ELE - ELECTRICAL ENGINEERING (ELE)

ELE 2114 Electrical Circuits (3-2-4)
Covers DC and AC fundamentals, which include Ohm's law, power dissipation, Kirchhoff's laws, and linear circuit theorems, such as Thevenin equivalence, Norton equivalence, and superposition. Introduces analysis of networks of series, parallel, and series-parallel linear circuits with various sources. Describes fundamental energy storage components. Explore transient and steady state responses and power dissipation of RC, RL, and RLC linear reactive circuits with a sinusoidal source.
Prerequisites: PHY 1203
Corequisites: ELE 2181

ELE 2153 Electrical Eng Fundamentals (3-1-3)
Examine the fundamental concepts of electrical engineering, which include identifying basic electrical quantities and common scales relative to current, voltage, resistance and power. Describe the construction, value and voltage-current characteristics of common passive components. Ohm's law is investigated by using laboratory equipment to measure voltage, current, power of series, parallel, series-parallel DC circuits.
Prerequisites: PHY 1203

ELE 2181 Circuit Lab (0-2-1)
Examine in a laboratory setting, DC and AC fundamentals, which include Ohm's law, power dissipation, Kirchhoff's laws, and linear circuit theorems, such as Thevenin equivalence, Norton equivalence, and superposition. Analyse networks of series, parallel, and series-parallel linear circuits with various sources. Explore transient and steady state responses and power dissipation of RC, RL, and RLC linear reactive circuits with a sinusoidal source.
Prerequisites: PHY 1203
Corequisites: ELE 2114

ELE 2213 Digital Circuits (2-2-3)
Covers fundamental concepts of digital systems including numbering systems, digital codes, logic symbols, and Boolean expressions. Students learn to apply logic minimization techniques to the analysis of combinational and sequential circuits. The classification of integrated circuit (IC) families is also presented.
Prerequisites: PHY 1203

ELE 2303 Power Generation and Transmission (3-1-3)
Covers the layout, main components, and characteristics of common electrical power generation plants with application to various thermal power plants and the power transmission process from generation to distribution. Develop expressions for resistance, inductance and capacitance of high-voltage power transmission lines which are used to determine the equivalent circuit of a three-phase transmission line.
Prerequisites: ELE 2114
Corequisites: ELE 2314

ELE 2314 Principles of Machines and Power (3-2-4)
Three phase electrical circuits are analyzed. Magnetic systems and electromagnetic induction is studied. The operation of electrical transformers and the performance of DC machines are explained. Practical investigations are utilized to reinforce concepts.
Prerequisites: ELE 2114, ELE 2181

ELE 2403 Electronics I (2-2-3)
Examine the construction and operation of a semiconductor diode. Explore the use of diodes in common practical applications. Analyse the construction, operation, characteristics, and common applications of semiconductors including BJTs, JFETs, MOSFETs, and IGBTs. Theoretical concepts are reinforced using both circuit simulation and practical experiments in a laboratory setting.
Prerequisites: ELE 2114

ELE 2573 Electric Circuit Design and PCB Manufacturing (2-2-3)
Explores the process of circuit design from circuit schematic, through simulation and PCB design to PCB fabrication. Building on the theoretical background of circuit design provided in other courses, students learn to use CAD tools to capture a schematic, run a simulation, design a PCB and fabricate a PCB.
Prerequisites: ELE 2403

ELE 2603 Instrumentation and Control (2-2-3)
Explores open and closed loop control systems with a focus on the role of transducers and actuators. Introduces set-points, feedback and error signals. Examine transducers and actuators to measure and control physical properties such as temperature, flow, pressure, position, level, rotation speed and torque. Includes various on/off and PID closed loop control systems which are analysed through simulation and practical laboratories.
Prerequisites: ELE 2114

ELE 2613 Industrial Automation (2-2-3)
Explore the Programmable Logic Controller (PLC) structure in terms of hardware and software components. Develop industrial control solutions in the laboratory using PLC features including relays, timers and counters. Practice systematic fault finding and debugging techniques. Use a SCADA system to control and supervise PLCs a simple industrial automation system.

ELE 2903 Sophomore Design Project (2-2-3)
Requires the formation of a team to propose, plan design and prototype an open ended project. The student team is totally responsible for the completion of the project milestones and course objectives while working under the mentorship of a faculty or industry engineer. The team is evaluated on its ability to coordinate efforts to propose the project design criteria, components, resources, implementation and prototyping schedule, and estimated cost. Also covers health, safety and environmental aspects related to electrical industry.

ELE 3203 Communication Systems (2-2-3)
Explores the fundamental components of an analogue communication system using the block diagram. Includes analogue modulation and demodulation techniques used in transmitters and receivers, respectively, propagation characteristics of the transmission channel and circuit simulation and laboratories.
Prerequisites: ELE 2114

ELE 3213 Engineering Electromagnetics (2-2-3)
Introduces the fundamentals of electromagnetics in both theory and application. Covers Vector Analysis, Electrostatic Fields, Electrical Field in Material's Space, Magneto-static Fields, Solution of Poisson's and Laplace's Equations, Faraday's and Ampere's Laws, Maxwell's Equations, Electromagnetic Wave Propagation, and Transmission Lines.
Prerequisites: ELE 2114

ELE 3323 Electrical Machines (2-2-3)
The fundamentals of electrical machines are introduced. The construction, operation and testing of electrical machines are presented. The performance and characteristics of induction machines and synchronous machines are explained. Practical investigations are utilized to reinforce concepts.
Prerequisites: ELE 2314

ELE 3413 Electronics II (2-2-3)
Explores the analysis and design of amplifier circuits in the context of various electronic applications, amplifier parameters such as frequency response, noise performance and impedance. Examines the properties of power amplifiers and circuit simulation and practical laboratories are utilized to reinforce concepts.
Prerequisites: ELE 2403

ELE 3613 Signals and Systems (2-2-3)
Covers time and frequency domain representation of fundamental, continuous and discrete time signals and systems. Explores fundamental signals and operations, system properties and the representation of linear time-invariant systems. Includes tools for analysis of systems such as continuous-time Fourier analysis, Laplace transform analysis, discrete-time Fourier analysis and Z transforms. Use of CAD tools to simulate, implement, and analyse signals and systems.
Prerequisites: MTH 2503

ELE 3614 Microcontroller Systems (3-3-4)
Covers the operation and implementation of microcontrollers in practical applications. Explore the software and hardware aspects microcontroller architecture. Common input and output modules are utilised in typical applications in a laboratory setting. Learn program development from flowcharts through to assembly language using a top down and modular approach. Explores the input/output modules available in modern microcontrollers, such as timers, serial interfaces, D/A and A/D converters in a laboratory setting.
Prerequisites: ELE 2213, EGN 2712

ELE 4213 Digital Communication (2-2-3)
Covers the fundamental principles of digital communication systems. Explores digital transmission, use of available bandwidth, line coding, PCM, delta modulation techniques, transmission modes, digital modulation techniques, multiplexing, error detection and correction coding techniques, and transmission media. Satellite and fibre optic communication systems are presented as practical applications. Circuit simulation and laboratories are utilized to reinforce concepts.
Prerequisites: ELE 3203

ELE 4223 Data Communication and Network (2-2-3)
The fields of networks and network protocols are introduced. Students examine Local Area Networks (LANs), Wireless LANS (WLANs), the OSI model, elements of the Internet network and network security. WLANS are explored using Bluetooth wireless technology as an example. Students explore aspects of the OSI and internet protocols focusing on the Network, Transport and Application layers including logical or IP addressing, delivery, forwarding, and routing of IP packets. Network security is also explored.
Prerequisites: ELE 3203

ELE 4233 Mobile Communications (2-2-3)
Examines mobile cellular communication through discussion of key concepts such as: architecture; cell design; frequency reuse; handoff; interference and capacity; and grade of service (GoS). Explores propagation radio channel, digital modulation and its performance over fading channels, and multiple access schemes such as TDMA, FDMA, CDMA and spread spectrum systems. Examines wireless standards and future development.
Prerequisites: ELE 3203

ELE 4243 Satellite Communications (3-1-3)
Use Concepts in a satellite communication system. Calculation of basic parameters in a satellite communication system. Aspects of satellite communication like orbital mechanics, launching techniques, satellite link design, earth station technology and different access system towards a satellite. Different applications of satellite communication Basic principles, Satellite orbits, Satellite construction (space segment), Satellite links, Earth station (earth segment), Role , applications and antennas of satellite communication.
Prerequisites: ELE 3613

ELE 4333 Electrical Power Distribution (2-2-3)
Covers the fundamentals of electrical power distribution, common distribution system layouts, including the function of substations and transmission equipment. Explores the factors affecting design calculations such as voltage regulation, power factor, power quality and tariff calculation. Covers the procedures and protection methods for power distribution systems and consumer installations.
Prerequisites: ELE 2303

ELE 4343 Power System Analysis (2-2-3)
The ability to analyze and solve problems commonly encountered in electrical power systems is essential for quality power systems. A revision of complex power calculations, per-unit system of analysis, and electrical network calculations is included, and topics related to system modelling, load flow analysis, fault analysis, and stability problems.
Prerequisites: ELE 2303, ELE 3323

ELE 4353 System Protection and Coordination (2-2-3)
Examines power system protection fundamentals, basic design requirements, and principles of operation for over-current, overvoltage, and under-voltage protection schemes for various power system components. Three-phase asymmetrical faults are analysed under various conditions and are used as a basis to select circuit breaker types and ratings. Various protective devices, such as over current and earth leakage, differential, distance, over voltage, and under voltage relays, are applied as appropriate. Unit protection, back up protection, and protection coordination are introduced.
Prerequisites: ELE 2314
Corequisites: ELE 4343

ELE 4363 Power Electronics (2-2-3)
Examines the control, protection and commutation of power switching devices including the diode, thyristor, MOSFET, and IGBT. Power systems such as: AC to DC converters; controlled rectifiers; AC to AC converters; single phase and three phase AC voltage controllers; cycloconverters; choppers for DC to DC power conversion; inverters; and square-wave inverters are explored. Students learn single phase and three phase pulse width modulation (PWM) techniques.
Prerequisites: ELE 2403

ELE 4373 Electric Drives (3-1-3)
Covers the theory and control methods for DC and AC electrical drive systems in laboratory settings. Includes methods for controlling DC and AC motors and mathematical models to implement linear control techniques. Introduces CAD tools to model and simulate various implementations and designs with the associated control mechanisms to investigate and test the overall DC and AC drive system performance under various operating conditions.
Prerequisites: ELE 4363, ELE 3323

ELE 4383 Electrical Maintenance Operation (2-2-3)
Examines preventive, corrective and opportunistic maintenance and testing of electrical equipment and subsystems including substations, circuit breakers, power transformers, and industrial machines. Utilize Electrical Preventive Maintenance and Test (EPMT) program with consideration of electrical safety, switching practices and precautions taken with live circuits. Explore maintenance options with respect to economic considerations and cost benefit analysis.
Prerequisites: ELE 3323, ELE 2303, ELE 2314

ELE 4393 Machine Control and Drives (3-1-3)
Explore the design and control strategies for motor drive systems in industrial settings from the point of view of fundamental physical, electrical and mechanical properties of DC and AC motors. Apply the relative merits of various AC inverter circuits for reliable and efficient operation of AC drives to a range of industrial applications. Use mathematical modelling and software analysis extensively.
Prerequisites: ELE 2403, ELE 3323

ELE 4423 Embedded System Design (2-2-3)
Examine the specification, design, development, and testing of embedded microcontroller systems. Present various architectures, programming, and interface of common peripheral devices. Apply skills and techniques in a laboratory setting.
Prerequisites: ELE 3614

ELE 4433 VLSI Design (2-2-3)
The design, simulation, and fabrication of CMOS very large scale integration (VLSI) digital circuits are introduced through the fabrication and layout of basic digital circuits (Inverter, NAND and NOR gates). The VLSI technology scaling at both transistor and interconnects levels is reviewed. The time delay and power dissipation are calculated, through simulation of basic digital circuits, such as full adders and n-bit multipliers. CAD tools are used at the simulation and design stages in accordance with fabrication specifications and performance targets.
Prerequisites: ELE 2213

ELE 4443 Advanced Microprocessors (2-2-3)
Examine modern microprocessor architecture which is contrasted with classical architecture. Explore RISC and CISC processors, pipelining and superscalar processors, interfacing techniques including polling, interrupt driven I/O and DMA based I/O. Develop I/O handler programmes for a modern microprocessor system.
Prerequisites: ELE 3614

ELE 4613 Programmable Devices (2-2-3)
Explores the use of programmable logic devices (PLDs) and field-programmable gate arrays (FGPAs) to implement combinational and sequential logic circuits, Trade-offs in terms of advantages, cost, programming and reliability of device. Use FPGA hardware to design, develop, synthesise, implement, test, and debug FPGA design project in accordance with a provided specification.
Prerequisites: ELE 2114

ELE 4623 Control Systems (2-2-3)
Use modelling and simulation to analyse, augment, and improve the performance of analogue single-input single-output LTI control systems for a variety of applications. Typical control systems are modelled by a transfer function and various frequency response methods are used to determine and assess the system response and stability. Use MATLAB/Simulink in the design and analysis of various compensators. Examine basic digital control systems and related properties.
Prerequisites: ELE 3613

ELE 4633 Digital Control Systems (2-2-3)
Explores topics related to digital control systems including the components of computer control systems, design and analysis of digital controllers, typical industrial applications and distributed control system architecture. Examines the realization of digital control systems, distributed control systems. Develop a practical implementation of a simple distributed control system.
Prerequisites: ELE 4623

ELE 4643 Intelligent Systems (3-1-3)
Explore Artificial intelligence (AI) and related system techniques and implement in various applications. Examine basic AI topics of knowledge representation, search techniques, and reasoning. Develop concepts and methods used in fuzzy sets and systems using fuzzy practical applications. Explore and implement the biological origins of artificial neural networks and genetic algorithms in practical applications.

ELE 4653 Digital Signal Processing (2-2-3)
Covers understanding of the fundamentals of digital signal processing through analysis of the time, amplitude, and frequency effects of sampling and digitizing continuous-time signals. Use the Z-transform and signal flow diagrams in the design of various FIR and IIR filter specifications. MATLAB is used to implement and analyse the frequency response. Circuit simulation is utilized to reinforce concepts.
Prerequisites: ELE 3613

ELE 4663 Robotics Technology (3-1-3)
Examines mechanical components, transducers, and actuators of a computer automated process. Use a hands-on approach to explore robotic embedded systems, associated programming, dedicated controllers, and related applications. The fundamental concepts are learned, describing robotics operation including coordinate transformations, sensor and actuator selection and interface, motion analysis, path planning and kinematics.
Prerequisites: ELE 2213

ELE 4673 Advanced Control Systems (2-2-3)
Covers a solid background for the understanding of modern control system concepts, analysis and design techniques, and hardware and software packages. Review of classical control systems is followed by an introduction to advanced classical control methods such as state space representation of continuous-time system, continuous-time response and performance specifications, state space analysis and design. A project based on problems drawn from industrial applications is incorporated in the key design activities.
Corequisites: ELE 4623

ELE 4713 Digital image processing (2-2-3)
This course covers the fundamental of image analysis and understanding: fundamentals of image formation, human vision system, spatial and frequency domain image processing, image transform and their use in image filtering, image segmentation and morphological image processing. It provides the basics concepts that enable learners understanding the compression of digital images. Also, the focus on the image representation and description gives students the necessary tools for applying image processing for solving real-life computer vision problems.
Prerequisites: ELE 3613, EGN 2712

ELE 4863 Special Topics in Electrical Engineering (2-2-3)
Presents a theoretical or practical topic proposed by the faculty beyond what is offered in existing courses. Can be repeated for credit.

ELE 4893 Directed Study (2-2-3)
Provides an opportunity to investigate under faculty supervision beyond what is offered in existing courses.

ELE 4902 Capstone Design Project I (1-3-2)
Student teams are formed to propose, plan, and design an electrical engineering project. The student team is solely responsible for the completion of the project milestones and related outcomes while working under the mentorship of a faculty or industry engineer. The team is evaluated on its ability to coordinate efforts to propose the project design criteria, components, resources, implementation schedule, and estimated cost.
Prerequisites: EGN 3806 or EGN 3812

ELE 4912 Capstone Design Project II (1-3-2)
The engineering design project is carried forward from the previous semester with student teams moving to the implementation, evaluation, and analysis of the project. Though guided by faculty, the student team is primarily responsible for the completion of the project milestones and course objectives. The course requires the integration and application of technological, organizational, communication, and interpersonal skills by the student team. Accurate analysis, implementation, documentation, and presentation skills form the basis for assessment.
Prerequisites: ELE 4902