COURSE DESCRIPTION

APPLIED ELECTRICAL ENGINEERING PROGRAM

KING SAUD UNIVERSITY- COLLEGE OF ENGINEERING- MUZAHMIA BRANCH

DEGREE REQUIREMENTS

MAY, 2014

COURSE DESCRIPTION

MATH 140 - Introductory Mathematics *2(2-1-0)*

Basic Algebraic Operations, Equations and Inequalities, Graphs, Functions, Polynomials and Rational Functions, Exponential and Logarithmic Functions, Trigonometric Functions, Trigonometric Identities and Conditional Equations, Systems of Equations and Inequalities; Matrices, Sequences and Series.

Pre-requisites: *None*.

MATH 150 - Differential Calculus *3(3-1-0)*

Limits and Continuity: The Concept of Limit, Computation of Limits, Continuity and its Consequences, Limits Involving Infinity, Formal Definition of the Limit. Differentiation: The Concept of Derivative, Computation of Derivatives (The Power Rule, Higher Order Derivatives, and Acceleration), the Product and Quotient Rules, The Chain Rule, Derivatives of Exponential and Logarithmic Functions, Implicit Differentiation and Inverse Trigonometric Functions, the Mean Value Theorem. Applications of Differentiation: Indeterminate Forms and L'Hopital's rule, Maximum and Minimum Values, Increasing and Decreasing Functions, Concavity and the Second Derivative Test, Optimization, Related Rates.

Pre-requisites: *None*.

ENG 140 - English Language I *8(20-0-0)*

This initial stage of the course is designed to give the students a strong foundation in the language, improving their command of English as well as improving their vocabulary, reading, writing and communication skills. In the process of improving these skills, students will also develop their confidence in the language and their presentation skills. These all contribute to the life skills of the student and help to prepare them for their future studies and careers beyond KSU. As the course progresses and students reach a higher level of English, the focus will switch to the academic side of the language. This will involve preparing students for the style of language they will need for their future studies.

Pre-requisites: *None*.

ENG 150 - English Language II *8(20-0-0)*

The final assessment for the course is the highly regarded International English Language Testing System (IELTS), which is used as a qualifying test for students wishing to attend university in many countries including the UK and Australia. Specialist material will be used to prepare students for this test with the aim of reaching an IELTS score of 5.0 by the end of the year.

Pre-requisites: *None*.

IT 140 - Computer Skills ***3(0-0-6)***

Basic Concepts of Information Technology, Using a computer and Managing Files, Word Processing, Spreadsheets, Databases, Presentation.

Pre-requisites: *None*.

CHS 150 - Health & Fitness ***1(1-1-0)***

Subjects about general health, body and brain fitness.

Pre-requisites: *None*.

CUR 140 - Learning, Thinking and Research Skills ***3(3-1-0)***

Learning skills**:** Self-management for learning, Learning tools, Reading strategies, Second language learning skills, Test administration. Thinking skills: Theory Of Inventive Problem Solving (TRIZ), Rounding Thinking, Expanding perception, Creative thinking. Research skills: Problem determining, Search for information strategies, Sites of sources, access this information, Using thin formation, Information construction, Information evaluation.

Pre-requisites: *None*.

ENT 101 – Entrepreneurship ***1(1-1-0)***

Subjects about fundamentals of entrepreneurship and its scientific applies, developing creative thinking, entrepreneur and analysis skills, developing thoughts and converting them to successful commercial projects, increasing of self-trust by speaking in business world language, skills for planning & organization to establish a commercial business, skills of teamwork administration and cooperation with colleagues.

Pre-requisites: *None*.

COM 140 - Communication Skills ***2(2-1-0)***

This course deals with communication skills as a tool for achieving personal psychological and social adaptability. It is one of the key skills in matrix of (self-development skills) this course covers skills related to communication sufficiency comprised of a wide array of major matrix of knowledge, skills and approaches comprised in four main sufficiency: Knowledge sufficiency, Social sufficiency, Comprehension sufficiency, Productive sufficiency.

Pre-requisites: *None*.

IC I - Islamic Culture I ***2(2-0-0)***

IC II - Islamic Culture II ***2(2-0-0)***

IC III - Islamic Culture III ***2(2-0-0)***

IC IV - Islamic Culture IV ***2(2-0-0)***

These courses aim to introduce the student to the Islamic culture; manifestation of the Muslims attitude towards other cultures; explaining the characteristics of Islam, such as: Universality, Comprehensibility, integrity, consistency with human nature (instinct), reason, and science. These courses also explain the Islamic tenet and its fundamentals, such as: To believe in Allah, the Hereafter, the Angles, the Holy Books, the Messengers, and Divine Destiny.

Each student is required to take one compulsory Islamic course and select 3 other courses (A total of 8 cr. hr.) from the Islamic Culture Courses pool provided by College of Education, department of Islamic Culture. Refer to section 2.2.2: (University Requirements)

Pre-requisite: *None*.

MATH 1110 : Calculus for Engineers ***3(3-2-0)***

Infinite series, convergence and divergence of infinite series, integral test, ratio test, root test and comparison test. Conditional convergence and absolute convergence, alternating series test. Power series, Taylor and Maclaurin series. Definite and indefinite integrals and the fundamental theorem of calculus. Double integral and its applications to area, volume, moments and center of mass. Double integrals in polar coordinates. Triple integral in rectangular, cylindrical and spherical coordinates and applications to volume moment and center of mass. Vector fields, line integrals, surface integrals, Green's theorem, the divergence theorem, Stoke' theorem.

Pre-requisites: *MATH 140, MATH 150*

MATH 1120 : Linear Algebra and Vector Analysis ***3(3-2-0)***

Introduction of Linear Algebra. Matrices and their operations. Types of matrices. Elementary transformations. Determinants, elementary properties. Inverse of a matrix. Linear systems of equations. Methods for solving the system of linear equations. Vector Calculus and line and plane in space. Calculus of vector valued function. Notions of limit, continuity, differentiability and optimization of function of several variables. Functions in two or three variables, limits, continuity, partial derivatives, differentials, chain rule, directional derivatives, tangent planes and normal lines to surfaces. Eigen values and Eigen vectors. Laplace transforms.

Pre-requisites: *MATH 1110*

MATH 1130 : Differential Equations ***3(3-2-0)***

Various types of first order differential equations and their applications. Linear differential equations of higher order. Systems of linear differential equations with constant coefficients, reduction of order. Power series methods for solving second order differential equations with polynomial coefficients. Fourier series, Fourier series for even and odd functions. Complex Variables. Complex Fourier series. The Fourier Transform. Engineering Applications.

Pre-requisites: *MATH 1120*

AGE 1150 : Engineering Probability and Statistics ***3(3-1-0)***

Probability and probability distribution, Mathematical expectations of random variables. Discrete and continuous distributions. Sampling distributions, Estimation, testing of hypothesis, Regression and correlation. Distribution functions. Statistical Analysis. Statistical Design of Experiment. Engineering Applications.

Pre-requisites: *None.*

PHYS 1210 : Physics for Engineers I ***4(3-0-2)***

Review of kinematics, reference frames and relative motion. Newton's laws of motion, forces and fields. Work, energy and power. Oscillator motion. Electrostatics and Gauss' law. Magnetic fields and forces. Introduction to special relativity. Magnetostatics: magnetic fields and forces, Biot-Savart laws, Ampere's circuital law, Maxwell's equations, electromagnetic potentials. Electrostatics: Coulomb's law, electric field, Gauss's law, energy and potential, conductors, semiconductors and dielectrics, capacitance, Poisson's and Laplace's equations. Steady electric currents

Pre-requisites: *None.*

PHYS 1220 : Physics for Engineers II ***4(3-0-2)***

Quantum nature of light and matter. Schrodinger equation: one-dimensional potential problems. Elements of atomic structure; electron spin, exclusion principle. Plane and spherical wave propagation, phase and group velocity, wave equation in one, two and three dimensions. Introduction to sound waves. Fermat's principle, matrix optics, aberrations. Polarization. Interference and diffraction. Lasers, detectors, introduction to fiber optics.

Pre-requisites: *PHYS 1210*

CHEM 1230 : Chemistry for Engineers ***4(3-0-2)***

Introduction to chemical and physical concepts, measurements and units, mole concept, chemical equation and quantitative equations, chemical bonding and

molecular geometry, gases and liquids (solutions), redox reaction, electro-chemistry, kinetics and equilibrium, acids and bases in solution (pH, K_w), organic chemistry and polymers.

Pre-requisites: *None.*

AGE 1310 : Basics of Engineering Drawing ***3(1-0-4)***

Constructional geometry and basics of lettering; Sketching; Orthographic projection; Sectional and auxiliary views; Dimensioning; Introduction to computer graphics; Engineering applications.

Pre-requisites: *None*.

AGE 1320 : Introduction to Manufacturing ***2(1-1-2)***

Introduction to manufacturing; A morphological Process Model: Basic Structure and classification of Manufacturing Processes; Material, energy and information flow systems, examples of manufacturing processes: Mass conserving (forming), Mass reducing (machining) and mass addition (Joining and Assembly) processes; Workshop requirements, Basic industrial and workshop safety, Principles of basic bench work operations and workshop metrology; manufacturing materials; The classification and fundamentals of manufacturing systems; Workshops visits; Some practical experiments, measurements, assignments and manufacturing operations.

Pre-requisites: *None.*

AGE 1510 : Technical Writing ***2(2-1-0)***

Types of documents. Principles of organizing, developing and writing technical information. Report structure and components. Report forms and rhetorical patterns common to scientific and technical Disciplines. Technical writing conversions including headings, illustrations, style and tone. Extensive writing assignments for various report and document types.

Pre-requisites: *None*.

MATH 2140 : Numerical Methods ***3(3-2-0)***

Direct (Gauss-elimination and its variants) and iterative methods (Jacobi and Gauss-Seidel) for solving system of linear equations along with error estimate; System of nonlinear equations (Newton's method); Interpolation and Polynomial Approximations numerical differentiation. Numerical integration. Numerical solutions of differential equation. Engineering Applications

Pre-requisites: *MATH 1120, MATH 1130*

AGE 2330 : Engineering Mechanics ***3(3-1-0)***

Force systems; vector analysis, moments and couples in 2D and 3D. Equilibrium of force systems. Analysis of structures; plane trusses and frames. Distributed force system; centroids and composite bodies. Area moments of inertia. Analysis of beams. Friction. Kinematics of a particle: curvilinear motion, and relative motion; Kinematics of a rigid body in plane motion: relative velocity and acceleration, and rotating axes; Kinetics of particles: Newton's law, work and energy, impulse and momentum, and impact; Kinetics of a rigid body in plane motion: translation, fixed axis rotation, general motion, work and energy, and impulse and momentum.

Pre-requisites: *MATH 1110 and MATH 1120.*

AGE 2340 : Basics of Engineering Measurements ***2(1-0-2)***

Measuring concepts; Engineering fundamentals: Engineering Problems and Fundamental Dimensions; System of Units and Unit Conversion. Types of instruments and measurements. Students T distribution; Errors in measurement; Uncertainty analysis of data; Evaluation of bias and precision uncertainty; Graphical presentation of data using Excel.; Analog and digital signals, Presentation of analog signals; Mean and RMS value of signals; Sampling of analog signals and associated errors; Digital signals; D/A and A/D converters. Analog and digital signal analysis; Data collection and analysis; Instrumentation specifications; Basic components of electrical and mechanical measurement system; Response of measurement system: Concept of order of measurement system; Time response of measurement system Measurement of length; time; mass; force, electric current; temperature; energy and power. Laboratory experiments both on mechanical and electromechanical measuring systems. Emphasis is on measurement of uncertainty and calibration of sensors.

Pre-requisites: *AGE 1150.*

AGE 2410 : Computer Programming ***3(2-1-2)***

Introduce the students to basic structures of computer and concepts of both procedural and object-oriented programming using programming language, provide them with basic techniques to formulate problems, and implement the solutions using programming language. Develop, write, test, and debug computer programs for solving engineering problems.

Pre-requisites: *None*.

AGE 2520 : Management Skills ***2(2-1-0)***

This course is about essential business skills for engineering students. Students will be exposed to a wide range of topics including management essentials, solving problems analytically and creatively, communicating supportively, managing groups and teams,

taking decisions, making oral and written presentations, negotiation skills and other skills.

Pre-requisites: *None*.

AGE 3350 : Introduction to Design ***1(1,0,0)***

Introduction to design process and phases. Enhancing on personal skills such as teamwork, leadership, written and oral presentation. Techniques for stimulation of ideas. Human factors in design. Searching, compiling, referencing and writing ethics. Guidelines for good written communication. Guidelines for slide preparation and good oral presentation. Delivering successful speeches. Writing memos and business letters. Introduction to academic and business proposals. Group dynamics, effective meetings, team-work, leadership and management skills. Engineering ethics and professional conduct. Intellectual property**.**

Pre-requisite: *AGE 1310.*

AGE 4530 : Engineering Economy ***2(2-0-0)***

Cost concepts. Time value of money operations. Measuring the worth of investments. Comparison of alternatives. Depreciation. Economic analysis of public projects.

Pre-requisites: *None*.

AGE 4540 : Seminar ***1(0-1-2)***

This course is to broaden and deepen students understanding of the different types of researches in the field of engineering. Also, to help students develop skills of analysis and criticism through training them in order to evaluate researches and design research plans. In this course a weekly seminar will be conducted by the different senior co-up graduation project teams as well as some invited speakers from industry. Students will widen his view of other engineering disciplines, which has a positive impact in his future career where skills of working with teams of different specialties is a necessity.

Pre-requisites: *None*.

AGE 4550 : Engineering Management ***2(2-1-0)***

This course is an introductory course on project management. The course covers the project management process from the beginning to the end, focusing on practical skills that make students able to immediately complete projects on time and on budget, while achieving their targets.

Pre-requisites: *None.*

AGE 4560 : Industry and Environment ***2(2-1-0)***

This course focuses on drawing the attention of students on different aspects of environmental issues, legal aspects, and engineering solution. Hydrology and hydrologic cycle; water and wastewater treatment are addressed. Air pollution, noise pollutions, industrial noise and radiation pollutions and their properties are well defined, explained and studied. Solid wastes, industrial wastes, hazardous wastes, and radioactive wastes and their management are identified and discussed. Eventually, site remediation, risk assessment, environmental regulations chapters are to be addressed as these topics have an important impact on students studying different engineering branches.

Pre-requisites: *None.*

AEE 2110: Electric Circuits I ***3(3-1-0)***

DC and sinusoidal steady state (AC) analysis of circuits. Basic passive circuit elements (resistors, capacitors, inductors). Voltage and current sources. Kirchhoff laws. Loop and nodal analysis. Circuit theorems: Superposition, Maximum power transfer, Thevenin, Norton. Forced and natural responses of RL and RC circuits using the differential equation approach. Sinusoidal signals, complex numbers, phasors and impedance concepts. Average and RMS quantities. Steady state time-domain behavior of inductors and capacitors. Complex, average and apparent power. Introduction to the use of electrical measurement equipment such as voltmeters, ammeters, wattmeters, function generators and oscilloscopes. Voltage, current and impedance measurement.

Pre-requisites: *MATH 1120.*

AEE 2120: Electric Circuits II ***3(3-1-0)***

Ideal operational amplifiers, analysis and applications. Forced and natural responses of RLC circuits using the differential equation approach. Transient circuit analysis using unilateral Laplace transforms. Two-port networks and parameters. Mutual inductance and the ideal transformer. Transfer functions. Frequency response of simple filters. Fundamentals of computer-aided circuit simulation. The measurement of sinusoidal and non-sinusoidal electrical quantities in analog and digital circuits. Introduction to sensors and instrumentation amplifiers. The measurement of non-electrical quantities.

Pre-requisites: *AEE 2110.*

AEE 2130: Electronics I ***3(3-1-0)***

Physics of semiconductors. Diodes: operation, models, and application circuits. Bipolar Junction Transistors: operation and characteristics. DC and AC circuit

models. Basic single stage BJT amplifier configurations. Field Effect Transistors: Structure and physical operation, bias circuits, small signal equivalent circuits and basic amplifiers. Basic concepts of digital logic circuits. The BJT inverter. The CMOS Inverter. Propagation delay of the CMOS inverter. CMOS gates and other digital circuits. Introduction to Semiconductor Power Devices: thyristor, triac, Insulated Gate Bipolar transistor. Power Electronics Applications: The AC/DC, and DC/AC converters.

Pre-requisites: *AEE 2110.*

AEE 2310: Engineering Electromagnetics ***3(3-1-0)***

Transmission lines: time and space dependence of signals, line parameters, input impedance, use as circuit elements, reflection coefficient, standing wave ratio, transient behavior. Impedance matching: transformers, stubs, analysis using the Smith Chart. Maxwell's and wave equations. Electromagnetic waves: TEM, TE, TM propagation. Waveguides: basic equations, parallel plate guide, rectangular guide. Introduction to antennas. Applications to communications and radar systems.

Pre-requisites: *MATH 1110* & *PHYS 1210.*

AEE 2410 : Signal and System Analysis ***3(3-1-0)***

Continuous-time and discrete-time signals. Mathematical description of systems. Properties of systems. Convolution and impulse response of continuous and discrete time LTI systems. Fourier series of periodic continuous and discrete time signals. Decomposition and approximation of signals by orthogonal functions. The Fourier transform of continuous and discrete time signals. Frequency response of systems. Frequency selective filtering. First and second order systems. Sampling and interpolation of continuous-time signals. LTI system analysis with Laplace transforms.

Pre-requisites: *AEE 2110.*

AEE 2710: Circuits Laboratory ***2(1-0-2)***

General introduction to the laboratory. Voltage, current, and power in DC circuits using KVL and KCL. Superposition, Thevenin's, and Maximum power transfer theorems in DC circuits; Series and parallel AC circuits; Resonance in series and parallel circuit; Maximum power transfer theorem and power factor improvement in AC circuits; Transients in DC circuits; Magnetically-coupled circuits; Three phase circuits.

Co-requisites: *AEE 2120.*

AEE 3140: Electronics II ***3(3-1-0)***

Differential Amplifiers: BJT, MOS. Multistage Amplifiers: Frequency Response: s,Domain analysis, amplifier transfer function, frequency response of CS, CE, CB, cascode, CC and cascaded amplifiers. Feedback: general feedback structure and basic feedback topologies. Stability, frequency compensation Output Stages and Power Amplifiers: Class A, B and AB output stages. IC and MOS power amplifiers.

Pre-requisites: *AEE 2130.*

AEE 3210 : Fundamentals of Power Systems ***3(3-1-0)***

Energy resources and electric power generation, transmission and distribution; simple generator models, transformers, transmission lines. Power system analysis: per unit representation, real and reactive power flow, VAR compensation, fault analysis and protection. Power system control. Power system stability. Load representation, power quality. Computational modelling of typical power system problems.

Pre-requisites: *AEE 2120.*

AEE 3220: Electric Machines ***2(2-1-0)***

Machinery principles. Three-phase systems, transformers. AC machinery fundamentals, synchronous generators, synchronous motors, induction motors. DC machinery fundamentals, dc motors and generators, special purpose motors, single-phase induction motors.

Pre-requisites: *AEE 2120.*

AEE 3420 : Digital Signal Processing ***2(2-1-0)***

Characterization and classification of discrete-time (DT) signals and systems. Typical DT signal processing operations. Linear time-invariant (LTI), DT systems; Linear constant coefficient difference equations. Frequency-domain representation of discrete-time signals and systems. The discrete Fourier transform (DFT); The fast Fourier transform (FFT). The *z* transform; Linear phase transfer functions. Digital Filter Structures; Finite impulse response (FIR) digital filter design; Infinite impulse response (IIR) digital filter design. Digital processing of continuous-time signals. Fundamentals of multirate digital signal processing. Applications.

Pre-requisites: *AEE 2410.*

AEE 3430: Communication System Principles ***3(3-1-0)***

Review of linear systems, the sampling theorem, and Fourier analysis. Noiseless analysis of the linear modulation schemes: double sideband, in-phase quadrature, single sideband, vestigial sideband and conventional AM. Super-heterodyne receivers.

Angle modulation: phase modulation, and frequency modulation. Carson's rule. Discriminator and phase-locked loop detection of FM. Basic digital modulation techniques: ASK, PSK, FSK. Bandwidth requirements of PAM (Nyquist's criterion). Pulse code modulation and companding. Introduction to error control coding and to information theory.

Pre-requisites: *AEE 2410.*

AEE 3510: Logic Systems Design ***3(3-1-0)***

Digital computers and information. Number systems and alphanumeric codes. Binary arithmetic. Boolean algebra. Logic functions representation, minimization and realization. Analysis, design and implementation of combinational circuits. Basic sequential circuits. Latches and flip-flops. Analysis and design of simple sequential circuits. Registers and counters. Implementation of digital circuits.

Pre-requisites: *None.*

AEE 3520: Automatic Control ***4(3-1-2)***

Introduction to control systems, mathematical models of systems, Laplace transforms, partial fraction methods. Block diagram and signal flow graph models, transfer functions of linear systems. Introduction to state-space models. Feedback control system characteristics, stability and tracking, the root locus method, design of industrial controllers, conformal mapping, the Nyquist stability criterion, Bode plots, design indexes, lead and lag controllers. Experiments to support control theory using physical processes (e.g. water level, temperature control, light intensity control, etc.); Control system simulation using Matlab; Modeling of physical (experimental) equipment; Static performance; Transient analysis; Measuring devices; Two-position control; Proportional control; PID control; Introduction to Electrical instrumentation and Measurements.

Pre-requisites: *AEE 2410.*

AEE 3610: Data Communication and Networking ***3(2-0-2)***

Overview of computer networking, communication and transmission systems. Physical layer: introduction to Fourier analysis and signal impairments; basics of information theory, channel capacity, analog and digital data transmission, signal encoding. Data link layer protocols and multiplexing. Medium Access Control, framing, error control, flow/congestion control and their algorithms. Network layer: circuit vs. packet switching, asynchronous transfer mode, routing algorithms. Internet architectures and protocols. LAN architectures. Introduction to Wireless LANs.

Pre-requisites: *None.*

AEE 3720: Electronics Laboratory ***2(1-0-2)***

Introduction to the lab tools, I-V characteristics of diode, clipping circuits using diodes, rectification using diodes, Zener diode and regulators, BJT DC biasing, CE BJT amplifier. MOSFET DC biasing, CS MOSFET amplifier, simple AM receiver circuit.

Co-requisites: *AEE 3140.*

AEE 3730 : Power Systems Laboratory ***1(0-0-2)***

Breakdown and dielectric strength of different insulating materials. Flashover tests on insulators. Over-voltage protection and insulation coordination. Corona and its effects. Grounding resistance measurements. Power System Simulator familiarization. Characteristics of isolated and interconnected systems. Transmission line characteristics. Load Flow Study. Faults and characteristics and coordination of overcurrent relays. Power Quality issues.

Co-requisites: *AEE 3210.*

AEE 3740: Machines and Power Electronics Laboratory ***2(1-0-2)***

Equivalent circuit of transformers; Three-phase connections and harmonic problems; Equivalent circuit of three-phase and single-phase induction motors; Load testing of induction motors; Starting of single-phase induction motors; Equivalent circuit of synchronous machine: Performance of synchronous motors; Performance of dc machines. Introduction to Switch-Mode Power Converters, Steady-State DC-DC Converter Analysis and Design, Semiconductor Power Switches, DC-DC Power Converter Topologies and Design, PWM Converters, Output Feedback Control Design, Inductor and Transformer Design

Co-requisites: *AEE 3220.*

AEE 3750: Microwave and Communications Laboratory ***2(1-0-2)***

AM and FM modulation and detection; PCM and delta modulation; Bit error rate measurements; TDM; ASK; FSK; Optical fiber parameter measurements; RF impedance measurements and matching; Basic propagation and antenna measurements.

Co-requisites: *AEE 3430.*

AEE 3760: Logic Design Laboratory ***1(0-0-2)***

Familiarization with logic circuits laboratory; Introduction to logic gates; Implementation of Boolean functions using AND and OR gates; NAND and NOR

implementation; XOR and adders; Design of combinational circuits; Flip-flops; Design of sequential circuits; Sequential PLA's

Co-requisites: *AEE 3510.*

AEE 4610: Introduction to Microcontroller ***3(2-1-2)***

Introduction to Microcontrollers, Embedded Controllers and application, Instruction Set and Register Set for microcontrollers, programming microcontroller, microprocessor and microcontrollers Hardware Configuration, Resets and Interrupts, Clock and Timer Systems, Memory maps, Analog-To-Digital (A/D) and Digital-To-analog (D/A), Converters, parallel interfacing, serial interfacing, microcontroller applications. C/Assembly programming and machine code generation; RAM and EPROM; RS-232C; SCI and serial port interface; Parallel I/O interface and DMA; Programmable I/O interfaces and UART; DAC and ADC converters; Real time implementation

Pre-requisites: *AEE 3510.*

AEE 4910: Cooperative Training (Part I): ***0 credits***

This part starts typically during the summer session upon completion of 125 credit hours. In this part the student will spend the whole summer at a company in which his co-operative program will be performed. Based on his summer experience within the company and with the consultation of the industrial training advisor, he should develop a proposal about an engineering problem related to his major and the company requirements.

Pre-requisites: *Senior standing, Completion of 125 credit hours.*

AEE 4920: Cooperative Training (Part II): ***9 credits***

Starts typically upon completion of the Summer Training (AEE 4910), the student will hand-in his proposal at the beginning of the semester and after acquiring the program approval he will be assigned an academic advisor to follow up on his training progress with the cooperation of the industrial advisor. The student will spend the whole semester at the company. However, he is required to communicate regularly with his academic advisor to follow up on his training and project progress. In addition, the academic advisor will visit the student on site and he will be in close contact with his industry advisor. At the end of his co-op training, the student is required to submit a full professional technical report about his training experience and the engineering skills and experience he has acquired. A public oral presentation by the student is required to be given in front of an examination committee that includes both advisors and other invited examiners and general audience and it is preferred to be given at the company site. The student's co-op final grade depends on

his performance during training sessions, quality of work and report, presentation and the acquired engineering skills as well.

Pre-requisites: *AEE 4910.*

AEE 4930: Capstone Senior Design Project ***3(1-0-4)***

Capstone Senior Design Project is a one-semester capstone experience in which senior students tackle engineering problems and attempt to formulate solutions. This project is a partnership program with industry that allows students working to solve actual problems encountered in industry. The project gives the students an opportunity to apply their skills in the real world and correlate their study with practical challenges. Towards the completion of the design project, students are allowed to work in teams or individually upon the obtaining of the program approval and their related academic and industrial supervisors. The major deliverable of the project is a comprehensive report that includes details of the background research, tasks, timelines, budget, preliminary feasibility studies, and project design steps. An oral presentation and poster demonstration are also required and will be evaluated by an examination committee to be chosen from industry experts as well as faculty members. The project grade reflects the student's ability to understand the engineering problem, formulate solution alternatives, identify the design constraints, and suggest a design proposal. Ethics in engineering practice and research, and professionalism are emphasized. Team design projects are highly encouraged.

Pre-requisites: *Senior standing, Completion of 125 credit hours.*

AEE 4110: VLSI Circuit Design ***3(2-1-2)***

Introduction to VLSI technology. Electrical properties of NMOS and CMOS transistors. NMOS subsystem design and layout. Subsystem design and layout using simple static, complex static, and dynamic domino CMOS logic circuits. Designs of NMOS and CMOS PLA, finite state machines and memory systems. System designs using BiCMOS technology, GaAs technology, gate arrays and Field Programmable Gate Arrays (FPGAs).

Pre-requisites: *AEE 3140, AEE 4920.*

AEE 4120 : Real Time Systems ***3(2-1-2)***

Basic issues in Real Time System Design, Conceptual models that can be used in capturing behavior and its implementation. Real Time operating System RTOS. Scheduling and Practical Implementation of Embedded Systems having a real time constraints. Translation of system specifications into a computation models and mapping these formal models into RTL level. Case Study on the Quartus II – Stratix II Environment integrating the NIOS Processor with FPGA

Pre-requisites: *AEE 4610, AEE 4920.*

AEE 4130: Embedded System Design ***3(2-1-2)***

Introduction to embedded systems. Technique and tools to understand used in design of an embedded system. Hardware and software aspect are addressed in this course. Basics of embedded System Architecture in terms of design with both hardware and software components, interface memories and I/O devices, embedded software to satisfy real-time requirements; integrate Software in hardware-based embedded system.

AEE 4210: Power System Planning ***3(2-1-2)***

Basic load forecast methodologies; Electric loads characteristics; consumer categories; Power system generation; Transmission and distribution reliability evaluation; System cost assessment; Load management and energy conservation strategies.

Pre-requisites: *AEE 3210, AEE 4920.*

AEE 4220: High Voltage Engineering ***3(2-1-2)***

Generation and measurements of high DC, AC and impulse voltages; Conduction and breakdown processes in gaseous, liquid, and solid insulating media; High voltage test techniques; Grounding and safety consideration.

Pre-requisites: *AEE 3210, AEE 4920.*

AEE 4230: Power System Protection ***3(2-1-2)***

Protection Principles and Components; Fault Calculations; Protective Transformers; Over current Protection; Distance Systems; Power Frequency and Carrier Systems; Protection of Generators, Motors, Bus bars, Reactors, and Capacitors; Transformers; Application of Protection to Distribution Systems; Station Layout and Configuration; Disturbance Monitoring; System Restoration; Microprocessor, Based Relaying.

Pre-requisites: *AEE 3210, AEE 4920.*

AEE 4310: Wave Propagation and Antennas ***3(2-1-2)***

Wave guides and cavities; Radiation and antennas; Antenna parameters; dipoles and loop antennas; traveling wave antennas; Aperture and patch antennas; Linear and planar antenna arrays; Basic propagation modes; Free space propagation; Ground wave propagation; Sky wave propagation; Space (terrestrial) wave propagation; Introduction to Propagation models in mobile radio systems.

Pre-requisites: *AEE 2310, AEE 4920.*

AEE 4320: RF Electronics ***3(2-1-2)***

BJT and MOS high frequency amplifiers, Cascade amplifiers, resonant circuits, RF amplifiers, RC and LC oscillators, AM receiver circuits(mixer circuit, AGC circuit, class A and class AB PA circuits). FM receiver. Phase locked loop.

Pre-requisites: *AEE 3140, AEE 4920.*

AEE 4410: Wireless Communications ***3(2-1-2)***

Basic concepts of wireless communications; The cellular concept; Cell splitting & sectoring; Cell coverage**;** Mobile radio propagation; Path loss models**;** Shadowing; Statistical fading models; Capacity of fading channels**;** Digital modulation Performance in fading channels**;** Equalization**,** diversity and channel coding**;** Speech coding; Multiple access techniques; Wireless networking; Modern wireless systems and standards.

Pre-requisites: *AEE 4310, AEE 4920.*

AEE 4420: Optoelectronics and Optical Communications ***3(2-1-2)***

Wave Particle duality of light. Interaction of light with matter. Review of semiconductor physics and introduction to optoelectronics. Generation of optical energy: light emitting diodes and lasers. Detection of optical energy: photoconductors, PIN and avalanche photodiodes. Introduction to electro-optics. Control of optical radiation: modulation and switching of light. Optics review. Dielectric slab waveguides and introduction to integrated optics. Optical fibers and fiber devices (band gap structures, Bragg reflectors). Theory of optical fiber communications. Signal degradation in optical fibers. Optical sources. Photo detectors. Optical transmitters. Optical receivers. Optical amplifiers. WDM Systems.

Pre-requisites: *AEE 3140, AEE 3430, AEE 4920.*

AEE 4510: Artificial Intelligence ***3(2-1-2)***

Introduction to artificial intelligence, Intelligent agents, Solving problems by searching, Game playing, logical agents and first order logic, Learning from observations, Learning in neural and belief networks, Practical language processing, Fuzzy logic and reasoning, Perception and pattern recognition, Artificial neural networks. Applications in image processing, Robotics, and projects.

Pre-requisites: *AEE 3520, AEE 4920.*

AEE 4520: Introduction to Robotics ***3(2-1-2)***

Evolution of robotics, mobile and manipulator robots, coordinate systems, kinematic models of manipulators, position, velocity and force control, sensors and actuators,

robotic vision, workspace modeling, task and path planning, industrial robots, manufacturing and autonomous systems, robot programming.

Pre-requisites: *AEE 3520, AEE 4920.*

AEE 4940: Selected Topics in Electrical Engineering I ***3(2-1-2)***

These courses will be offered upon the request of some industrial needs and requirements and tailored to answer some of these practical industrial issues and could be offered jointly by the assistance from the industry experts. The applied and practical contents of these courses are highly encouraged.

Pre-requisites: *AEE 4920 & Instructor and Program Approval.*

AEE 4950: Selected Topics in Electrical Engineering II ***3(2-1-2)***

These courses will be offered upon the request of some industrial needs and requirements and tailored to answer some of these practical industrial issues and could be offered jointly by the assistance from the industry experts. The applied and practical contents of these courses are highly encouraged.

Pre-requisites: *AEE 4920 & Instructor and Program Approval.*