EEL: Engineering: Electrical Courses

Courses

EEL 2948  Service Learning Field Study I
1-3 sh (may be repeated for up to 4 sh of credit)

Placement in community agency or other social organizational setting related to field of study. Supervision by faculty and agency. Students and faculty "customize" courses to fit a full range of services that are available in the setting. Student must be able to draw correlation between the discipline and field study. Journal and reflective experience paper are required. With the agreement of the student's faculty sponsor, a minimum of 4-6 hours per week must be done at the field site per semester hour of credit. Permission is required.

EEL 3111  Circuits I
3 sh (may not be repeated for credit)
Prerequisite: (PHY 2049 OR PHY 2049C) AND (EGN 3204* OR EGM 3344*) AND ((EEL 3111L* AND MAC 2313))

Basic Analysis of DC and AC electric circuits.

EEL 3111L  Electrical Circuits Laboratory
1 sh (may not be repeated for credit)
Prerequisite: EEL 3111*

Introductory electrical engineering laboratory in electrical instrumentation, devices, and systems. Material and supply fee will be assessed. Credit may not be received in both EEL 3117L and EEL 3303L.

EEL 3112  Circuits II
3 sh (may not be repeated for credit)
Prerequisite: EEL 3111 AND EGM 4313* AND MAP 2302

Continuation of EEL 3111 with emphasis on circuit applications of convolution, the Fourier series, and the Laplace and Fourier transforms. A grade of "C" or better is required in the prerequisites.

EEL 3135  Discrete-Time Signals and Systems
3 sh (may not be repeated for credit)
Prerequisite: (EEL 3112*) AND (EEL 4834 OR COP 3014 OR EGN 3203)

Difference equations, discrete convolutions, the z transform, discrete and fast Fourier transforms, digital processing of analog signals, sampling theorem, probability and random signals.

EEL 3211  Basic Electric Energy Engineering
3 sh (may not be repeated for credit)
Prerequisite: EEL 3111 AND EEL 3211L*

Introduction to the fundamentals of energy conversion; Power transformers, DC machines, Poly-phase induction machines, synchronous machines, single phase motors and permanent magnet machines, Speed control of DC motors, Speed control of ac motors. A C is required in the prerequisites to this course.

EEL 3211L  Electric Energy Engineering Laboratory
1 sh (may not be repeated for credit)
Co-requisite: EEL 3211
Hands on experience with fundamental devices of electric power systems such as transformers, electrical machines, power passive components, and power electronic converters as well as all measuring and recording instruments. Lab corresponds with EEL 3211.

EEL 3472  Electromagnetic Fields and Applications I
3 sh (may not be repeated for credit)
Prerequisite: (PHY 2049 OR PHY 2049C) AND (MAC 2312)

Electric and magnetic fields and forces, Maxwell's equations in point and integral form, plane wave propagation, energy and power.

EEL 3473  Electromagnetic Fields and Applications II
3 sh (may not be repeated for credit)
Prerequisite: EEL 3472
Maxwell's equations, electromagnetic wave propagation in different media, antennas, waveguides, numerical methods, electromagnetic coupling. A grade of "C" or better is required in the prerequisite(s).

EEL 3701  Digital Logic and Computer Systems
3 sh (may not be repeated for credit)
Prerequisite: (MAC 2311* OR MAC 1114 OR MAC 2312) AND (EEL 3701L*)
Co-requisite: EEL 3701L

An overview of logic design, algorithms, computer organization, sequential circuit design, and computer engineering technology.

EEL 3701L  Digital Logic and Computer Systems Laboratory
1 sh (may not be repeated for credit)
Prerequisite: EEL 3701*

Practical applications of digital logic. Material and supply fee will be assessed.

EEL 3905  Directed Study
1-12 sh (may be repeated indefinitely for credit)

EEL 4213  Electric Energy Systems 1
3 sh (may not be repeated for credit)
Prerequisite: EEL 3211

System models for generators, transformers, transmission lines and large-scale power networks. Matrix formulations, power flow and analysis, symmetrical component theory, balanced and unbalanced fault analysis. A grade of "C" or better is required in the prerequisite(s).

EEL 4242  Power Electronic Circuits
3 sh (may not be repeated for credit)
Prerequisite: EEE 3308

Circuit topologies, analysis, design, and simulation of electronic circuits such as power supplies and motor drives. A grade of "C" or better is required in the prerequisite(s).

EEL 4276  Cyber Security of Industrial Control System
3 sh (may not be repeated for credit)

This course is used to teach and share in-depth defense strategies and up-to-date information on cyber threats and mitigations for vulnerabilities with the goal of improving cyber security preparedness in the industrial control systems community. This course provides an overview of operations security for industrial control systems and prepares the students for the risks and threats associated with electric grids and other centralized and distributed control systems. Offered concurrently with EEL 5277; graduate students will have additional work.
EEL 4283  Introduction to Renewable Energy
3 sh (may not be repeated for credit)
Prerequisite: CHM 2045 AND ENC 1102 AND PHY 2049
The main objective of this course is to study the different types of energy sources and storages, renewable energy systems, energy distribution, energy policy and management. Computer-aided analysis of renewable energy resource information and data for evaluating energy potential and energy costs.

EEL 4287  Future Energy Systems
3 sh (may not be repeated for credit)
Prerequisite: EEL 3111
Study and analyze renewable energy sources and their integration into the grid, microgrid, smart grid power management, plug in electric vehicles, modern energy storage technologies, energy efficient buildings, cyber security and other new technologies that are revolutionizing the power industry.

EEL 4290  Sustainable Power Systems
3 sh (may not be repeated for credit)
Prerequisite: EEL 4287
Key technical and economic characteristics of power systems and their interaction in the design and operation of markets that foster environmental, economic, and security stability in today's complex power systems.

EEL 4514  Communication Systems and Components
3 sh (may not be repeated for credit)
Prerequisite: EEL 3112 AND EEL 3135 AND EEL 4514L* AND EGM 4313
Theory of communication, and applications to radio, television, telephone, satellite, cellular telephone, spread spectrum, and computer communication systems. A grade of "C" or better is required in the prerequisite(s).

EEL 4514L  Communication Laboratory
1 sh (may not be repeated for credit)
Prerequisite: EEE 3308L AND EEL 4514*
Experiments with communication circuits and radio frequency instruments, devices, and measurements. Material and Supply Fee will be assessed.

EEL 4567  Linear Control Systems
3 sh (may not be repeated for credit)
Prerequisite: EEL 3111 AND EEL 4657L* AND MAP 2302
Theory and design of linear control systems.

EEL 4657L  Linear Controls Laboratory
1 sh (may not be repeated for credit)
Prerequisite: EEL 4657*
Practical applications of linear control theory.

EEL 4663  Elements of Robotics
3 sh (may not be repeated for credit)
Prerequisite: (MAP 2302) AND (EGM 4313 OR EGM 3344)
An introductory course in the multidisciplinary field of robotics with analysis and design of robots and robotic tasks. Includes class projects in robot programming and design. A grade of "C" or better is required in the prerequisite(s). Material and supply fee will be assessed.

EEL 4712  Digital Design
3 sh (may not be repeated for credit)
Prerequisite: (EEL 4834 OR COP 3014) AND (EEL 3701)
Co-requisite: EEL 4712L
Advanced modular logic design, design languages, finite state machines, and binary logic. A grade of "C" or better is required in all prerequisites.

EEL 4712L  Digital Design Laboratory
1 sh (may not be repeated for credit)
Prerequisite: (EEL 4834 OR COP 3014) AND (EEL 3701*)
Co-requisite: EEL 4712
Design and applications of advanced digital logic using VHDL.

EEL 4713  Digital Computer Architecture
3 sh (may not be repeated for credit)
Prerequisite: EEL 4712

EEL 4744  Microprocessor Applications
3 sh (may not be repeated for credit)
Prerequisite: (EEL 4834 OR COP 3014) AND (EEL 3701)
Elements of microprocessor-based systems; hardware interfacing and software design for their application. A grade of "C" or better is required in the prerequisite(s).

EEL 4744L  Microprocessor Applications Laboratory
1 sh (may not be repeated for credit)
Prerequisite: (EEL 4834* OR COP 3014) AND (EEL 3701L)
Co-requisite: EEL 4744
Practical applications of microprocessor-based systems, software and hardware interface. A grade of "C" or better is required in the prerequisites. Material and supply fee will be assessed.

EEL 4759  Digital Image Processing
3 sh (may not be repeated for credit)
Prerequisite: EEL 3112 AND EGN 3203
An introduction to digital images and digital image processing techniques, including frequency and spatial image enhancement, image restoration, wavelets and morphology.

EEL 4822  Pattern Recognition
3 sh (may not be repeated for credit)
Prerequisite: EEL 4834 AND EGN 3203
An introduction to pattern recognition and classification techniques, including Bayesian classifiers, linear and non-linear classifiers, clustering, perceptrons, and feature generation/selection.

EEL 4834  Programming for Engineers
3 sh (may not be repeated for credit)
Prerequisite: MAC 1114 OR MAC 2311* OR MAC 2312
Develop computer skills and art of writing good computer programs using a high level programming language like C. Examples and exercises relevant to Electrical Engineering are used.

EEL 4905  Individual Problems in Electrical Engineering
1-12 sh (may be repeated indefinitely for credit)
May be repeated with a change of content up to a maximum of 4 credits. Selected problems or projects in the student's major field of engineering study. Permission is required.
EEL 4930  Special Topics in Electrical Engineering
1-4 sh (may be repeated for up to 6 sh of credit)
May be repeated with change of content up to a maximum of 6 credits. Special courses covering selected topics in electrical engineering. Permission is required. A grade of "C" or better is required in the prerequisite(s). (Contact the department for prerequisites).

EEL 4940  Engineering Internship
1 sh (may be repeated for up to 3 sh of credit)
Prerequisite: EEL 3111 OR EEL 3701 OR EEL 4834
Practical and significant electrical and/or computer engineering based work experience under approved industrial supervision. Graded on a satisfactory / unsatisfactory basis only. Permission from department co-op advisor is required.

EEL 4949  Co-Op Work Experience
1 sh (may be repeated for up to 4 sh of credit)
Practical co-op work under approved industrial supervision. Grading is on satisfactory / unsatisfactory basis only. Permission is required.

EEL 5277  Cyber Security of Industrial Control System
3 sh (may not be repeated for credit)
This course is used to teach and share in-depth defense strategies and up-to-date information on cyber threats and mitigations for vulnerabilities with the goal of improving cyber security preparedness in the industrial control systems community. This course provides an overview of operations security for industrial control systems and prepares the students for the risks and threats associated with electric grids and other centralized and distributed control systems. This course introduces students to new developments in cyber threats, breaches and incidents in electrical grid and other industrial control systems. The course also discusses issues and methods to improve industrial security on the automation platform. Offered concurrently with EEL 4276; graduate students will have additional work.

* This course may be taken prior to or during the same term.