EGE505. Analytical Techniques I. 3 Credits.
Restrictions:
• Must have the following level: Graduate

May not be repeated for credit

EGE506. Analytical Techniques II. 3 Credits.
Restrictions:
• Must have the following level: Graduate

May not be repeated for credit

EGE511. Digital Data and Computer Communication. 3 Credits.
Restrictions:
• Must have the following level: Graduate

May not be repeated for credit

EGE512. Communication Systems. 3 Credits.
Signal analysis, signal transmission. Digital communication systems. Amplitude modulation; angle modulation.
Restrictions:
• Must have the following level: Graduate
• Must be enrolled in the following field(s) of study (major, minor or concentration): Electrical Engineering (265)

May not be repeated for credit

EGE513. Digital Signal Processing. 3 Credits.
Restrictions:
• Must have the following level: Graduate

Prerequisites:
• EGE311 Minimum Grade of C-

May not be repeated for credit

EGE514. Advanced Communications. 3 Credits.
Restrictions:
• Must have the following level: Graduate

Prerequisites:
• EGE 312 Minimum Grade of C- or EGE412 Minimum Grade of C-

May not be repeated for credit

EGE521. CMOS Analog Circuit Design. 3 Credits.
Analysis and optimized design of analog integrated circuits and systems in CMOS technology. Specific topics include MOS devices, device physics, basic CMOS analog circuit building blocks, single stage amplifiers, differential amplifiers, operational amplifiers, reference sources, distortions and controls, various circuit design techniques, options and trade-offs. Graduate Standing or Permission of the Instructor.
Restrictions:
• Must have the following level: Graduate

May not be repeated for credit

EGE522. Advanced Analog Circuits. 3 Credits.
Restrictions:
• Must have the following level: Graduate

Prerequisites:
• EGE321 Minimum Grade of C-

May not be repeated for credit

EGE523. Wireless Communications. 3 Credits.
Overview of wireless systems, propagation characteristics of wireless channels, modems for wireless communications, cells and cellular traffic, fading and multiple access techniques.
Restrictions:
• Must have the following level: Graduate

May not be repeated for credit

EGE525. Microelectronic Fabrication. 3 Credits.
The physics and technology of various steps required to fabricate complicated integrated circuits are explained. The Si and GaAs materials will be covered. The course will cover microelectromechanical systems (MEMS) fabrication as well.
Restrictions:
• Must have the following level: Graduate

May not be repeated for credit
**EGE527. Electronic Properties of Materials. 3 Credits.**

Introduction to electronic properties of materials through the concepts of classical mechanics and quantum mechanics principles. Topics include fundamentals of quantum mechanics, Schrödinger wave equations, energy bands, free-electron energy, applications of electronic theory upon electrical, thermal, optical and magnetic properties of materials. Graduate Standing or Permission of the Instructor.

**Restrictions:**
- Must be enrolled in the following class: Graduate

May not be repeated for credit

**EGE532. Computer Arithmetic. 3 Credits.**

Deals with algorithms and architectures used for computer arithmetic. Issues that will be addressed include: number systems and representation, redundant and residue systems. Addition/subtraction circuits. Multiplication, division, square root algorithms, cording arithmetic system. Floating-point arithmetic systems. Implementation issues -- pipelining, low-power, fault- tolerant designs.

**Restrictions:**
- Must have the following level: Graduate

May not be repeated for credit

**EGE533. Introduction to Parallel Computing. 3 Credits.**

Paradigms of parallel computer systems, memory system implementation, idealized versus practical parallel computer models, parallel algorithms, algorithmic complexity, survey of commercial parallel machines.

**Restrictions:**
- Must have the following level: Graduate

May not be repeated for credit

**EGE534. Fault-Tolerant Design of Digital Systems. 3 Credits.**


**Restrictions:**
- Must have the following level: Graduate

May not be repeated for credit

**EGE535. Low Power VLSI Design. 3 Credits.**

Deals with the design of digital systems for low power dissipation. Issues that will be addressed include CMOS power dissipation, analysis and design tools used for low power digital circuits, design methodologies for low power CMOS circuits, low power memory system designs and a discussion on future challenges in low power digital design. Builds on the VLSI design course previously covered by students in Electrical Engineering/Computer Engineering/Computer Science areas. Students are expected to have a background in circuit theory, electronics, digital logic fundamentals, and probability theory fundamentals. These courses are all covered under core courses in the undergraduate program.

**Restrictions:**
- Must have the following level: Graduate

May not be repeated for credit

**EGE536. Computer Architecture. 3 Credits.**

Computer architecture and hardware system organization are examined. Topics include performance issues, CPU organization and instruction set implementation, performance enhancement through pipelining, memory organizations, input/output structure, and an introduction to parallel architectures.

**Restrictions:**
- Must be enrolled in the following class: Graduate

May not be repeated for credit

**EGE537. VLSI Design. 3 Credits.**

Introduction to MOS devices and circuits (N-MOS and CMOS), MOS transistor theory, integrated circuit processing technology and design rules (N-MOS and CMOS), circuit characterization and performance estimation, logic design, interfacing, design tools, testability analysis, and discussion of chip design projects.

**Restrictions:**
- Must be enrolled in the following class: Graduate

May not be repeated for credit

**EGE541. Transmission Line Theory. 3 Credits.**

Analysis and design of short, medium and long transmission lines. Bundled conductors, skin effect, proximity effect and geometric mean distance. Ferranti effect. Standing waves and traveling waves.

**Restrictions:**
- Must have the following level: Graduate

May not be repeated for credit

**EGE542. Numerical Methods in Engineering. 3 Credits.**

Review of electromagnetic theory and analytical methods. Time domain and frequency domain finite difference methods. Moment methods application to radiation and scattering problems.

**Restrictions:**
- Must have the following level: Graduate
- Must be enrolled in the following field(s) of study (major, minor or concentration): Electrical Engineering (265)

May not be repeated for credit

**EGE543. Antennas and Wave Propagation. 3 Credits.**

Wire antennas and arrays. Aperature antennas and arrays. Solutions of antennas by the moment method. Antenna synthesis and optimization.

**Restrictions:**
- Must have the following level: Graduate

May not be repeated for credit
**EGE544. Microwave Circuits. 3 Credits.**
Review of transmission lines, waveguides, impedance matching and scattering parameters. Microwave resonators, power dividers, directional couplers, and hybrids, microwave litters, microwave defectors, mixers, amplifiers, and oscillators.

**Restrictions:**
- Must have the following level: Graduate

May not be repeated for credit

**EGE545. Satellite Communication. 3 Credits.**

**Restrictions:**
- Must have the following level: Graduate

May not be repeated for credit

**EGE548. Software Defined Networks. 3 Credits.**
Broadband and Carrier Ethernet Networks and technologies. Role of SDN in defining architecture of the next generation of networks. Determination of conformance criteria for networks standards and protocols to support industry solutions and applications.

**Restrictions:**
- Must have the following level: Graduate
- Must be enrolled in the following field(s) of study (major, minor or concentration): Electrical Engineering (265)

May not be repeated for credit

**EGE550. Electromechanical Energy Conversion. 3 Credits.**
Fundamentals of energy conversion including electric circuits and magnetic circuits. Ideal transformers will be introduced first, and real transformer construction and equivalent circuit will be presented. The equivalent circuit will be solved to determine the transformer efficiency and voltage regulation. Single phase and three phase induction machine construction, equivalent circuit and its analysis under load will be performed to determine motor load characteristics and efficiency. Single phase and three phase synchronous machine construction, excitation, and load characteristics will be studied in detail, and machine transient characteristics will be covered briefly.

**Restrictions:**
- Must have the following level: Graduate

May not be repeated for credit

**EGE551. Real Time Systems. 3 Credits.**
Practical experience of real-time operating systems (RTOS) and real-time debugging as applied to real-time embedded systems. Design and implementation of real-time embedded systems: controller, data storage, data acquisition, and communication using a commercially available RTOS.

**Restrictions:**
- Must have the following level: Graduate
- Must be enrolled in the following class: Graduate
- Must be enrolled in the following field(s) of study (major, minor or concentration): Electrical Engineering (265)

May not be repeated for credit

**EGE552. Electric power Systems. 3 Credits.**
Energy courses, transmission line parameters, transmission lines modeling, power flow analysis, voltage frequency control, and power system protection.

**Restrictions:**
- Must be enrolled in the following field(s) of study (major, minor or concentration): Electrical Engineering (265)

May not be repeated for credit

**EGE553. Adaptive Control. 3 Credits.**

**Restrictions:**
- Must have the following level: Graduate
- EGE 317 Minimum Grade of C- or EGE417 Minimum Grade of C-

May not be repeated for credit

**EGE554. Optimal Control. 3 Credits.**

**Restrictions:**
- Must have the following level: Graduate
- EGE 316 Minimum Grade of C- or EGE416 Minimum Grade of C-

May not be repeated for credit

**EGE555. Non-Linear Control. 3 Credits.**

**Restrictions:**
- Must have the following level: Graduate
- EGE 316 Minimum Grade of C- or EGE416 Minimum Grade of C-

May not be repeated for credit

**EGE556. Real Time Systems. 3 Credits.**
Prepares engineering students for a career in management. Through class discussions, group projects, role playing, and guest speakers, students find out what a management role will entail. Students learn how to go from being a practicing engineer to being an engineering manager.

**Restrictions:**
- Must be enrolled in the following class: Graduate

May not be repeated for credit

**EGE557. Fiber Optics. 3 Credits.**

**Restrictions:**
- Must have the following level: Graduate

May not be repeated for credit

**EGE558. Engineering Management. 3 Credits.**

**Restrictions:**
- Must have the following level: Graduate

May not be repeated for credit

**EGE559. Heterostructure Devices. 3 Credits.**

**Restrictions:**
- Must be enrolled in the following class: Graduate

May not be repeated for credit
EGE580. Power Electronics. 3 Credits.
Restrictions:
• Must have the following level: Graduate

EGE590. Thesis in Electrical Engineering. 3-6 Credits.
Research, writing and defense of a thesis under the guidance of the major professor. Required form available in the Records and Registration Office. Required each semester after thesis research project is begun.
Restrictions:
• Must have the following level: Graduate

May be repeated for credit

EGE593. Engineering Selected Topic. 3-12 Credits.
Selected topics courses are regularly scheduled courses that focus on a particular topic of interest. Descriptions are printed in the Schedule of Classes each semester. Selected topics courses may be used as elective credit and may be repeated for credit, provided that the topic of the course changes.
Restrictions:
• Must have the following level: Graduate

May be repeated for credit

EGE594. Fieldwork Engineering. 1-12 Credits.
Restrictions:
• Must have the following level: Graduate

May be repeated for credit

EGE595. Indep Study Elec Engineering. 1-12 Credits.
Restrictions:
• Must have the following level: Graduate

May be repeated for credit

EGE599. Comprehensive Exam Workshop. 0 Credits.
Non-credit workshop for students who wish to devote the semester immediately following the completion of their coursework to prepare for the comprehensive exam.
Restrictions:
• Must have the following level: Graduate
• Must be enrolled in the following field(s) of study (major, minor or concentration): Electrical Engineering (265)

May not be repeated for credit

EGE790. Thesis Engineering. 1-12 Credits.
Restrictions:
• Must be enrolled in the following class: Graduate

May be repeated for credit

EGE795. Indep Study Elec Engineering. 0 Credits.
Restrictions:
• Must have the following level: Graduate

May be repeated for credit

EGE799. Continued Registration. 1 Credit.
Restrictions:
• Must have the following level: Graduate

May be repeated for credit