Course Descriptions for Courses Offered by the EEE Program

EEEN 220 Signal and Systems I (3:0:0)
Pre-requisite(s): MATH 113
Co-requisite(s): EEEN 221

Introduction to methods of representing continuous-time signals and systems, and interaction between signals and systems. Analysis of signals and systems through differential equations and transform methods; Laplace and Fourier transforms; frequency response of systems; stability in time and frequency domains. Presents application examples from communications, circuits, control, and signal processing.

EEEN 221 Signal and Systems I Lab (0:3:0)
Co-requisite(s): EEEN 220

Laboratory course to accompany EEEN 220. In this course, the student will acquire hands-on experience with programming in MATLAB. Topics include representation of different signals, system linearity and time invariance, analysis of a first - order system, implementing matched filter for Barker codes, response of second - order systems and damping ratio, synthesis periodic signals

EEEN 280 Electric Circuit Analysis I (3:0:0)
Pre-requisite(s): PHYS 220

Basic circuit concepts and DC analysis, circuit analysis techniques, circuit theories, fundamental operation of operational amplifiers and their applications, transient and steady state analysis of RL, RC, and RLC circuits and basic AC analysis.

EEEN 281 Electric Circuit Analysis I Lab (0:3:0)
Co-requisite(s): EEEN 280 or MENG 231

Laboratory course to accompany EEEN 280. In this course, students will experimentally verify circuit analysis concepts under DC excitation and transient response. They will use different measurement instruments and build DC electric circuits.

EEEN 282 Electric Circuit Analysis II (3:0:0)
Pre-requisite(s): EEEN 280

Review of AC sinusoidal circuit analysis with active and reactive power. Covers magnetically coupled inductors and ideal transformers, three phase circuits, Laplace transform, application of Laplace transform in circuit analysis, passive and active filter analysis and design, two port networks.

EEEN 283 Electric Circuit Analysis II Lab (0:3:0)
Pre-requisite(s): EEEN 281
Co-requisite(s): EEEN 282

Laboratory course to accompany EEEN 282. In this course, students will experimentally verify circuit analysis concepts under steady state AC excitation. They will use different measurement instruments and build AC electric circuits.

EEEN 305 Electromagnetic Theory (3:0:0)
Pre-requisite(s): PHYS 220 and MATH 214

Course uses vector algebra and vector calculus. Covers topics related to electrostatic and magnetostatic fields, electric and magnetic properties of media, electric boundary value problems, Maxwell's equations, electromagnetic waves and plane wave propagation, Poynting theorem and transmission line theory.

EEEN 331 Digital System Design (0:3:0)
Pre-requisite(s): PHYS 220
Co-requisite(s): EEEN 332

This course covers principles of digital logic and digital system design. Topics include number systems; Boolean algebra; analysis, design, and minimization of combinational logic circuits; analysis and design of synchronous and asynchronous finite state machines; and an introduction to VHDL and behavioral modeling of combinational and sequential circuits.

EEEN 332 Digital Systems Design Lab (0:3:0)
Pre-requisite(s):
Co-requisite(s): EEEN 331

Laboratory course to accompany EEEN 331. In this course, the student will acquire hands-on experience with basic logic components, combinational and sequential logic circuits and the use of VHDL.

EEEN 333 Linear Electronics I (3:0:0)
Pre-requisite(s): EEEN 280

Principles of operation and application of electron devices and linear circuits. Topics include semiconductor properties, diodes, bipolar and field effect transistors, biasing, amplifiers, frequency response, operational amplifiers and analog design.

EEEN 334 Linear Electronics I Lab (0:3:0)
Pre-requisite(s): EEEN 281
Co-requisite(s): ECEN 333.

Laboratory course to accompany EEEN 333. In this course, the student will acquire hands-on experience with basic Electronic components and circuits. Topics covered include: Semiconductor diodes, rectification, Zener diodes, BJT and FET transistors and Amplifiers.

EEEN 360 Random Signal and Noise (3:0:0)
Pre-requisite(s): STAT 346 and EEEN 220.

Introduction to set theory, probability, random variables and random processes. Modelling various types of noise encountered in communication systems as random processes. Analyzing the system response in the presence of random noise processes and calculating the power spectral density.

EEEN 431 Digital Circuit Design (3:0:0)
Pre-requisite(s): EEEN 331 and EEEN 333

Analysis and design of discrete and integrated switching circuits. Topics include transient characteristics of diodes, bipolar, and field-effect transistors; MOS and bipolar inverters; no regenerative and regenerative circuits; TTL, ECL, IIL, NMOS, and CMOS technologies; semiconductor memories; VLSI design principles; and SPICE circuit analysis.

EEEN 433 Linear Electronics II (3:3:0)
Pre-requisite(s): EEEN 333.

Differential amplifiers, feedback circuits, power amplifiers, feedback amplifier frequency response, analog integrated circuits, operational amplifier systems, oscillators, wide band and microwave amplifiers, and computer–aided design.

ECEN 434 Linear Electronics II Lab (0:3:0)
Pre-requisite(s): EEEN 334.
Co-requisite: EEEN 433

Laboratory course to accompany EEEN 433. In this course, the student will acquire hands-on experience with Electronic Amplifiers, active filters and oscillators. Topics covered include: Cascade amplifiers, differential amplifier, active filters, oscillators, and feedback amplifier concepts. **(Writing Intensive Course)**

EEEN 437 Power Electronics (3:0:0)
Pre-requisite(s): EEEN 333

Course examines the application of electronics to energy conversion and control. The subject covers modern power semiconductor devices e.g., diodes, thyristors, MOSFETS, and other insulated gate devices; Static and switching characteristics, gate drive and protection techniques; Various DC-DC, AC-DC and DC-AC converter circuit topologies, their characteristics and control techniques; Analysis of input and output waveforms of these circuits; and their applications. Utility interference and Harmonic issues for power electronics Circuits.

EEEN 460 Communication Systems (3:0:0)
Pre-requisite(s): EEEN 220 and STAT 346

Introduction to analog and digital communications. Topics include review of important concepts from signals and systems theory and probability theory; Gaussian processes and power spectral density; digital transmission through additive white Gaussian channels; sampling and

pulse code modulation; analog signal transmission and reception using amplitude, frequency and phase modulation; and effects of noise on analog communication systems.

EEEN 461 Communication Engineering Lab (0:3:0)
Pre-requisite(s): EEEN 460
Co-requisite(s): EEEN 464.

Laboratory course to follow EEEN 460 and accompany EEEN 464. In this course, the student will acquire hands-on experience with fundamental blocks of Analog and Digital communication systems. Topics covered include: Amplitude and Angle Modulation and demodulation, sampling and reconstruction, PCM Encoding & PCM Decoding and digital modulation and demodulation.

EEEN 462 Data and Computer Communications (3:0:0)
Pre-requisite(s): EEEN 220 and STAT 346

Introduction to modern data communications and computer networks. Topics include point -to-point communication links and transmission of digital information, modems, and codecs; packet switching, multiplexing, and concentrator design; multi-access and broadcasting; local area and wide area networks; ISDN; architectures and protocols for computer networks; OSI reference model and seven layers; physical interfaces and protocols; and data link control layer and network layer.

EEEN 464 Digital Communication Systems (3:0:0)
Pre-requisite(s): EEEN 460
Co-requisite(s): EEEN 461

Introduces digital transmission systems. Topics include quantization, digital coding of analog waveforms, PCM, DPCM, DM, base band transmission, digital modulation schemes, ASK, FSK, PSK, MSK, QAM, pulse shaping, inter symbol interference, partial response, voice band and wideband modems, digital cable systems, regenerative repeaters, clock recovery and jitter, multi path fading, digital radio design, optimal receiver design, MAP receiver, and probability of error.

EEEN 466 Digital Signal Processing (3:0:0)
Pre-requisite(s): EEEN 320 and STAT 346

This course provides a thorough treatment of digital signal processing including the fundamental theorems and properties of discrete-time linear systems, filtering, sampling, and discrete-time Fourier Analysis.

EEEN 467 Mobile and Wireless Communications (3:0:0)
Pre-requisite(s): EEEN 460

Cellular systems design fundamentals, fading and multipath channels, Modulation techniques for mobile radio systems, Diversity and combining techniques for mobile radio systems, multiple access techniques for mobile systems, Mobile systems and standards.

EEEN 472 Antenna Theory and Design (3:0:0)
Pre-requisite(s): EEEN 305

Course provides the fundamental knowledge in the theory and design of antennas. The theory of electromagnetic radiation is introduced and the fundamental antenna properties and parameters are explained. Standard antenna characterization parameters such as impedance, far-field radiation pattern, gain, directivity, bandwidth, beam width, polarization, efficiency, antenna temperatures are studied. The electromagnetic theory behind antenna operation and an overview of different antenna systems such as monopoles, dipoles, wire antennas and loop antennas etc… are discussed. The principles of analysis and design of antenna arrays are discussed.

EEEN 473 Radio Frequency and Microwave Engineering (3:0:0)
Pre-requisite(s): EEEN 305

This course covers a broad range of topics in the field of radio frequency (RF) and microwave engineering. This includes transmission lines, waveguides, impedance matching, microwave resonators, RF filters, RF amplifiers, and passive RF and microwave devices (mixers, diplexers, etc.). Furthermore, RF/microwave communications link design will be provided.

EEEN 474 Advanced Information theory and coding (3:0:0)
Pre-requisite(s): EEEN 460

Advanced topics in information theory and coding. The course is divided into two main parts, namely, Source coding and data compression, and channel coding and error detection/correction codes. The first part covers, entropy, amount of information source coding techniques, Shannon Fano, Huffman, and Lempel-Ziv codes. The second part covers binary symmetric channels, Z-channels, and E-channels, channel capacity, mutual information, linear block codes and convolutional codes, Viterbi decoders and cyclic redundancy check codes.

EEEN 481 Concepts of Multimedia Processing and Transmission (3:0:0)
Pre-requisite(s): EEEN 320 or CSCI 462

The course introduces the fundamentals of signal processing and communications for multimedia applications. It covers various topics relating to audio, image and video processing, storage and transmission. It discusses the human visual and hearing systems and relates them to image and sound digitization processes. The course also covers various lossless and lossy methods for audio, image and video compression. In addition, it gives the student hands on experience on applying the presented processing techniques using suitable software packages.

EEEN 491 Engineering Seminar (1:0:0)
Pre-requisite(s): Senior Standing

Engineering ethics, professionalism, the role of engineers in society, current topics, and employment opportunities.

EEEN 492 Senior Design Project I (0:6:0)
Pre-requisite(s): Senior Standing

Conception of senior design project and determine of feasibility of proposed project. Includes development of a preliminary design and implementation plan.

EEEN 493 Senior Design Project II (0:12:0)
Pre-requisite(s): EEEN 492

Implementation of project from EEEN 492. Project includes designing and constructing hardware, writing required software, conducting experiments or studies, and testing complete system. Requires oral and written reports during project and at completion.

EEEN 499 Special Topics in EEEN (3:0:0)
Pre-requisite(s): Senior Standing

Advanced and emerging topics in electronics and communication engineering. Topics are announced through the Schedule of Classes.

EEEN 350 Electric Machines (3:0:0)
Pre-requisite(s): EEEN 282
Co-requisite(s): EEEN 351

The general theory of electro-mechanical motion devices relating to electric variables and electromagnetic forces. Basic concepts and operational behavior of DC motors, induction and brushless DC Motors, and stepper motors used in control applications.

EEEN 351 Electric Machines Lab (0:3:0)
Co-requisite(s): EEEN 350

Laboratory course to accompany EEEN 350. In this course, students will acquire hands-on experience with the characteristics of dc motors and dc generators (separate, series, shunt and compound). They will learn to find the parameters of transformers and evaluate their performance characteristics. The starting, speed control and performance of 3-phase induction motors are also studied.

EEEN 412 Power Systems (3:0:0)
Pre-requisite(s): EEEN 350

Electric Power Systems, Elements of a Power Systems; The analysis of power systems starting with the calculation of line resistance, line inductance, and line capacitance of power transmission lines; Analysis of power systems in terms of current, voltage, and active/reactive power; Per–Unit Quantities; Load Flow Study; Economic Dispatch; Symmetrical Components; Fault Study; System Protection; System transient and Stability issues**.**

EEEN 421 Power System Protection (3:0:0)
Pre-requisite(s): EEEN 412

Power systems protection schemes for transmission and distribution networks, connection and standards of current and voltage instrument transformers for protection and metering applications, Protective relays, Protection of generators; Differential protection - Problems with differential protection - Biased differential protection - Biased differential protection of generator - Over current and earth fault protection, P; Buchholz relay - Biased differential protection of transformers - Harmonic restraint – Harmonic blocking - Other transformer protections, Protection of transformers, Protection of transmission lines.

EEEN 422 High Voltage Engineering (3:0:0)
Pre-requisite(s): EEEN 282

The components of power system and their characteristics. Fundamental electric field calculations (Laplacian fields) in insulation systems of simple geometries, introduction to gas discharge physics, Townsends theory of electric breakdown in air and Paschens law and its implications on gas insulation strength. Experimental techniques applied in high voltage engineering.

EEEN 423 Electrical Energy Systems & Fault Analysis (3:0:0)
Pre-requisite(s): EEEN 412

Energy and power; forms of energy; energy conversion from energy sources including wind , solar, tidal, bio-fuel, wave, hydro, nuclear and fossil fuel. Structure of a modern power system: operating charts, voltage control, and matrix representation of transmission lines. Two port network representation of transmission lines, per unit system, fault analysis: symmetrical components, transformers: construction, operation, connections, and relevant calculations. Load flow analysis: network matrix representation, Gauss-Seidel and Newton-Raphson solution techniques. AC/DC conversion: converter types, dc transmission, advantages compared to AC transmission. Over-voltages: switching and fault over-voltages, Bewley Lattice diagrams, switchgear principles, current chopping, insulation coordination. Modal component theory: wave propagation.

EEEN 425 Smart Power Grid Systems Theory & Implementation (3:0:0)
Pre-requisite(s): EEEN 412

This course explores a set of emerging concepts, technologies, applications and business models, and the related trade-off decisions involved in transforming the traditional centralized power grid into a climate and renewable energy-friendly "Smart Grid." A cross-disciplinary approach intended to deepen individual areas of expertise in the context of multidisciplinary teamwork. Basic Smart Grid literacy, applications of this knowledge base to specific "real world" case studies.

EEEN 426 Renewable Energy Systems (3:0:0)
Pre-requisite(s): Senior standing

The course aims to introduce a general engineering/science audience to the basic concepts of renewable energy. In the interest of time some mathematical criteria will be covered, e.g. Betz limit for wind, limit of efficiency of WEC point absorber. Each lecture contains several examples from real world applications and in-progress industrial developments

EEEN 451 Control Theory (3:0:0)
Pre-requisite(s): EEEN 220 or MATH 214

Introduction to feedback control systems; Block diagram and signal flow Graph representation; Mathematical modeling of physical systems; Stability of linear control systems; Time-domain and frequency-domain analysis tools and performance assessment; Lead and lag compensator design; Multi input multi output systems; Routh, Nyquist; Bode and root locus diagrams; Introduction to state variable techniques; state transmission matrix and state variable feedback.