ELEN 102 AutoCAD (0:3:0)

1 Semester Credit Hour

Introduction to Computer Aided Drawing (AutoCAD) Software, Drawing limits, grid setting and drawing aids, coordinate system, drawing tools (point, line , ray, multi-line, poly-line, polygons, rectangle, arc, circle, ellipse), Modify tools (copy, erase, offset, move, rotate, lengthen, terminate, fillet, chamfer, array), Layers, Zoom, dimensions, text, hatch, isometric drawing.

ELEN 350 Electric Machines (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): ECEN 282

Co-requisite(s): ELEN 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.

ELEN 351 Electric Machines Lab (0:3:0)

1 Semester Credit Hour - Co-requisite(s): ELEN 350 Laboratory course to accompany ELEN 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. **(Writing Intensive Course)**

ELEN 412 Power Systems (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): ELEN 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**.**

ELEN 420 Power Systems Operation and Protection (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): ELEN 350

Introducing and thoroughly explaining the elements of the supply chain and how they function in the National Electricity Market; demand-side management options including smart meters; load forecasting and optimal load scheduling for secure energy supply and use; including communication media, architectures, automation, standards, protocols and security. Operation and control of power systems, Economic operation of power system, Power system planning and power markets.

ELEN 421 Power System Protection (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): ELEN 350

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.

ELEN 422 High Voltage Engineering (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): ELEN 350

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.

ELEN 423 Electrical Energy Systems & Fault Analysis (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): ELEN 350

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.

ELEN 424 Electric Power Transmission and Distribution (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): ELEN 350

This course provides students with an understanding of electrical power transmission and distribution. The course covers components of industrial utility power systems, voltage levels, types of transmission systems and their components, High Voltage Transmission (HVT) line electric design; conductors, corona, insulators, clearances, DC characteristic, feeders voltage drop, capacitors; different electrical distribution systems.

ELEN 425 Smart Power Grid Systems Theory & Implementation (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): ELEN 350

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.

ELEN 426 Renewable Energy Systems (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): ELEN 350 or MENG 361

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.

ELEN 427 Advanced Power Systems (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): ELEN 350

Review of power distribution concepts, power flow analysis. Economic dispatch, overview of power system operation. Network Representation, Power flow analysis, Case studies, Economic dispatch and optimal power distribution, Transient stability, Small-perturbation stability, Load-frequency stability, advanced topics as time permits.

ELEN 451 Control Theory (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): ECEN 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.

ELEN 492 Senior Design Project I (0:6:0)

2 Semester Credit Hours - Pre-requisite(s): Senior Standing

Conception of senior design project and determination of feasibility of proposed project. Work includes developing preliminary design and implementation plan.

ELEN 493 Senior Design Project II (0:12:0)

4 Semester Credit Hours - Pre-requisite(s): ELEN 492

Implementation of project for which preliminary work was done in EE 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. Completing this course with a C or better satisfies university's general education synthesis requirement.

ELEN 499 Special Topics in ELEN (3:0:0)

3 Semester Credit Hours - Pre-requisite(s): Senior Standing

Advanced and emerging topics in Electrical Power Engineering. Topics are announced through the Schedule of Classes. A course will be developed for each topic through the Schedule of Classes.