, physical media, LAN architecture and components, Ethernet, TCP/IP, and related standards. Prerequisite: EE 3320 or EE 3420 with a grade of "C" or better. Corequisite: EE 3370 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter

EE 4374. Introduction to Wireless Communication.
This course covers the principles, practice, and system overview of mobile systems. Topics include modulation, demodulation, coding, encoding, and multiple access techniques. Prerequisites: EE 4370 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter

EE 4375. Building a Smart Grid Architecture.
In this course, students will learn the current 20th-century power grid structure and the key elements required to transform it to a 21st-century Smart Grid. Topics include two-way power/data flow to monitor, control, manage and integrate traditional bulk generation and bulk/renewable/distributed generation. Prerequisite: EE 3370 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4376. Introduction to Telecommunications.
This course covers the fundamentals of telecommunications, telephone networks, switching and transmission systems, circuit and packet switching, cell processing, and queuing theory and applications. Co-requisite: EE 4370 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter

EE 4377. Introduction to Digital Signal Processing.
This course covers discrete systems, convolution, spectral analysis, and FIR and IIR filter design. Prerequisites: EE 3370 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter

EE 4378. Data Compression and Error Control Coding.
Introduction to information theory, information content of messages, entropy and source coding, data compression, channel capacity data translation codes, and fundamentals of error correcting codes. Corequisite: EE 4370 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required
Grade Mode: Standard Letter

EE 4380. Electric Machines.
This course teaches the principles and analysis of electromechanical systems. Students will develop analytical techniques for predicting device and system interaction characteristics, strengthen understanding of the phenomena and interactions in electromechanics, and learn to design major classes of electric machines. Prerequisite: EE 3340 with a grade of "C" or better. Corequisite: EE 4180 and EE 4360 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4381. Sustainable Energy & Storage.
This course examines the consumption and production of energy and the principles and technologies behind renewable energy sources. It also introduces the basics of energy storage systems such as batteries, gravitational, and hybrid. Prerequisite: [EE 3300 or EE 3400] and PHYS 2326 and CHEM 1335 all with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4382. Advanced Power Systems.
This course is an advanced treatment of various elements of power systems, including symmetrical and unsymmetrical faults, symmetrical components, system protection, transient stability, transient operation of transmission lines, and supervisory control and data acquisition (SCADA). Prerequisite: EE 4357 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 4390. Electrical Engineering Design I.
This course is a team-based design of a system or component, which will include oral presentations and written reports. (WI) Prerequisites: EE 3420 and EE 3350 and EE 3370 and IE 3320 all with grades of "C" or better. Corequisites: EE 4352 or EE 4356 or EE 4360 or EE 4370 any with a grade of "C" or better.
3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required|Writing Intensive
Grade Mode: Standard Letter

EE 4391. Electrical Engineering Design II.
Advanced team-based design of a system or component, which will include oral presentations and written reports. (WI) Prerequisites: EE 4390 with a grade of "C" or better. Corequisite: EE 4352 or EE 4370 either with a grade of "C" or better.
3 Credit Hours. 2 Lecture Contact Hours. 2 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering|Lab Required|Writing Intensive
Grade Mode: Standard Letter

EE 4392. Microelectronics Manufacturing I.
This course provides an overview of integrated circuit fabrication. This includes crystal growth, wafer preparation, epitaxial growth, oxidation, diffusion, ion-implantation, thin film deposition, lithography, etching, device and circuit formation, packaging, and testing. The laboratory component involves production and testing of a functional semiconductor device. Prerequisite: [CHEM 1341 or CHEM 1335] with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 5320. Advanced Computer Architecture and Arithmetic.
This course teaches design and analysis of high-performance computer systems, focusing on quantitative analysis of the latest processors and compilers. Current processor architectures are surveyed for system design. Topics include instruction sets, parallelizing architectures, pipelining, I/O, memory and cache organization, parallel/vector processing, fast arithmetic units design, and implementation using HDL.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5321. Computer-Aided Engineering Simulations on HPC Systems.
This course covers development of simulations for engineering applications that are solved using High Performance Computing (HPC) environments. Topics include programming techniques for multicore processors, processor and memory architecture, computation for dense and spare linear algebra applications, computational temperature analysis, fluid dynamics, stencil and stochastic algorithms, and other applications. Prerequisite: EE 5320 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5323. Digital Image Processing.
This course provides the necessary fundamental techniques to analyze and process digital images. It covers principles, concepts, and techniques of digital image processing and computer vision. Restricted to students enrolled in the MS Engineering program.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5330. Embedded and Real-Time Computing.
This course teaches development of embedded computing systems with strong resource constraints. Key concepts include managing constrained memory and processing speed limitations, and programming for soft and hard real-time constraints. Students will learn use of a Real-Time Operating System (RTOS).
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5331. Machine Learning for Engineering Applications.
This course covers an introduction to machine learning focused on deep learning techniques using engineering applications with Python. Topics include model characteristics, neural network theory, classifiers for network and signal processing applications, regression and convolutional modeling for object-detection, time-series and forecasting machine learning models for Smart City concepts. Prerequisite: ENGR 5310 with a grade of "C" or better.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5350. Advanced Electronic Circuit Design.
This course includes low and high power RF amplifier design techniques, oscillators, FM demodulators, limiters, and mixer design. Additional topics include circuit design to minimize intermodulation and other forms of distortion, and RD and high-speed analog circuits with emphasis on digital-friendly applications.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5353. Fundamentals of Advanced Semiconductor Technology.
In this course students will learn key concepts and trends of advanced semiconductor device technology. Topics include Moore's law, MOSFET, CMOS and scaling, high-K gate dielectrics, new channel materials replacing silicon, three dimensional and compound semiconductor device structures. In addition students will be involved in laboratories and seminar presentations. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5354. Flexible Electronics.
This course will cover the materials systems, processes, device physics and applications of flexible electronics. The materials range from amorphous and nanocrystalline silicon, organic and polymeric semiconductors to solution cast films of carbon nanotubes. Real device discussions include high speed transistors, photovoltaics, flexible flat-panel displays, medical image sensors, etc. Prerequisite: Instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Dif Tui- Science & Engineering
Grade Mode: Standard Letter

EE 5355. Electronic Materials and Devices.
This course covers theoretical concepts applicable to the understanding of unique properties exhibited by electronic materials, especially by dielectrics, oxide semiconductors, ferroelectrics, pyroelectrics, piezoelectrics, magnetic, and multifunctional and multiferroic materials. The various microelectronic devices and modern novel technologies based on these materials are emphasized.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5357. Power Systems for Engineering.
This course introduces the analysis of various elements of power systems, including power generation, transformer action, transmission line modeling, symmetrical components, power factor correction, real and quadrature power calculations, load flow analysis, and economic considerations in operating systems.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5360. Thin Film Technology.
This course covers the theoretical and practical aspects of thin film technology in modern devices. The design and fabrication of thin film heterostructures is discussed. Growth and nucleation of epitaxial thin films with diverse properties and devices with combined properties will be emphasized.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5361. Nanofabrication Technology for Semiconductor Device Processing.
This course provides an overview of nanofabrication techniques for conventional and emerging micro- and nano-electronic devices. Topics include semiconductor crystal growth, wafer preparation, epitaxial growth, oxidation, control of dopant profiles for the formation of shallow junctions, ion-implantation, thin film deposition, photolithography, metallization etching, device and circuit formation, and testing.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5372. Advanced Networking.
This course develops important theoretical and application topics related to advanced networking. Theoretical topics are introduced using mathematical treatments, including queuing theory and some random processes. The course includes applications of these topics to communications networks, and focuses on architectures, applications and technologies which affect modern computer and data networks.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5374. Advanced Wireless Communication.
This course teaches principles and practices in designing and analyzing cellular and other wireless communication systems. Topics include RF propagation modeling, fast and slow fading, modulation, demodulation, coding, and multiple access techniques.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5375. Smart Grid: an Application Development Platform.
This course introduces students to the development of real applications for the smart grid and models its performance with simulations and stochastic models. Topics include energy informatics, smart metering, home energy management, demand response, load disaggregation and APIs/OpenData. The mathematical tools used include: Optimization/ Control, Machine Learning and Stochastic Processes.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5377. Statistical Signal Processing.
This course develops the theory and applications of random processes using mathematical treatments, including elementary discrete and continuous time linear systems theory, elementary probability, and transform theory. Topics include applications of random processes to information and communication theory, estimation and detection, control, signal processing, and stochastic systems theory. Prerequisite: ENGR 5310 with a grade of "C" or better or instructor approval.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5380. Advanced Electric Machines.
This course teaches the principles and analysis of electromechanical systems. Students will develop analytical techniques for predicting device and system interaction characteristics as well as learn to design major classes of electric machines.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5381. Advanced Sustainable Energy & Storage.
This course examines the consumption and production of energy and the principles and technologies behind renewable energy sources. It also introduces the basics of energy storage systems such as batteries, gravitational, and hybrid. Current research in the field is examined.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5382. Advanced Power Systems Analysis.
This course is an advanced treatment of various elements of power systems, including case studies, analysis of relevant peer-reviewed literature, symmetrical and unsymmetrical faults, symmetrical components, system protection, transient stability, transient operation of transmission lines, and supervisory control and data acquisition (SCADA).
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 5398A. Antenna Theory, Design and Applications.
This course covers the basic theory, design and applications of antennas. The topics include antenna radiation, fundamental parameters of antennas, linear wire antennas, loop antennas, antenna arrays, long-periodic antennas, horn antennas, microstrip antennas and modern nano-antennas.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

EE 5398B. Electronic Materials and Beyond for Sustainable Energy.
This course covers the basic science and technology for sustainable energy from the view of materials, where electronic materials are highly emphasized. The topics include solar cells, thermoelectrics, batteries, supercapacitors, artificial photosynthesis, fuel cells, biomass and nuclear energy.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing|Topics
Grade Mode: Standard Letter

EE 7199. Dissertation.
This course includes original research and writing in electrical engineering, to be accomplished under direct supervision of the PhD research advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
1 Credit Hour. 1 Lecture Contact Hour. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

EE 7299. Dissertation.
This course includes original research and writing in electrical engineering, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
2 Credit Hours. 2 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

EE 7300. Research Methods and Technical Writing in Electrical and Computer Engineering.
This course prepares students for advanced research by examining how to plan, conduct, and report on empirical investigations. This course covers techniques applicable to each of the steps of a research project, including formulating research questions, theory building, data analysis, building evidence, assessing validity, and publishing. Students practice a variety of research methodologies and explore the capacities and limitations of specific approaches. Other topics covered are principles of good writing, format of a scientific manuscript, issues in publication and peer review, utilizing different online databases, attributing credit for prior work, respecting intellectual property rights, and maintaining ethics in research.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7301. Advanced Digital System Design.
This course covers digital systems design using hardware description languages and their associated tooling to capture, integrate, verify, simulate, and synthesize digital hardware. The course examines modern hardware design flows using high-level synthesis and register-transfer-level (RTL) synthesis. It covers the role of hardware description languages in the verification, simulation, and integration process of hardware modules in large digital systems. The course projects offer an integrated experience in advanced digital systems design combining hardware description languages, hardware design methodologies, and hardware design practice on a programmable target, such as an FPGA or ASIC.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7302. Hardware Acceleration for Machine Learning.
This course is a comprehensive exploration of AI system design, from the intricacies of deep learning architecture to hardware considerations. The course covers a range of computing platforms in CPUs, TPUs, and GPUs, emphasizes FPGA fundamentals and programming, and delves into memory structures crucial for AI. It also provides strategies for optimizing power consumption in system-level and RT-level design.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7303. Physical Electronics.
This course addresses the advanced concepts of semiconductor device physics and operations. The course helps students to gain a foundation in the area of physical electronics as a basis of continued course work and research in nano- and micro- electronics devices and systems. Topics will include quantum mechanics, the statistics of particles, transport in crystalline semiconductors, and optoelectronic devices.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7304. Modern Semiconductor Devices.
This course reviews and deepens understanding of advanced topics in semiconductor devices. Topics of this course include semiconductor physics, metal-semiconductor contacts, the physical principles and operation of P-N junctions, MOS capacitors, MOS field-effect transistors, scaling and short-channel effects of modern and future MOSFETs, and optoelectronic devices such as photodetectors, solar cells, light emitters and display devices.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7305. Energy Storage and Sustainability.
This course provides a basic understanding of the various mechanisms and related technologies that are currently employed for energy storage and sustainability. Topics covered range from basic concepts to the most important methods for energy storage. General principles involved in various electro-chemical technologies are introduced, followed by a presentation of the most important battery systems. Most important storage methods and major areas of application are discussed, in addition to policies and actions needed to transition to 100% clean, renewable energy and storage for businesses, nonprofit and government organizations. State-of-the-art and challenging research topics are discussed.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7306. Artificial Intelligence in Smart Grids.
This course introduces artificial intelligence (AI) and machine learning (ML) techniques, algorithms, and tools for smart grid applications. Topics covered range from fundamentals of machine learning and artificial intelligence to state-of-the-art research on using AI and ML algorithms and tools to design, operate, and manage smart grids. Related applications are covered, including but not limited to energy forecasting, smart meter data analytics, and nonintrusive load monitoring.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7307. Mobile and Microgrid Design and Operations.
This course covers advanced modeling, control, resilience and security technologies useful for grid modernization from the angle of microgrid design, analysis and operation. Topics include smart inverters, microgrid architectures, distributed energy resources modeling, microgrid hierarchical control, microgrid stability, fault management, resilient microgrids through programmable networks, reliable networked microgrids, and cyber security.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7308. High and Medium Voltage Power Transmission.
This course covers electric power transmission and distribution systems. With increased amounts of distributed generation (photovoltaics, small-scale wind), distributed storage, and controllable loads, it has become more and more important for researchers and power industry professionals to understand power distribution and transmission systems. This course provides an introduction to distribution grids, including their components, typical topologies, and operational strategies. Then, it covers power flows in distribution grids and distribution transformers. Additionally, the course covers the fundamentals of electric loads, including electric load modeling, analysis, and control methodologies.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7331. AI and Machine Learning for Engineers.
This course provides an in-depth exploration of fundamental machine learning concepts and techniques, including supervised, unsupervised, and semi-supervised learning, alongside practical applications of these concepts in real-world problems. It further delves into the intricate world of deep learning, investigating critical topics such as deep neural networks, convolutional neural networks, and recurrent neural networks, as well as recent advancements in the field. Additionally, the course explores essential reinforcement learning concepts, including Markov Decision Processes, Q-learning, and policy gradients, preparing students for advanced AI research and development for engineering applications.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7354. Advanced Flexible Electronics.
This course covers the materials systems, processes, device physics and applications of flexible electronics. Study of materials will include amorphous and nanocrystalline silicon, organic and polymeric semiconductors, and solution cast films of carbon nanotubes, graphene and other 2D materials. Contemporary research and advancement in the areas of high-speed transistors, switches, photovoltaics, and communication devices will be covered.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7359. Research in Electrical Engineering.
This research course is for doctoral students in electrical engineering who have not yet passed their candidacy exam, typically under supervision of the PhD Research Advisor.
3 Credit Hours. 0 Lecture Contact Hours. 12 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

EE 7372. Wireless and Mobile Networks.
This course provides an in-depth presentation of concepts, fundamentals, and technologies of modern wireless and mobile networks. Topics covered include wireless signal propagation characteristics and modeling, coding and modulation, link-layer techniques for reliable communications, and multiple access schemes and protocols. Wireless local area networks, wireless personal area networks, sensor networks, and wide area networks (5G/6G networks) are also covered, as are low-power wide area networks energy-aware and energy-harvesting schemes and protocols. Additional topics include mobile ad-hoc networks and variants, such as unmanned aerial networks and vehicle ad hoc networks, Internet of Things, and AI- and ML-based mobile and wireless networks.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7374. Smart Data Networks.
This course covers fundamentals for the design of smart data networks, which represent the evolution of data networks by taking advantage of artificial intelligence and machine-learning technologies to push the boundaries of traditional networks and the internet. All layers of the protocol stack are re-examined with a focus on how AI and ML-based technologies can advance the design of new protocols and algorithms. Hence, the course covers AI- and ML-enhanced medium access control protocols, routing, congestion control, transport protocols, multimedia streaming, network applications, traffic characterization, and advanced networking topics, such as IoT and digital twins.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Grade Mode: Standard Letter

EE 7399. Dissertation.
This course includes original research and writing in electrical engineering, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

EE 7599. Dissertation.
This course includes original research and writing in electrical engineering, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
5 Credit Hours. 5 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

EE 7699. Dissertation.
This course includes original research and writing in electrical engineering, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
6 Credit Hours. 6 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit

EE 7999. Dissertation.
This course includes original research and writing in electrical engineering, to be accomplished under direct supervision of the dissertation advisor. While conducting dissertation research and writing, students must be continuously enrolled each long semester.
9 Credit Hours. 9 Lecture Contact Hours. 0 Lab Contact Hours.
Course Attribute(s): Exclude from 3-peat Processing
Grade Mode: Credit/No Credit