

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.

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) 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 4242 Power Electronic Circuits

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

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

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. 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: 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

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 4594 Introduction to Mobile Robotics

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

3 sh (may not be repeated for credit)

Prerequisite: (EGM 4313 OR EGM 3344) AND (EEL 3111)

This is an introductory course to mobile robotics with emphasis on mobile robot models, control, planning, and navigation. The course will cover proprioceptive and exteroceptive mobile robot sensors and their processing; basic concepts of localization and mapping; Kalman filtering; design and evaluation of path tracking algorithms; planning and obstacle avoidance; intelligent control architecture.

EEL 4603L Introduction to KUKA Robotics

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

1 sh (may not be repeated for credit)

Prerequisite: EEL 3111

A hands on, laboratory based introductory course in programming robot operational tasks utilizing an industry standard controller and robot work cell. Upon completion of this course, students may choose to take the KUKA Robot Programming and Simulation exam and earn certification.

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)

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

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*)

Co-requisite: 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 OR (COP 3014 AND 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)

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

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

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

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

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

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

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 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.

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.

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 6617 Multivariable Linear Control Systems

College of Sci and Engineering, Department of Intelligent Systems & Robotics

3 sh (may not be repeated for credit)

This course focuses on input-output and state space representation of linear continuous time dynamic systems. Topics include: analysis and synthesis techniques for multi-input/multi-output (MIMO) control systems, design and analysis of single and multi-variable feedback control systems in transform and time domain. Students will study the stability and robustness of feedback loops, while employing approaches for optimal and robust feedback control design, chiefly H_2 , H_∞ , and μ synthesis.

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)