EEL: Engineering: Electrical Courses

Courses

EEL 3111 Circuits I
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: (PHY 2049/L) 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
College of Sci and Engineering, Department of Electrical & Computer Engineer

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: ((EEL 3111 AND MAP 2302)) AND (EGM 4313* OR EGM 3344*)

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, except MAP 2302, which requires a grade of "C-" or better.

EEL 3135 Discrete-Time Signals and Systems
College of Sci and Engineering, Department of Electrical & Computer Engineer

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: EEL 3111

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

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 3701 Digital Logic and Computer Systems
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: (MAC 2311* OR MAC 1114 OR MAC 2312 OR MAC 1147) 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
College of Sci and Engineering, Department of Electrical & Computer Engineer

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

1-12 sh (may be repeated indefinitely for credit)

EEL 4210 Smart Distribution Systems
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: EEL 3211

Theory and practical application methods available in the industry for the protection of distribution systems and includes smart grid applications for protection and control. Covering a broad range of topics related to developments and trends in smart distribution technologies including automatic restoration, data management, cybersecurity, interoperability and standards, and future vision. Offered concurrently with EEL 5291. Graduate students will be assigned additional work.

EEL 4213 Electric Energy Systems 1
College of Sci and Engineering, Department of Electrical & Computer Engineer

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 4241 Advanced Topics in Power Electronics
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: EEE 3308

The course covers Advanced topics and trend in power electronics such as converters topologies for renewable energies and electric vehicles applications, Grid synchronization, power and voltage control, multilevel converters and wideband gap semiconductors. Offered concurrently with EEL 5245. Graduate students will be assigned additional work.

EEL 4252 Power System Operation and Control
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may be repeated indefinitely for credit)
Prerequisite: EEL 3211

Planning, design, operation, control and protection of power systems requires continuous and comprehensive mathematical analysis to evaluate the current states and remedial control. This course introduces and explores the possible solutions to planning, operating, and controlling power generation and transmission systems in electric utilities. Offered concurrently with EEL 5266. Graduate students will be assigned additional work.

EEL 4276 Cyber Security of Industrial Control System
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: EEL 4834* OR COP 2334* OR COP 3014*

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: EEL 3111

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: EEL 3111

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: EEL 3112 AND EEL 3135 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
College of Sci and Engineering, Department of Electrical & Computer Engineer

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 4552 Digital Signal Processing
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: EEL 3112 AND EEL 3135*

Discrete-time signals and systems, including frequency analysis of discrete-time signals and systems, sampling and quantization. Introduction to and applications of Discrete and Fast Fourier as well as Z transforms. Design of digital filters. Offered concurrently with EEL 5553. Graduate students will be assigned additional work.

EEL 4657 Linear Control Systems
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: EEL 3111 AND MAP 2302

Theory and design of linear control systems.

EEL 4657L Linear Controls Laboratory
College of Sci and Engineering, Department of Electrical & Computer Engineer

1 sh (may not be repeated for credit)
Prerequisite: EEL 4657*

Practical applications of linear control theory.

EEL 4663 Elements of Robotics
College of Sci and Engineering, Department of Electrical & Computer Engineer

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: (EEL 4834 OR COP 3014) AND (EEL 3701) AND (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
College of Sci and Engineering, Department of Electrical & Computer Engineer

1 sh (may not be repeated for credit)
Prerequisite: (EEL 4834 OR COP 3014) AND (EEL 3701) AND (EEL 4712*)

Design and applications of advanced digital logic using VHDL.

EEL 4713 Digital Computer Architecture
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: EEL 4712

The use of electronic digital modules to design computers. Organization and operation of computers. Hardware/software trade-offs. Design of computer interfacing.

EEL 4744 Microprocessor Applications
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: (EEL 3701) AND (COP 3014 OR EEL 4834)

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

1 sh (may not be repeated for credit)
Prerequisite: (EEL 4834 OR COP 3014) AND (EEL 3701L) AND (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 4834 Programming for Engineers
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: MAC 1114 OR MAC 1147 OR MAC 2312 OR MAC 2311*

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 4888 Software/Hardware Integration
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)
Prerequisite: (EEL 4834 OR COP 3014) AND (EEL 3701 OR EEL 3111)

The course is concerned with the learning of software and hardware systems integration. Students will design and implement digital and analog systems using Arduino Mega microcontrollers, C, and C Sharp programming.

EEL 4905 Individual Problems in Electrical Engineering
College of Sci and Engineering, Department of Electrical & Computer Engineer

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

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
College of Sci and Engineering, Department of Electrical & Computer Engineer

1 sh (may be repeated for up to 3 sh of credit)

Practical and significant discipline applicable 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
College of Sci and Engineering, Department of Electrical & Computer Engineer

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 5245 Advanced Topics in Power Electronics
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)

The course covers Advanced topics and trend in power electronics such as converters topologies for renewable energies and electric vehicles applications, Grid synchronization, power and voltage control, multilevel converters and wideband gap semiconductors. Offered concurrently with EEL 4241. Graduate students will be assigned additional work.

EEL 5266 Power System Operation and Control
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)

An overview of modern power systems operation and control problems and solution techniques, including the current and advanced technologies and trends in development that will shape future electrical power systems.

EEL 5267 Intelligent Systems Applications to Power Systems
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)

An overview of the intelligent systems applications in power system operation. It covers applications of artificial neural networks, fuzzy systems, and heuristic search algorithms.

EEL 5277 Cyber Security of Industrial Control System
College of Sci and Engineering, Department of Electrical & Computer Engineer

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.

EEL 5291 Smart Distribution Systems
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)

Theory and practical application methods available in the industry for the protection of distribution systems and includes smart grid applications for protection and control. Covering a broad range of topics related to developments and trends in smart distribution technologies including automatic restoration, data management, cybersecurity, interoperability and standards, and future vision, this course will be taught as a multidisciplinary course and emphasis is placed on the importance of strong collaboration between academia, utility and industry. Offered concurrently with EEL 4210. Graduate students will be assigned additional work.

EEL 5520 Communications Networks
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)

Introduction to communications networks. Design principles of communications networks, Protocols. The OSI model and layering model of networks. Physical, data link, network layers. Network topologies. Routing, multiplexing, and error detection and correction. Local Area networks (intro).

EEL 5553 Digital Signal Processing
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)

Discrete-time signals and systems. Frequency analysis of discrete-time signals and systems. Sampling and quantization. Discrete Fourier transform. Windowing effect. Z-transform. FIR and IIR Digital filters designs. Fast Fourier transform. Offered concurrently with EEL 4552. Graduate students will be assigned additional work.

EEL 5630 Digital Control Systems
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)

The course introduces feedback computer-controlled systems, the components of digital control systems, and system models using the z-domain (z-transfer functions) and the time domain (state variable representations). Evaluation of system performance is studied. Discrete-time controllers are designed including PID-controllers, state and output feedback controllers, and reconstruction of states using observers.

EEL 5654 Advanced Control Systems
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)

This course is focused on the analysis, modeling, and design of advanced control systems in time and frequency domains. Implementation of control systems using continuous and digital techniques will also be covered.

EEL 5683 Introduction to Autonomous Systems
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)

This course is focused on mobile robotics with emphasis on robot control, navigation, and motion planning using kinematics and dynamics. Topics include mobile robot sensors, sensor data processing, Kalman filtering, mobile robot localization, basic concepts of mapping, path planning and obstacle avoidance, and intelligent control architecture.

EEL 5905 Directed Study
College of Sci and Engineering, Department of Electrical & Computer Engineer

1-12 sh (may be repeated indefinitely for credit)

EEL 6042 Data Analytics and Applications to Engineering
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)

An overview of Engineering data analytic techniques structured around the broad contours of the different types of data analytics, namely, descriptive, inferential, predictive, and prescriptive analytics. Mathematical approaches (such as linear algebra) and software programming will be used to develop a better intuition for machine learning and deep learning algorithms so as to ensure that a better model is developed to solve graduate level engineering problems.

EEL 6246 Power Electronics and Utility Applications
College of Sci and Engineering, Department of Electrical & Computer Engineer

3 sh (may not be repeated for credit)

This course focuses on power electronics structures and interfaces as related to various utility applications.

EEL 6606 Aerial Robotics
College of Sci and Engineering, Department of Intelligent Systems & Robotics

3 sh (may not be repeated for credit)

This course introduces and demonstrates the applications and algorithms in design of autonomous aerial robots. The course includes coordinate frames, aerial robot kinematics and dynamics, state estimation, and path planning. Activities and projects will be used to develop autonomous navigation algorithms for aerial robots. The class provides instructions and practical exercises in motion planning, flight control, and understanding vehicle dynamics of aerial robots. The class will focus on mathematical and theoretical foundations of aerial robot development.

EEL 6692 Wearable Robotics
College of Sci and Engineering, Department of Intelligent Systems & Robotics

3 sh (may not be repeated for credit)
Prerequisite: EEE 6772

An applied investigation of wearable robotics. Physical assistive devices can take many forms, but all have a foundation in mechanical design, robotics, and biomechanics. This applied course will investigate the issues and approaches for assistance in the areas of mobility, rehabilitation, strength enhancement, and injury prevention. The student will review and present the state of the art in each of these areas.

EEL 6905 Directed Study
College of Sci and Engineering, Department of Electrical & Computer Engineer

1-12 sh (may be repeated indefinitely for credit)

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