EELE - Electrical Engineering

EELE 101 Introduction to Electrical Fundamentals: 3 Credits (1 Lec, 2 Lab)
PREREQUISITE: M 151Q or equivalent. (F, Sp) Lecture/laboratory introduction to electrical fundamentals including Kirchhoff's and Ohm's Laws, using meters and oscilloscopes, time-varying signals in electric circuits, inductors and capacitors, series and parallel circuits, introduction to digital circuits, problem solving including computer applications, technical communications, team work

EELE 201 Circuits I for Engineering: 4 Credits (3 Lec, 1 Lab)
PREREQUISITE: EELE 101, M 172
COREQUISITE: PHSX 222. (F, Sp) Introduction to circuit analysis, Ohm's and Kirchhoff's Laws, nodal and mesh methods, network theorems; resistors, capacitors, inductors, dependent sources, ideal op-amps; the complete response of first order circuits; complex frequency and phasors; steady-state AC circuits, coupled inductors and ideal transformers
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EELE 203 Circuits II for Engineering: 4 Credits (3 Lec, 1 Lab)
PREREQUISITE: EELE 201, M 274. (F, Sp) Natural and forced response of R-L-C circuits, frequency response of R-L-C circuits and Bode plots, frequency response, slew-rate and DC imperfections of real op-amps; Laplace Transform, Fourier series and Fourier Transform techniques in circuit analysis; basic R-L-C and op-amp filters; two port networks

EELE 217 The Science of Sound: 2 Credits (2 Lec)
PREREQUISITE: M 121Q, M 132, or M 105Q, or the equivalent. (F) Introduction to the principles of musical acoustics, sound systems, and audio technology for non-engineering students. This course is particularly geared toward students in the College of Arts and Architecture and in the Music Technology program

EELE 250 Circuits, Devices and Motors: 4 Credits (3 Lec, 1 Lab)
PREREQUISITE: M 166 or M 172 and PHSX 207 or PHSX 222. (F, Sp, Su) Introduction for non-majors to electrical circuit principles, voltage and current laws, frequency response; introduction to electronic circuits including operational amplifiers, and power electronics; introduction to electromechanical energy conversion devices, DC and AC machines

EELE 261 Intro To Logic Circuits: 4 Credits (3 Lec, 1 Lab)
(F, Sp, Su) An introductory course in the fundamental concepts of classical digital design. Course covers design and implementation of combinational logic circuits, synchronous sequential circuits and information storage circuits. Basic concepts of Hardware Description Languages(HDLs), design and simulation of digital systems using HDLs, and digital system implementation with programmable logic devices are presented.

EELE 290R Undergraduate Research: 1-6 Credits (1-6 Other)
(F, Sp) Directed undergraduate research which may culminate in a written work or other creative project. Course will address responsible conduct of research. May be repeated.
Repeatable up to 99 credits.

EELE 291 Special Topics: 1-4 Credits (1-4 Lec)
PREREQUISITE: None required but some may be determined necessary by each offering department. Courses not required in any curriculum for which there is a particular one-time need, or given on a trial basis to determine acceptability and demand before requesting a regular course number
Repeatable up to 12 credits.

EELE 292 Independent Study: 1-3 Credits (1 Other)
PREREQUISITE: Consent of instructor and approval of department head. (F, Sp) Directed research and study on an individual basis
Repeatable up to 6 credits.

EELE 308 Signals and Systems Analysis: 4 Credits (3 Lec, 1 Lab)
PREREQUISITE: EELE 203, M 273, and EGEN 350. (F, Sp) Discrete and continuous time signals and systems. Properties, application, synthesis and analysis for the CT and DT Fourier Series, the Fourier transform, the DTFT, z and Laplace transform. Applications in differential and difference equations, sampling, feedback, and communications. Introduction to the DFT. Laboratory experience emphasizing applications in differential and difference equations, sampling, and engineering data analysis

EELE 317 Electronics: 4 Credits (3 Lec, 1 Lab)
PREREQUISITE: EELE 203. (F, Sp) This is an introductory course in electronics. It introduces diodes, bipolar junction transistors, field effect transistors and bipolar and MOS analog and digital circuits

EELE 321 Introduction To Feedback Controls: 3 Credits (3 Lec)
PREREQUISITE: EELE 203 for Electrical and Computer Engineering majors, M 274 for non-majors. (F, Sp) Classical continuous-time, transfer function approach to control systems engineering. Approximations, linearization, and time response. Design and analysis via root-locus, Nyquist, and Bode methods. Proportional, dominant pole, lead, lag, PID, and minor loop compensation. Describing functions

EELE 334 Electromagnetic Theory I: 3 Credits (3 Lec)
PREREQUISITE: PHSX 222, M 273. (F, Sp) Basic electric and magnetic fields including transmission lines. The materials covered will include both static and dynamic fields, traveling waves, and transmission line concepts such as impedance, reflection coefficient, and transient response

EELE 354 Electric Power Applications: 3 Credits (2 Lec, 1 Lab)
PREREQUISITE: M 166 or M 171Q and PHSX 207 or PHSX 222. (F) An applied study of electricity and electrical power circuits, with laboratory experience, for that person not expected to deal with electronics or advanced circuit techniques. Topics covered include electrical circuit laws; power and energy; alternating current circuits; residential, commercial and industrial wiring; wire sizing, three-phase circuits; and application of transformers and electric motors

EELE 355 Energy Conversion Devices: 4 Credits (3 Lec, 1 Lab)
PREREQUISITE: EELE 203. (Sp) Three-phase power; electromechanical energy conversion devices and motor drives; introduction of power electronic converters for power control and motor drive applications. Laboratory experience includes power measurements; experience with transformers and motor-generator operational characteristics and DC and AC motor drives operation. -

EELE 367 Logic Design: 4 Credits (3 Lec, 1 Lab)
PREREQUISITE: EELE 261 Advanced combinational and sequential logic design. (Sp, Su) Hardware descriptive language (HDL) programming knowledge. Laboratory experience implementing advanced logic designs using FPGAs

EELE 371 Microprocess HW and SW Systems: 4 Credits (3 Lec, 1 Lab)
PREREQUISITE: EELE 261 and knowledge of a programming language or consent of instructor
COREQUISITE: CSCI 109 or CSCI 112. (F, Sp, Su) Introduction to the structure of microprocessors, arithmetic and logic units, processor control, interrupts, memories, and input/output. Laboratory experience in assembly level programming of microprocessor applications
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EELE 394 Multidisciplinary Seminars: 1 Credits (1 Other)
PREREQUISITE: Junior standing. (F, Sp) Students attend seminars presented by a variety of departments and disciplines to gain an appreciation of multidisciplinary environments leading to a greater understanding of the impact of engineering solutions in a global and societal context

EELE 407 Intro To Microfabrication: 3 Credits (2 Lec, 1 Lab)
PREREQUISITE: Junior standing and PHSX 222 or PHSX 207.
(F) Provide an introduction to clean room safety protocol and micro
fabrication. Lectures will introduce micro fabrication methods, models and
equipment. Laboratories will perform the steps to produce and characterize
a metal-oxide-semiconductor transistor. -

EELE 408 Photovoltaic Systems: 3 Credits (2 Lec, 1 Lab)
PREREQUISITE: PHSX 222. (Sp) Provide a basic understanding of the
design, fabrication and operating principles of solar cells and how they are
integrated into photovoltaic systems. Laboratories will perform the steps
required to produce and characterize silicon solar cells. -

EELE 409 EE Material Science: 3 Credits (3 Lec)
PREREQUISITE: EELE 203. (F) Basic material properties of dielectrics,
magnetic materials, conductors, and semiconductors. Practical applications
of materials to semiconductor devices

EELE 411 Advanced Analog Electronics: 3 Credits (3 Lec)
PREREQUISITE: EELE 317. () Spring alternating, odd years. This course
covers differential and multistage amplifiers, frequency response, feedback,
analog integrated circuits, filters, and tuned circuits, analog to digital and
digital to analog conversion, noise in electronics, current topics

EELE 417 Acoustics/Audio Engineering: 3 Credits (3 Lec)
PREREQUISITE: PHSX 222. () Fall alternating, even years. Introduction
to the principles of acoustics, audio engineering, and audio signal
processing. Propagation of sound in enclosures. Engineering analysis of
loudspeakers, microphones, and recording devices. Human psychoacoustics

EELE 418 The Art of Biochips – An Introduction to BioMEMS: 3 Credits (3 Lec)
PREREQUISITE: PHSX 222 or EBIO 316 or BIOB 260 or NEUR 313
or CHMY 323. (Sp) "The art of biochips" is an introductory course into
the interdisciplinary and rapidly growing field of developing, fabricating,
testing and translating Biomedical devices using Micro Electro Mechanical
Systems (BioMEMS). This course will be offered as a co-convened class with
ELEE 509 which is at the graduate level. The course content is intended
for non-specialized upper-level undergraduates and graduate students with
basic knowledge in chemistry, biology, or physics, and will introduce the
miniaturization of devices to handle biological things at a scale we cannot
control with our fingers or see with our naked eyes

EELE 422 Intro to Modern Control: 3 Credits (3 Lec)
PREREQUISITE: EELE 321. (F) Introduction to techniques of modern
control with emphasis on discrete time, including matrices, norms, state-
space, and stochastic processes. Stability, Lyapunov functions, Lyapunov
stability. Observability, controllability, reachability. State feedback and
observers. Model based control. Performance and robustness

EELE 432 Applied Electromagnetics: 3 Credits (3 Lec)
PREREQUISITE: EELE 334 or PHSX 423. (Sp) Advanced study of
electromagnetic wave propagation, including polarization, reflection
and refraction at interfaces, and cavities and multilayer structures, to
investigate a number of practical devices with applications related to
electrical engineering and optics, such as waveguides, fiber optics, and
antennas

EELE 445 Telecommunication Systems: 4 Credits (3 Lec, 1 Lab)
PREREQUISITE: EELE 308, EELE 317. (Sp) Introduction to analog
and digital communication systems with lab. Topics include signals in
communications; noise characterizations; bandwidth considerations;
probability of error; analog and digital modulation; frequency domain
analysis; matched filter applications. Experiments involve modulation,
demodulation, A/Ds, sampling theory, and aliasing

EELE 447 Mobile Wireless Communications: 3 Credits (3 Lec)
PREREQUISITE: EELE 445. (F) Characteristics of the radio environment,
propagation, cellular concepts, channel allocation, modulation techniques,
multiple access techniques, Shannon's Capacity Theorem, error-correcting
codes, data compression, spread spectrum modulation, current wireless
communication systems

EELE 448 Optical Communications Systems: 3 Credits (3 Lec)
PREREQUISITE: EELE 308 and EELE 445 or consent of instructor.
(Sp) Advanced undergraduate/early graduate level course in fiber-optic
communication systems and networks. Topics include: Optical fibers and
transmission effects, optical transmitters, modulators, optical receivers,
optical amplifiers, and intensity-modulation/direct-detection systems.
Graduate students will also study coherent optical communications
systems, digital signal processing for optical communications, and optical
networking

EELE 451 Power Electronics: 3 Credits (2 Lec, 1 Lab)
PREREQUISITE: EELE 317, EELE 321 and EELE 355. () Spring
alternating even years. Introduction to solid-state power devices; topologies,
operating principles, modeling and control, and design of basic power
converters; magnetic design; applications of power converters in renewable
energy source power systems, electric and hybrid electric vehicles, and other
residential, commercial, and industrial systems; laboratory experience with
basic power converters

EELE 452 Power System Operation and Control: 3 Credits (3 Lec)
PREREQUISITE: EELE 454. () On demand. The course will help students
to understand the nomenclature and layout of generation and power
delivery. The focus of the course is on electrical faults and contingency
calculations, economic operation of large-scale generation and transmission
systems. Fast-decoupled power flow, economic load dispatch, optimal power
flow, voltage control, load-frequency control, control of active and reactive
power flow are presented in this course. A special emphasis is placed on
applications of computer-based methods to power-system problems

EELE 454 Power Systems Analysis and Design: 3 Credits (3 Lec)
COREQUISITE: EELE 355. (Sp) On demand. Power system fundamentals
and components, power transformers, transmission system design, power
flow studies, power system equivalent models, symmetrical components.y

EELE 455 Alternative Energy Power Gen: 3 Credits (3 Lec)
PREREQUISITE: EELE 355 or equivalent. (F) Exploration and analysis
of alternative power generation sources and systems such as wind, solar,
microturbine, and fuel cells, combined sources and their design, power
electronic interfacing, and energy storage systems. Co-convened with
EELE 555

EELE 456 Power Systems Protection & Control: 3 Credits (3 Lec)
PREREQUISITE: EELE 454 or equivalent. () On demand. Continuation
of EELE 454. Symmetrical and unsymmetrical fault analysis, system
protection, introduction to load frequency control, voltage control,
economic dispatch, and introduction to power system stability

EELE 465 Microcontroller Applications: 4 Credits (2 Lec, 2 Lab)
PREREQUISITE: EELE 371. (Sp) Lecture/laboratory exposure to micro
controller hardware and software applications, serial and parallel I/O,
timing, interrupts LCDs, keypads, A to D conversion, and a project
realizing a real time control problem

EELE 467 SoC FPGAs I : Hardware-Software Codesign: 4 Credits (3 Lec, 1 Lab)
PREREQUISITE: EELE 367 (or VHDL Programming Experience) and CSCI 112 (or C Programming Experience). (F) Design of advanced digital systems using System-on-Chip (SoC) Field Programmable Gate Arrays (FPGAs). Design of custom hardware components for the FPGA fabric using VHDL. Implementation of custom hardware-software interfaces. Writing programs and Linux device drivers in C to interact with custom hardware. Laboratory experience developing custom systems using SoC FPGAs

EELE 468 SoC FPGAs II: Application Specific Computing: 4 Credits (3 Lec, 1 Lab)
PREREQUISITE: M 221 and EELE 467
COREQUISITE: EELE 477. (Sp) Design of custom digital systems using SoC FPGAs, emphasizing computational tasks such as digital signal processing, audio, or video processing. Department of Electrical & Computer Engineering
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EELE 477 Digital Signal Processing: 4 Credits (3 Lec, 1 Lab)
PREREQUISITE: EELE 308. (Sp) Analysis and design of discrete-time systems, including frequency response. Sampling and reconstruction of continuous signals. Analysis, design, and applications of FIR and IIR digital filters. Properties and applications of the discrete Fourier transform. Laboratory experience implementing off-line and real time digital signal processing algorithms

EELE 481 Optical Design: 3 Credits (3 Lec)
PREREQUISITE: EELE 482 or PHSX 427 Optical design using geometric optics and computer ray-tracing software. () Spring alternating, odd years. Introduces ray and wave front aberrations, control of aberrations in optical systems, designing for system requirements, and analytic tools including the moducation transfer function

EELE 482 Electro-Optical Systems: 3 Credits (2 Lec, 1 Lab)
PREREQUISITE: EELE 334 or PHSX 423 or equivalent. (F) Provides an overview of electro-optic systems and components. Lectures cover ray optics, scalar wave optics, laser and Gaussian beam optics, optical polarization and polarization devices, light sources, detectors, and electro-optic and acoustic-optic photonic devices. Laboratory experiments introduce basic photonic instrumentation and measurement techniques

EELE 484 Laser Engineering: 3 Credits (3 Lec)
PREREQUISITE: PHSX 222. () Spring alternating, even years. The laser engineering course provides a basic understanding of the design and operational principles of lasers. Discussions of design and operation of several types of lasers will be covered including solid state lasers, gas lasers, and semiconductor lasers

EELE 487 Prof, Ethics & Engr Practices: 1 Credits (1 Lec)
PREREQUISITE: Junior standing. (Sp) Engineers from industry and others give presentations on professionalism, ethics, and engineering practices. Included are specific well-known, historical engineering ethics cases and professional practices of engineering, intellectual property issues, and new developments

EELE 488R Electrical Engineering Design I: 3 Credits (3 Lec)
PREREQUISITE: EELE 317. (F, Sp) Part I of a two consecutive semester senior capstone design sequence in Electrical Engineering. Students, under the guidance of a faculty supervisor, formulate a solution to a real-world design problem culminating in a critical design review. Co-convened with EELE 489R

EELE 489R Electrical Engr Design II: 3 Credits (3 Lec)
PREREQUISITE: EELE 488R. (F, Sp) The second of a two consecutive semester senior capstone design sequence in Electrical Engineering. Students, under the guidance of a faculty supervisor, realize, assess and document the performance of their solution to a real-world design problem. Co-convened with EELE 488R

EELE 490R Undergraduate Research: 1-6 Credits (1 Other)
(F, Sp) Directed undergraduate research which may culminate in a research paper, journal article, or undergraduate thesis. Course will address responsible conduct of research. May be repeated.
Repeatable up to 6 credits.

EELE 491 Special Topics: 1-4 Credits (1-4 Lab)
PREREQUISITE: EELE 308, EELE 445. On demand. Senior-level undergraduate course in fiber-optic communication systems and networks. Topics include:. Optical fibers and transmission effects, optical transmitters, modulators, optical receivers, optical amplifiers, intensity-modulation/direct-detection systems, coherent optical communications systems, digital signal processing for optical communications, optical networking
Repeatable up to 12 credits.

EELE 492 Independent Study: 1-3 Credits (1 Other)
PREREQUISITE: Junior standing, consent of instructor and approval of department head. (F, Sp) Directed research and study on an individual basis
Repeatable up to 6 credits.

EELE 498 Internship: 1-2 Credits (1 Other)
PREREQUISITE: Sophomore standing and consent of instructor. (F, Sp, Su) On-site, one semester practicum under guidance of employer designated mentor
Repeatable up to 12 credits.

EELE 503 Advanced Analog Circuit Design: 3 Credits (3 Lec)
PREREQUISITE: EELE 317. (F) Fall alternating, odd years. Solid state device models, p-spice and other computer simulations, single and multiple state amplifier design, current sources, operation amplification design, frequency response, feedback and feed forward amplifier analysis, noise and distortion in electronics

EELE 505 MEMS Sensors and Actuators: 3 Credits (2 Lec, 2 Lab)
PREREQUISITE: EELE 409. () Spring alternating, odd years. Micro fabrication of electrical and mechanical devices. Theory of various mechanical transducers and physical sensors including optical MEMS, RF MEMS, and Bio/Chemical MEMS

EELE 508 Solar Cell Basics for Teachers: 2 Credits (1 Lec, 1 Lab)
(Su) This graduate course introduces the concepts of the design, fabrication and operating principles of solar cells and how they are integrated into photovoltaics systems. The course contains a laboratory experience where the graduate students perform the steps required to produce and characterize silicon solar cells. Offered Summer.

EELE 509 The Art of Biochips - Solving Healthcare Problems with BioMEMS: 3 Credits (3 Lec)
PREREQUISITE: All students must be full-time graduate student in good standing. (Sp) "The art of biochips" is an introductory course into the interdisciplinary and rapidly growing field of developing, fabricating, testing and translating Biomedical devices using Micro Electro Mechanical Systems (BioMEMS). This course will be offered as a co-convened class with ELEE 418 which is at the undergraduate level. The course content is intended for graduate students with basic knowledge in chemistry, biology, or physics and non-specialized upper-level undergraduates, and will introduce the miniaturization of devices to handle living things at a scale we cannot control with our fingers or see with our naked eyes

EELE 517 Acoustics/Audio Engineering: 3 Credits (3 Lec)
PREREQUISITE: PHSX 222. () Fall alternating, even years. Introduction to the principles of acoustics, audio engineering, and audio signal processing. Propagation of sound in enclosures. Engineering analysis of loudspeakers, microphones, and recording devices. Human psychoacoustics

EELE 522 Adaptive Control: 3 Credits (3 Lec)
PREREQUISITE: EELE 422. () Spring alternating, even years. On-line parameter estimation, self tuning regulators, model reference adaptive controls. Robust control

EELE 525 System Identification: 3 Credits (3 Lec)
PREREQUISITE: EELE 422. () Fall alternating, odd years. System identification with emphasis on off-line techniques. Stability of matrix decompositions used for identification. Recursive least squares, auto regressive techniques, hypothesis testing. Geometrical and statistical interpretations of least squares, maximum likelihood, and Bayesian estimation. Derivative and derivative-free iterative solutions. Modeling and model order selection. Analytical techniques including Lagrange multipliers

EELE 526 Sequential State Estimation: 3 Credits (3 Lec)
PREREQUISITE: EELE 422. () Fall alternating, even years. Sequential state estimation, with emphasis on Kalman filtering and smoothing. Continuous and discrete time

EELE 528 Advanced Controls and Signals: 3 Credits (3 Lec)
PREREQUISITE: EELE 422 or equivalent. () On demand. Reading, discussion and exploration of original source material on advanced control systems and signal processing. Topics selected to compliment current interest and existing courses; for example, computational statistical methods, estimation, modeling, compression, advanced analytical techniques, multi-dimensional systems, spectral analysis, and implementation
Repeatable up to 6 credits.

EELE 533 Antenna Engineering: 3 Credits (3 Lec)
PREREQUISITE: EELE 334 or equivalent. () Fall alternating, even years. Introduction to the electromagnetic theory and practice of antenna design and analysis. Common antenna structures are studied, including dipoles, arrays, horns, and reflectors. Applications will be explored in wireless communication, remote sensing, and related fields. Numerical electromagnetic simulation techniques are used for antenna modeling

EELE 538 Adv Top Electromagnet & Optics: 3 Credits (3 Lec)
() Fall alternating, even years. Advanced topics in applied electromagnetics and optics, chosen to represent current research in this field.
Repeatable up to 6 credits.

EELE 541 Advanced Communication Theory: 3 Credits (3 Lec)
PREREQUISITE: EELE 445. () On demand. Signal spectrum analysis, random processes, correlation functions, functional transformations of random variables, optimal linear filtering and estimation, statistical analysis of digital and analog modulation systems, orthogonality and related signals: time, bandwidth, and dimensionality

EELE 543 Advanced Telecom Systems: 3 Credits (3 Lec)
PREREQUISITE: EELE 445. () Fall alternating, odd years. Digital and analog switching systems, packet and circuit telecommunication transmission networking and media selection (fiber optics, cable, microwave and satellite), network configuration, network technologies, equipment selection, system design examples and project

EELE 547 Ad Hoc Wireless Sensor Network: 3 Credits (3 Lec)
PREREQUISITE: EELE 447 and EELE 543. () On demand. Stationary and mobile sensor network topologies, RF technologies, frequency selection, link layer and media access protocols, energy management techniques, mobility management, standards and applications

EELE 548 Optical Communications Systems: 3 Credits (3 Lec)
PREREQUISITE: EELE 308 and EELE 445. Advanced undergraduate/early graduate level course in fiber-optic communication systems and networks. Topics include: Optical fibers and transmission effects, optical transmitters, modulators, optical receivers, optical amplifiers, and intensity-modulation/direct-detection systems. Graduate students will also study coherent optical communications systems, digital signal processing for optical communications, and optical networking

EELE 552 Power System Operation and Control: 3 Credits (3 Lec)
PREREQUISITE: EELE 454. () On demand. Representation of power system elements, fast-decoupled power flow, optimal power flow, voltage control, load-frequency control, control of active and reactive power flow, application of FACTS devices in power flow control, electrical faults and contingency calculations, transient stability, dynamic stability

EELE 555 Alt Energy Dist Gen Systems: 3 Credits (3 Lec)
PREREQUISITE: EELE 355. Exploration and analysis of alternative power generation sources and systems such as wind, solar, microturbine, and fuel cells, combined sources and their design, power electronic interfacing, and energy storage systems. Co-convened with EELE 455

EELE 556 Advanced Power Electronics: 3 Credits (3 Lec)
PREREQUISITE: EELE 451. mathematical modeling of switching power converters, advanced power converter topologies, design constraints and control methods, design-oriented analysis techniques for applications in electro-mechanical systems, power systems, transportation systems, etc. () Fall alternating, odd years

EELE 558 Advanced - Electrical Power: 3 Credits (3 Lec)
PREREQUISITE: EELE 454 or equivalent. () On demand. Reading, discussion and exploration of advanced electrical power topics including power system operation and control, power dynamics, power markets, protection, electric drives, or power electronics
Repeatable up to 6 credits.

EELE 565 Parallel Processing: 3 Credits (3 Lec)
PREREQUISITE: Prior experience in any programming language. () Fall alternating, odd years. Architecture and applications of parallel processors, major design issues, fault tolerant computing, performance measures of parallel systems, and issues in concurrent programming

EELE 575 Research/Prof Paper/Project: 3-6 Credits (3-6 Other)
PREREQUISITE: Graduate standing. (F, Sp, Su) A research or professional paper dealing with a topic in the field. The topic must have been mutually agreed upon by the student and his or her major advisor and graduate committee. This course is required for students in the Electrical Engineering non-thesis (plan B) master's degree program
Repeatable up to 6 credits.

EELE 577 Adv Digital Signal Processing: 3 Credits (3 Lec)
PREREQUISITE: EELE 477. (Sp) Spring alternating, odd years. Advanced topics in digital signal processing. Review of LTI discrete-time systems; signal and coefficient quantization; sample rate conversion and multirate filter structures; time-varying and adaptive systems; fast algorithms; system implementation alternatives; DSP applications in current research

EELE 578 Speech Signal Processing: 3 Credits (3 Lec)
PREREQUISITE: EELE 477. () Fall alternating, even years. Digital signal processing techniques that are used to analyze, code, and manipulate speech signals will be covered. Topics include modification, coding, enhancement, and recognition of speech signals

EELE 581 Fourier Optics/Imaging Theory: 3 Credits (3 Lec)
PREREQUISITE: EELE 334 or consent of instructor. () Fall alternating, odd years. Optical propagation and diffraction using scalar wave approach and Fourier Theory of imaging. Introduces concepts of pupil function, point and line spread function and optical transfer function, image formation with coherent and incoherent light, holography and diffractive optical elements

EELE 582 Optical Design: 3 Credits (3 Lec)
PREREQUISITE: EELE 482 or PHSX 427. () Spring alternating, odd years. Optical design using geometric optics and computer ray-tracing software. Introduces ray and wave front aberrations, control of aberrations in optical systems, designing for system requirements, and analytic tools including the modulation transfer function for describing the imaging and beam-conditioning properties of typical optical systems, including lenses, mirrors, cameras, and telescopes

EELE 583 Remote Sensing Systems: 3 Credits (3 Lec)
PREREQUISITE: EELE 334 or PHSX 423 or equivalent. () Spring alternating, even years. Design, analysis, and calibration of electromagnetic remote sensing systems. Combines an introduction to atmospheric radiative transfer and wave propagation principles with detailed coverage of radiometry and optical detectors to analyze remote sensing systems. The course considers the full electromagnetic spectrum, but emphasizes optical systems at ultraviolet, visible, and infrared wavelengths, including cameras, spectrometers, radiometers, polarimeters, multispectral and hyperspectral imagers, laser radars, etc

EELE 584 Laser Engineering: 3 Credits (3 Lec)
PREREQUISITE: PHSX 222. () Spring alternating, odd years. The laser engineering course provides a basic understanding of the design and operational principles of lasers. Discussions of design and operation of several types of lasers will be covered including solid state lasers, gas lasers, and semiconductor lasers

EELE 589 Graduate Consultation: 1-3 Credits (1-3 Other)
PREREQUISITE: Master's standing and approval of the Dean of Graduate Studies. (F, Sp, Su) This course may be used only by students who have completed all of their course work (and thesis if on a thesis plan) but who need additional faculty or staff time or help
Repeatable up to 3 credits.

EELE 590 Masters' Thesis: 1-10 Credits (1-10 Other)
PREREQUISITE: Master's standing
Repeatable up to 99 credits.

EELE 591 Special Topics: 1-4 Credits (2-8 Lab)
Special Topics.
Repeatable up to 12 credits.

EELE 592 Independent Study: 1-6 Credits (1-6 Other)
(F, Sp, Su) Independent study for electrical engineering students.
Repeatable up to 6 credits.

EELE 598 Internship: 1-12 Credits (1 Other)
PREREQUISITE: Graduate standing, consent of instructor and approval of Department Head. An individual assignment arranged with an agency, business or other organizations to provide guided experience in the field
Repeatable up to 12 credits.

EELE 690 Doctoral Thesis: 1-10 Credits (1-10 Other)
PREREQUISITE: Doctoral standing
Repeatable up to 99 credits.