EGE193. 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: Undergraduate

EGE200. Circuit Analysis. 3 Credits.
Electrical circuit parameters; Kirchoff's laws; circuit theorems; transient analysis of first and second-order circuits; sinusoidal excitation: phasor analysis, complex power; frequency response; resonance and filters; magnetically-coupled circuits and transformers; three-phase circuits.

Prerequisites:
- (PHY 202 with a minimum grade of C- and MAT 359 with a minimum grade of C-) and EGE 201 (may be taken concurrently) with a minimum grade of C-

Restrictions:
- Must have the following level: Undergraduate
- Must have the following field(s) of study (major, minor or concentration):
  - Mechanical Engineering (521)
  - Computer Engineering (518)
  - Undeclared: Pre-Engineering (00EN)
  - Electrical Engineering (517)

EGE201. Circuits Laboratory. 1 Credit.
Computer simulation and hardware experimentation on equivalent resistance, nodal and mesh approaches. Thvenin theorem, maximum power transfer, step response of first and second order circuits, power factor correction, and resonant circuits.

Prerequisites:
- (PHY 202 with a minimum grade of C- and MAT 359 with a minimum grade of C-)

Restrictions:
- Must have the following level: Undergraduate
- Must have the following field(s) of study (major, minor or concentration):
  - Mechanical Engineering (521)
  - Computer Engineering (518)
  - Undeclared: Pre-Engineering (00EN)
  - Electrical Engineering (517)

EGE293. Engineering Selected Topic. 1-12 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.

Prerequisites:
- PHY 202 with a minimum grade of C-

Restrictions:
- Must have the following level: Undergraduate

EGE295. Indep Study Elec Engineering. 1-12 Credits.
Selected research areas specific to faculty.

Restrictions:
- Must have the following level: Undergraduate

EGE302. Antenna Laboratory. 1 Credit.
Measurement of the far field pattern and characteristics of wire antennas and arrays for VHF. Measurement of the field pattern and characteristics of reflector type antennas in the X-band, and of aperture type antennas and arrays in the X-band.

Prerequisites:
- EGE 445 (may be taken concurrently) with a minimum grade of C-

Restrictions:
- Must have the following level: Undergraduate
- Must have the following field(s) of study (major, minor or concentration):
  - Computer Engineering (518)
  - Mechanical Engineering (521)
  - Electrical Engineering (517)

EGE303. Microwave Fundamentals Laboratory. 1 Credit.
Measurement of VSWR and wavelength in waveguides, stub tuners and matching, calibration of attenuators, time domain reflectometry and frequency domain network analyzer measurement. Prerequisite/Corequisite: EGE342.

Prerequisites:
- EGE 342 with a minimum grade of C-

Restrictions:
- Must have the following level: Undergraduate
- Must have the following field(s) of study (major, minor or concentration):
  - Computer Engineering (518)
  - Mechanical Engineering (521)
  - Electrical Engineering (517)

EGE306. Microwaves Circuits Laboratory. 1 Credit.
Design, build and test planar microwave devices such as power divider, coupler, filter, mixer, amplifier, and oscillator.

Restrictions:
- Must have the following level: Undergraduate
- Must have the following field(s) of study (major, minor or concentration):
  - Computer Engineering (518)
  - Mechanical Engineering (521)
  - Electrical Engineering (517)
EGE311. Signals and Systems . 3 Credits.
Continuous and discrete-time signals, systems, and their properties; linear time-invariant systems: convolution; system descriptions using differential and difference equations; Fourier series, Fourier Transform and their properties. Laplace transform and Z-transform.
Prerequisites:
• (EGE 200 with a minimum grade of C- or EGE 250 with a minimum grade of C-)
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Mechanical Engineering (521)
  • Computer Engineering (518)
  • Engineering (EGG)
  • Electrical Engineering (517)

EGE320. Electronics I . 3 Credits.
Prerequisites:
• (EGE 200 with a minimum grade of C- or EGE 250 with a minimum grade of C-) and EGE 322 (may be taken concurrently) with a minimum grade of C-
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Mechanical Engineering (521)
  • Computer Engineering (518)
  • Engineering (EGG)
  • Electrical Engineering (517)

EGE321. Electronics II . 3 Credits.
Prerequisites:
• EGE 320 (may be taken concurrently) with a minimum grade of C-
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Mechanical Engineering (521)
  • Computer Engineering (518)
  • Engineering (EGG)
  • Electrical Engineering (517)

EGE322. Electronics I Laboratory . 1 Credit.
Laboratory exercises covering op-amps, characterization of diodes, BJT, and MOSFET, diode circuits, biasing and amplification of BJT and MOSFET, including simple current source.
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Mechanical Engineering (521)
  • Computer Engineering (518)
  • Engineering (EGG)
  • Electrical Engineering (517)

EGE323. Electronics II Laboratory . 1 Credit.
Laboratory exercises covering the multistage amplifier, direct coupled amplifier, difference amplifier, op-amp applications, frequency response, oscillator, waveform generator, power amplifier, and frequency response.
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Mechanical Engineering (521)
  • Computer Engineering (518)
  • Engineering (EGG)
  • Electrical Engineering (517)

EGE331. Computer Simulation. 3 Credits.
Prerequisites:
• (EGE 200 (may be taken concurrently) with a minimum grade of C- or EGE 250 (may be taken concurrently) with a minimum grade of C-)
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Mechanical Engineering (521)
  • Computer Engineering (518)
  • Electrical Engineering (517)
EGE340. Applied Electromagnetics. 3 Credits.
Transmission line theory. Graphical solutions using Smith Chart. Impedance matching. Transients on lossless lines. Electrostatics, capacitance and electric energy. Magnetostatic, Inductance and magnetic energy. Maxwell's equations, the wave equation, and uniform plane waves.
Prerequisites:
• (EGE 200 with a minimum grade of C- or EGE 250 with a minimum grade of C-) and MAT 353 with a minimum grade of C-
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Mechanical Engineering (521)
  • Computer Engineering (518)
  • Engineering (EGG)
  • Electrical Engineering (517)

EGE342. Microwave Fundamentals. 3 Credits.
Review of Maxwell's equations, propagation of plane waves, reflection and transmission of plane waves, transmission line analysis, strip lines and microstrip lines, waveguide analysis, microwave networks.
Prerequisites:
• EGE 340 with a minimum grade of C-
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Mechanical Engineering (521)
  • Computer Engineering (518)
  • Engineering (EGG)
  • Electrical Engineering (517)

EGE350. Electric Energy Systems. 3 Credits.
Electric energy generation by using resources such as fossil fuels, nuclear, wind, water, and waves. Power plant equipment, such as boilers, reactors, turbines, generators, transformers and switchgear. Electric power transmission, distribution, utilization and conversion to other energy forms.
Prerequisites:
• EGE 340 with a minimum grade of C-
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Computer Engineering (518)
  • Mechanical Engineering (521)
  • Electrical Engineering (517)

EGE351. Electric Energy Systems Laboratory. 1 Credit.
Experimental verification of material studied in EGE350 such as single phase and three phase circuit, two watt meter method for measurement of three phase power, in balanced and unbalanced circuits, characteristics of single phase and three phase transformers, synchronous generators, electric power transmission, and distribution, three phase and single phase induction motors.
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Computer Engineering (518)
  • Mechanical Engineering (521)
  • Electrical Engineering (517)

EGE393. Engineering Selected Topics. 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: Undergraduate

EGE399. Modular Course. 0 Credits.
Restrictions:
• Must have the following level: Undergraduate

EGE412. Communication Systems. 3 Credits.
Signal analysis, signal transmission. Digital communication systems. Amplitude modulation; angle modulation.
Prerequisites:
• EGE 311 with a minimum grade of C-
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Computer Engineering (518)
  • Mechanical Engineering (521)
  • Electrical Engineering (517)

EGE413. Communication Systems Laboratory. 1 Credit.
AM communication circuits. FM communication. SSB communication circuits. RF power transmitting. Phase-locked loop circuits, frequency synthesis, time division multiplexing (sampling, PCM, DM), frequency division multiplexing, amplitude shift keying, phase shift keying, frequency shift keying.
Prerequisites:
• (EGE 412 with a minimum grade of C- or EGE 312 with a minimum grade of C-)
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Computer Engineering (518)
  • Mechanical Engineering (521)
  • Electrical Engineering (517)
EGE416. Control Systems. 3 Credits.
Feedback and robustness; transfer function, block diagram and signal-flow graph: Mason’s gain formula; stability. Routh-Hurwitz array; steady-state error; state-space: relation to transfer function, state-diagram; design of PID controllers; design of state-feedback controllers.
Prerequisites:
• EGE 311 with a minimum grade of C- or EGM 312 with a minimum grade of C-
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Computer Engineering (518)
  • Mechanical Engineering (521)
  • Electrical Engineering (517)

EGE417. Digital Control Systems. 3 Credits.
Analysis and design of control systems that use digital controllers. Representation of digital systems with difference equations and the Z-transform; Representation of Hybrid control systems (digital controller-analog plant); Stability analysis; Design of digital controller algorithms; Verification of digital controller design via MATLAB simulation.
Prerequisites:
• EGE 416 with a minimum grade of C-
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Computer Engineering (518)
  • Mechanical Engineering (521)
  • Electrical Engineering (517)

EGE418. Control Systems Laboratory. 1 Credit.
Simulation and hardware experiments on the following topics: plant parameter identification, robustness, steady-state error, transient duration, absolute and relative stability. Verification via simulation of controller design in the same time domain and in the frequency domain.
Prerequisites:
• EGE 416 (may be taken concurrently) with a minimum grade of C-
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Computer Engineering (518)
  • Mechanical Engineering (521)
  • Electrical Engineering (517)

EGE421. Microelectronic Technology. 3 Credits.
Miller indices, Crystal growth, Major steps in the fabrication of microelectronic devices (diffusion ion implantation, thermal oxidation, film deposition (physical and chemical), etching, lithography, contacts and interconnections and yield.
Prerequisites:
• EGE 320 with a minimum grade of C-
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Computer Engineering (518)
  • Mechanical Engineering (521)
  • Electrical Engineering (517)

EGE422. Electronic Design Automation Lab. 1 Credit.
Principles of electronic design, schematic design, electronic packaging technologies, PCB materials, PCB Layout, PCB Assembly, PCB manufacturing processes, principles of 3D modeling, 3D modeling of electronic components and enclosures.
Prerequisites:
• EGC 331 (may be taken concurrently) with a minimum grade of C-
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Computer Engineering (518)
  • Mechanical Engineering (521)
  • Electrical Engineering (517)

EGE423. Solid State Devices. 3 Credits.
This course introduces the basics of semiconductor physics and modeling and devices such as pn junction diode, bipolar transistor, metal-semiconductor contacts, field effect translator (MESFET and MOSFET), optical (solar cell LED, laser diode), power and microwave devices.
Prerequisites:
• EGE 320 with a minimum grade of C-
Restrictions:
• Must have the following level: Undergraduate
• Must have the following field(s) of study (major, minor or concentration):
  • Computer Engineering (518)
  • Mechanical Engineering (521)
  • Electrical Engineering (517)
EGE424. Microelectronic Technology Lab. 1 Credit.
This course introduces students to various processing involved in fabrication of integrated circuits such as thermal oxidation, film deposition, lithography, cleaning and etching, rapid thermal processing and characterization.

Prerequisites:
- EGE 320 with a minimum grade of C- and EGE 436 (may be taken concurrently) with a minimum grade of C-

Restrictions:
- Must have the following level: Undergraduate
- Must have the following field(s) of study (major, minor or concentration):
  - Computer Engineering (518)
  - Mechanical Engineering (521)
  - Electrical Engineering (517)

EGE435. VLSI Design . 3 Credits.
Introduction to MOS devices and circuits (N-MOS, CMOS), MOS transistor theory. Integrated system processing technology and design rules (N-MOS and CMOS), circuit characterization and performance estimation, N-MOS and CMOS circuits and logic design. Interfacing. Introduction to VLSI design tools. Testability analysis. Microarchitecture of VLSI systems. Chip design projects.

Prerequisites:
- (EGC 230 with a minimum grade of C- or EGC 220 with a minimum grade of C-) and EGE 320 with a minimum grade of C-

Restrictions:
- Must have the following level: Undergraduate
- Must have the following field(s) of study (major, minor or concentration):
  - Computer Engineering (518)
  - Mechanical Engineering (521)
  - Electrical Engineering (517)

EGE441. 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.

Prerequisites:
- EGE 340 with a minimum grade of C-

Restrictions:
- Must have the following level: Undergraduate
- Must have the following field(s) of study (major, minor or concentration):
  - Mechanical Engineering (521)
  - Electrical Engineering (517)
  - Computer Engineering (518)
  - BS Computer Engineering/MS EE (266)
  - BS Elec. Engineering/MS EE (267)

EGE445. Antenna Systems . 3 Credits.
Antenna parameters, wire antennas, arrays of wire antennas, aperture and printed circuit type antennas, reflectors and feeds.

Prerequisites:
- EGE 340 with a minimum grade of C-

Restrictions:
- Must have the following level: Undergraduate
- Must have the following field(s) of study (major, minor or concentration):
  - Computer Engineering (518)
  - Mechanical Engineering (521)
  - Electrical Engineering (517)

EGE446. Antenna Systems Laboratory. 1 Credit.
Measurement of the far field pattern and characteristics of wire antennas and arrays for VHF. Measurement of the field pattern and characteristics of reflector type antennas in the X-band, and of aperture and printed circuit type antennas and arrays in the X-band.

Prerequisites:
- EGE 445 (may be taken concurrently) with a minimum grade of C-

Restrictions:
- Must have the following level: Undergraduate
- Must have the following field(s) of study (major, minor or concentration):
  - Computer Engineering (518)
  - Mechanical Engineering (521)
  - Electrical Engineering (517)

EGE451. Electromechanical Energy Conversion . 3 Credits.
Advanced topics in electromechanical energy conversion and drives. Transformers. Induction machines, three phase and single phase, Synchronous machines, Electric drives, Induction generators.

Prerequisites:
- EGE 350 with a minimum grade of C-

Restrictions:
- Must have the following level: Undergraduate
- Must have the following field(s) of study (major, minor or concentration):
  - Mechanical Engineering (521)
  - Computer Engineering (518)
  - Engineering (EGG)
  - Electrical Engineering (517)
EGE452. Electric Power Systems . 3 Credits.
Energy courses, transmission line parameters, transmission line modeling, power flow analysis, voltage frequency control, power system protection.
**Prerequisites:**
- EGE 350 with a minimum grade of C-

**Restrictions:**
- Must have the following level: Undergraduate
- Must have the following field(s) of study (major, minor or concentration):
  - Mechanical Engineering (521)
  - Computer Engineering (518)
  - Engineering (EGG)
  - Electrical Engineering (517)

EGE455. Electromechanical Energy Conversion Laboratory. 1 Credit.
**Prerequisites:**
- EGE 451 (may be taken concurrently) with a minimum grade of C-

**Restrictions:**
- Must have the following field(s) of study (major, minor or concentration):
  - Computer Engineering (518)
  - Mechanical Engineering (521)
  - Electrical Engineering (517)

EGE493. Engineering Selected Topics. 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: Undergraduate

EGE494. Fieldwork Engineering. 1-12 Credits.
Complete a prearranged and supervised industry-based project and submit a final technical report.
**Restrictions:**
- Must have the following level: Undergraduate

EGE495. Indep Study Elec Engineering. 1-12 Credits.
Selected research areas specific to faculty.
**Restrictions:**
- Must have the following level: Undergraduate