Academic Plan for the Degree of"Bachelor in Electrical Engineering"

Level 1		
Course Code	**Course Title**	**Hr.**
MATH 100	College Algebra	3
ACT 105	Academic and Life Skills	3
ENGL 125	General English-I	9
TECH 130	Computer Skills	3
Total		**18**

Level 2			
Course Code	**Course Title**	**Hr.**	**Requisites**
			Pre
PHYS 100	Fundamental of	3	--
MATH 108	Trigonometry	3	---
ENGL 126	General English-II	6	--
ENGL 127	English for Engineering Purposes	4	--
Total		**16**	

Level 3				
Course Code	**Course Title**	**Cr. Hr**	**Requisite**	
			Pre-	**Co-**
IC 101	Introduction to Islamic Culture	2 (2,0,0)		
MATH 105	Differential Calculus	3 (3,1,0)		
CHEM 101	General Chemistry (1)	4 (3,1,2)		
PHYS 103	General Physics (1)	4 (3,1,2)		
GE 212	Computer Programming	3 (2,0,2)		
GE 106	Introduction to Engineering	2 (1,0,2)		
Total		**18**		

Level 4				
Course Code	**Course Title**	**Cr. Hr**	**Requisite**	
			Pre-	**Co-**
ARAB 101	Language Skills	2 (2,0,0)		
MATH 106	Integral Calculus	3 (3,1,0)	MATH 105	
MATH 107	Vector and Matrices	3 (3,1,0)	MATH 105	
PHYS 104	General Physics (2)	4 (3,1,2)	PHYS 103	
GE 107	Engineering Drawing and Design	3 (1,0,4)		
ENGL 116	English Composition	3 (3,0,0)		
Total		**18**		

Level 5				
Course Code	**Course Title**	**Cr. Hr**	**Requisite**	
			Pre-	**Co-**
ENGL 107	Technical Writing	3 (3,0,0)		
MATH 203	Calculus for Engineering Students	3 (3,1,0)	MATH 106 MATH 107	
EE 201	Fundamentals of Electric Circuits	3 (3,1,0)	MATH 106 PHYS 104	
EE 208	Logic Design	3 (3,1,0)		
EE 210	Logic Design Laboratory	1 (0,0,2)		EE 208
EE 213	Engineering Electromagnetics (1)	3 (3,1,0)	PHYS 104	MATH 203
EE 205	Electric Circuits Laboratory	1 (0,0,2)		EE 201
Total		**17**		

Level 6				
Course Code	**Course Title**	**Cr. Hr**	**Requisite**	
			Pre-	**Co-**
IC 102	Islam and Society	2 (2,0,0)		
IC 103	The Islamic Economic System	2(2,0,0)		
MATH 204	Differential Equations	3 (3,1,0)	MATH 203	
EE 212	Electric Circuit Analysis	2 (2,1,0)	EE 201 MATH 107	
EE 215	Engineering Electromagnetics (2)	3 (3,1,0)	EE 213	
MATH 254	Numerical Methods	3 (3,1,0)	MATH 107 GE 212	
EE 353	Introduction to Microprocessors	3(2,1,2)	EE 208	
Total		**18**		

Level 7				
Course Code	**Course Title**	**Cr. Hr**	**Requisite**	
			Pre-	**Co-**
ARAB 103	Expository Writing	2(2,0,0)		
IC 104	Fundamentals of the Islamic Political System	2(2,0,0)		
EE 301	Signals and Systems Analysis	3(3,1,0)	EE 212	
EE 309	Electronics (1)	3 (3,1,0)	EE 212	
EE 312	Electronics Laboratory	1 (0,0,2)		EE 309
STAT 324	Engineering Probability and Statistics	3(3,1,0)		
EE 340	Fundamentals of Power Systems	3(3,1,0)	EE 212	
Total		**17**		

Level 8				
Course Code	**Course Title**	**Cr. Hr**	**Requisite**	
			Pre-	**Co-**
EE 314	Measurements and Instrumentation	3(3,1,0)	EE 212	
EE 318	Industrial Electronics	2(2,1,0)	EE 309	
EE 320	Communications Principles	3(3,1,0)	EE 301	
EE 330	Electromechanical Energy Conversion (1)	3(3,1,0)	EE 212 EE 213	
EE 331	Electromechanical Energy Conversion Lab (1)	1(0,0,2)		EE 330
EE 351	Automatic Control	3(2,1,2)	EE 301	EE 314
EE 471	Renewable Energy Engineering	2(2,1,0)	EE 309 EE 340	
Total		**17**		

Level 9				
Course Code	Course Title	Cr. Hr	Requisite	
			Pre-	Co-
GE 404	Management of Engineering Projects	2 (2,1,0)		
EE 496	Senior Design Project (1)	2(2,0,0)		
CE 499	Cooperative Summer Training	0 (0,0,0)	104 hours excluding PYP hours	
EE 4xx	Specialized Elective Courses	13	Refer to Tables A-D	
Total		17		

Level 10				
Course Code	Course Title	Cr. Hr	Requisite	
			Pre-	Co-
GE 403	Engineering Economy	2(2,1,0)		
GE 490	Ethics and professional practice	2(2,1,0)		
EE 497	Senior Design Project (2)	2 (2,0,0)	EE 496	
EE 4xx	EE Specialized Elective Course	10	Refer to Tables A-D	
Total		16		

Elective Courses of Specialized Areas

TABLE A: ELECTRONICS TRACK				
Course Code	Course Title	Cr. Hr.	Requisites	
			Pre-	Co-
EE 401	Advanced Electronic Circuits	3 (3, 1, 0)	EE 309	
EE 402	Electronic Circuits Laboratory	1 (0, 0, 2)		EE 401
EE 403	Semiconductor Devices	3 (3, 1, 0)	EE 309	
EE 404	Solar Cells and Photovoltaic Systems	3 (3, 1, 0)	EE 309	
EE 405	VLSI Circuit Design	3 (3, 1, 0)	EE 309	
EE 406	VLSI Design Laboratory	1 (0, 0, 2)		EE405
EE 407	Electronic Communication Circuits	3 (3, 1, 0)	EE 401	
EE 408	VLSI Technology and Fabrication	3 (3, 1, 0)	EE 309	
EE 409	Electronic Instrumentation	3 (3, 1, 0)	EE 401	
EE 410	Optoelectronic Devices and Systems	3 (3, 1, 0)	EE 309	
EE 412	Low Power VLSI Design	3 (3, 1, 0)	EE 405	
EE 415	Principles of Nanoelectronics	3 (3, 1, 0)	EE 403	
EE 419	Introduction to Electronic Warfare	3 (3, 1, 0)	EE 401	

TABLE B: COMMUNICATION SYSTEMS TRACK				
Course Code	Course Title	Cr. Hr.	Requisites	
			Pre-	Co-
EE 420	Digital Signal Processing	3 (3, 1, 0)	EE 301	
EE 421	Communications Laboratory	2 (0, 0, 4)	EE 320	
EE 422	Digital Communications	3 (3, 1, 0)	EE 320	
EE 423	Wave Propagation and Antennas	3 (3, 1, 0)	EE 215	
EE 425	Satellite Communications	3 (3, 1, 0)	EE 423	
EE 426	Microwave Engineering	3 (3, 1, 0)	EE 215	
EE 428	Error correcting coding for communication systems	3(3, 1, 0)	EE 422	
EE 460	Advanced communications	3(3, 1, 0)	EE420 EE422	
EE 463	Wireless Communications	3 (3, 1, 0)	EE 422 EE 423	
EE 464	Optical Communications	3 (3, 1, 0)	EE 423	
EE 468	Selected Topics in Communications and Signal	3 (3, 1, 0)	Instructor and Department	

	Processing		Approval
EE 469	Selected Topics in Engineering Electromagnetics	3 (3, 1, 0)	Instructor and Department Approval

TABLE C: ELECTRICAL POWER ENGINEERING TRACK				
Course Code	**Course Title**	**Cr. Hr.**	**Requisites**	
			Co-	**Pre-**
EE 431	Electromechanical Energy Conversion (2)	2 (2, 1, 0)	EE 330	
EE 433	Electromechanical Energy Conversion Laboratory (2)	1 (0, 0, 2)		EE 431
EE 435	Electric Drives	3 (3, 1, 0)	EE 330 EE 318	
EE 436	Electrical Machine Dynamics and Stability	3 (3, 1, 0)	EE 330	
EE 441	Power System Analysis	3 (3, 1, 0)	EE 340	
EE 443	Power System Operation and Control	3 (3, 1, 0)	EE 441	
EE 444	Power System Planning	3 (3, 1, 0)	EE 340	
EE 445	Electrical Power Laboratory	2 (0, 0, 4)	-	EE 441 EE318
EE 446	High Voltage Engineering	3 (3, 1, 0)	EE 340	
EE 447	Electricity Market and Energy Transactions	3 (3, 1, 0)	EE 441	
EE 448	Power Distribution Systems	3 (3, 1, 0)	EE 340	
EE 449	Power System Protection	3 (3, 1, 0)	EE 441	
EE 475	Power System Grounding	3 (3, 1, 0)	EE 340	
EE 479	Selected Topics in Electrical Power Engineering	3 (3, 1, 0)	Instructor and Department Approval	

TABLE D: AUTOMATION AND INTELLIGENT SYSTEM				
Course Code	**Course Title**	**Cr. Hr.**	**Requisites**	
			Co-	**Pre-**
EE 450	Computer Architecture &Organization	3 (3, 1, 0)	EE 353	
EE 452	Digital Control Systems	3 (3, 1, 0)	EE 351	
EE 453	Microprocessor and Embedded System Design	3 (3, 1, 0)	EE 353	
EE 454	Advanced Control Systems	3 (3, 1, 0)	EE 351	
EE 456	Automatic Control Applications	3 (3, 1, 0)	EE 351	
EE 457	Applied Control Laboratory	1 (0, 0, 2)		EE 456
EE 458	Advanced Logic Design	3 (3, 1, 0)	EE 210	
EE 459	Advanced Logic Design Laboratory	1 (0, 0, 2)		EE 458
EE 480	Introduction to Artificial Intelligence	3 (3, 1, 0)	EE 351	
EE 481	Real Time System Design	3 (3, 1, 0)	EE 353	
EE 482	Computer Networks	3 (3, 1, 0)	EE 422	

COURSE DESCRIPTION

IC 102 - Islam and Society

This course aims to highlight the characteristics of the Muslim community and its foundations specially in the area of family formation, with emphasis on the role of women in the family and the shaping of society. Then, it shows the teachings and guidance of Islam in the district of marriage, raising children, which helps to preserve the entity and stability of the family, and thus strengthen the cohesiveness of society and, finally, addressing the Islamic solutions for what is happening in the family issues and problems, as well as the most important issues of society

IC 103 - The Islamic Economic System

This course aims to introduce the Islamic conception of economic life as well as patterns of behavior of systems and institutions that demonstrate the rules and legal provisions related to economic life and economic implications with the results of its application in modern life. The course includes also a brief comparison with other economic systems in order to bring out the main advantages of the Islamic system.

IC 104 - Fundamentals of the Islamic Political System

This course aims to introduce the political system in Islam and the most important foundations on which it is based, then the statement distinguishes the political system of Islam and other political systems as it is a part of the comprehensive system of Islam which is a global and moral one.

Pre-requisite: *None*.

ARAB 101 - Language Skills

The syntax signs, the actual sentence, the nominal sentence, the subject of the nominal sentence, the predicate, " verily (enna), almost (kada), suppose (znna), was (kana)" and similar verbs, links: pronouns, relative pronouns, demonstrative pronouns and others numbers.

ARAB 103 - Expository Writing

Reading skills, and skill of conversation, writing the paragraph and the article, the development of the paragraph to the article, writing the administrative letters.

Math 105 - Differential Calculus

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.

MATH 106 - Integral Calculus

Introduction to differentiation, methods of differentiation, differentiation of parametric equations, differentiation of implicit and logarithmic functions. The definite integral, fundamental theorem of calculus, the indefinite integral, change of variable, numerical integration. Area, volume of revolution, work, arc length. Differentiation and integration of inverse trigonometric functions. The logarithmic, exponential, hyperbolic and inverse hyperbolic functions. Techniques of integration: substitution, by parts, trigonometric substitutions, partial fractions, miscellaneous substitutions. Indeterminate forms, improper integrals. Polar coordinates.

MATH 107 – Vectors and Matrices

Vectors in two and three dimensions, scalar and vector products, equations of lines and planes in space, surfaces, cylindrical and spherical coordinates. Vector valued functions, their limits, continuity, derivatives and integrals. Motion of a particle in space, tangential and normal components of acceleration. Functions in two or three variables, their limits, continuity, partial derivatives, differentials, chain rule, directional

derivatives, tangent planes and normal lines to surfaces. Extrema of functions of several variables, Lagrange multipliers. Systems of linear equations, matrices, determinants, inverse of a matrix, Cramer's rule.

MATH 203 - Calculus for Engineering Students

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. Double integral and its applications to area, volume, moments and centre of mass. Double integrals in polar coordinates. Triple integral in rectangular, cylindrical and spherical coordinates and applications to volume moment and centre of mass. Vector fields, line integrals, surface integrals, Green's theorem, the divergence theorem, Stoke' theorem.

MATH 204 - Differential Equations

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

MATH 254 Numerical Analysis

Various numerical methods for solving nonlinear equations. Direct and iterative methods for solving systems of linear equations along with error estimate. Polynomial interpolation with error formula. Numerical differentiation and integration with error terms. An introduction to numerical solution of ordinary differential equations..

STAT 324 - Engineering Probability and Statistics

Probability and probability distribution - Mathematical expectations of random variables. Discrete and continuous distributions. Sampling distributions - Estimation, testing of hypothesis - Regression and correlation.

PHYS 103 - General Physics (1)

Motion: vectors, gravitational fields and its applications (measurement of the acceleration of the gravity by the simple pendulum and by the compound pendulum experiment) - applications of Newton’s laws (one and two dimensions).

Fluid Mechanics: fluid static and fluid dynamics (measurement of surface tension by direct method and by capillary tube experiment) – viscosity (measurement of the coefficient of viscosity experiment) - static equilibrium and elasticity.

Conservation of Energy: temperature (measurement of specific heat experiment) – (measurement of the thermal conductivity experiment) – first law of thermodynamics heat engines – entropy and second law of thermodynamics – the kinetics theory of gases – waves – sound waves (measurement of sound velocity experiment)

Lab: simple pendulum- compound pendulum – Hooke’s law – measurement of coefficient of viscosity of liquid- surface tension – measurements of thermal conductivity – measurement of the specific heat of solid bodies.

PHYS 104 - General Physics (2)

Basics of quantum mechanics: quantum measurement theory, the uncertainty principle, one-dimensional potential models, and the Schrodinger-von Neumann equation, semiconductor physics.
Electrostatics: charge and matter- electric field – Gauss's law – electric potential – direct current – electric circuits (Ohm's law experiment) – capacitors (measurement of capacitance of a capacitor).
Magnetism: magnetic field (magnetic field experiment) Ampere's law – Biot& Savart law – magnetic materials- Faraday's law of induction.
Geometrical optics: Snell's law - reflection and refraction of light (refractive index experiment) - (measurement of magnification factor of the microscope)- fiber optics - dispersion of light – lenses law (determination of the radius of the curvature of lens experiment), (determination of the focal length of the lens experiment).

Lab: Ohm's law – Whetstone's bridge - measurement of capacitance of a capacitor -resonance in RLC Circuits - – magnetic field - determination of radius of curvature and focal length of a lens - measurement of refractive index of glass – microscope - measurement of light velocity.

CHEM 101 - General Chemistry (1)

Stoichiometry: SI Units, chemical formulas, the mole, methods of expressing concentration, Calculations based on chemical equations. Gases: laws, kinetic theory, deviation and van der Waals equation. Thermochemistry: Types of enthalpy changes, Hess Law and its applications, first law of thermodynamics. Solutions: Type of solutions and laws related, colligative properties. Chemical kinetics: Law of reaction rate, reaction order, factors affecting the rates. Chemical Equilibrium: Relation between Kc &Kp, Le Chatelier's principle and factor affecting equilibrium. Ionic equilibrium: Acid and base concepts, pH calculations of acid, base and buffer solutions. Atomic Structure: emission spectrum, Bohr's theory de Broglre's hypothesis, quantum numbers, electronic configuration of elements, consequences of the periodic table.

ENGL 107 - Technical Writing

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.

ENGL 116 -English Composition

This course intends to provide the students with rhetorical foundations that prepare them for the demands of academic and professional writing; the strategies and processes that successful writers employ as they work to accomplish specific purposes. The course covers different forms of writing such as descriptive and discursive essays, summaries, notes, reports, formal emails and letters. The course deals with different ways of sentence formation and essentials of paragraph writing.

GE 106 Basic Engineering Drawing

Part I: Introduction and practicing the engineering professional culture and ethics. Problem definition and techniques for simulation of ideas. Problem solving strategies. Engineering science sectors and branches; Governmental and Private opportunities for engineers, Global issues.
Part II: Commitment to safety (safety and risk), safety regulations. Engineering materials and their uses, measurement methods and metrology.

Part III: Design of engineering products by using: Fitting and hand works, material removal processes, joining metallic parts, shaping and production of parts (casting). This will enhance personal skills such as teamwork, leadership, practical report, written and oral presentation.
Pre-requisite:None.

GE 107 Engineering Drawing and Design

This course is designed to construct geometry and basics of lettering; Sketching; Orthographic projection; Pictorial and auxiliary views; Dimensioning; Introduction to computer graphics; Engineering applications. Computer aided design using Auto CAD.

GE 212 - Computer Programming

Introduction to computers and programming. Compilers and numbers systems. Program structures, comments, and printing. Formatting output, escape sequence, and program debugging. Variables, arithmetic operators, and expressions. Access of input/output files. Program control using: if-else statement, switch commands, for loops, and while loops. User-defined functions. One- and two-dimensional Arrays. Multidimensional arrays. Strings and Pointers. Engineering Applications.

GE 403 -Engineering Economy

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

GE 490 - Ethics and Professional Practice

Codes of Ethics; Professional Liability; Essentials of plans and specifications; Bidding; Awarding and administration of contracts; Contracts and Contract Law; Standardization and Standards; Licensure; Bonding claims; Public policy and its impacts; Risks and managing the risks;

EE 201 - Fundamentals of Electric Circuits

Circuit theorems: superposition principle, Thevenin and Norton theorems, maximum power transfer theorem. Techniques of circuit analysis: Nodal and mesh analysis, Sinusoidal sources and the concept of phasors in circuit analysis. Introduction to the concept of average, reactive and complex power, and power factor. Three phase circuits.

EE 205 - Electric Circuits Laboratory

General introduction to the laboratory. Voltage, current, and power in DC circuits using KVL and KCL. Nodal-voltage and Mesh-currents in DC circuits. Superposition, Thevenin's, Norton's, and Maximum power transfer theorems in DC circuits. AC measurements using oscilloscope. Series and parallel AC circuits. Resonance in series and parallel circuit. Power in AC circuits. Measuring the PF in AC circuits.

EE 208 - Logic Design

Number systems; Boolean algebra and logic gates; Simplification of Boolean functions; Combinational logic circuits design and analysis; MSI and PLD components; Introduction to synchronous sequential logic; Flip flops; Analysis of clocked sequential circuits; State reduction and assignment; Design of synchronous sequential circuits and PLA's.

EE 210 - Logic Design Laboratory

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

EE 212 - Electric Circuit Analysis

Introduction to the Laplace Transform. The Laplace Transform in Circuit Analysis. Frequency response of RLC and selective circuit: concept of transfer function, resonance, bode plots, introduction to filters; Two-Port networks; Mutual inductance and transformers; Transient analysis of first and second order circuits.

EE 213 – Engineering Electromagnetics (1)

Vector Analysis; Coulomb's Law and Electric Field Intensity; Electric Flux and Electric Flux Density, Gauss's Law, Divergence; Energy and Potential; Conductors and Dielectrics; Current and Current Density; Capacitance; Poisson's and Laplace's equations; The Steady Magnetic Field.

EE 215– Engineering Electromagnetics (2)

Biot-Savart and Ampere's laws; Curl and Stokes' theorem; Magnetic materials and circuits; Self and mutual inductances; Energy in static Fields. Time varying fields; Faraday's law. Transformer and motional emfs; Displacement current; Maxwell's equations and time harmonic fields; Wave equation; Power transfer and Poynting vector; Plane wave propagation in free space, in lossy dielectrics and in good conductors; Polarization; Reflection of plane wave at normal and oblique incidence; Transmission line Theory; Impedance matching.

EE 301 - Signals and Systems Analysis

Motivation and Applications, Signal Classifications, Signal Operations, Singularity Functions; Linear Time-Invariant Systems and Convolution; Correlation; Fourier Series and Transform for continuous and discrete time signals; Frequency response; Laplace transform and applications.

EE 309- Electronics (1)

Introduction to semiconductor material properties; semiconductor diodes: structure, operation, and circuit applications; special diodes: Zener, LED, Solar cell and photodiode; Metal Oxide Field Effect Transistors (MOSFETs): structure, operation, and circuit applications; Bipolar Junction Transistor (BJT): structure operation, and circuit applications. Low frequency amplifiers for BJT and MOSFETs with different configurations

EE 318 – Industrial Electronics

Principles: Background, organizing and analyzing switches; Classification of power electronics converters, Power semiconductor devices: terminal characteristics; Power converters: AC-AC converters, rectifiers, inverters, DC-DC converters and resonant converters; Applications in power systems.

EE 312– Basic Electronics Laboratory

General introduction to the laboratory. 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.Transfer and output characteristic of MOSFET, MOSFET as a switch.

EE 320 - Communications Principles

Overview and Basic elements of Communication Systems; Transmission through Systems and Channels; Modulation; AM; Frequency Conversion; FM and PM; Superhetrodyne Receiver; FDM; Stereo Broadcasting; Sampling; Pulse Modulation (PAM, PWM, PPM); TDM; Pulse Code Modulation (PCM); DPCM and DM; Regenerative Repeaters; Advantages of Digital Communication; Line Coding (Binary Signaling); Introduction to Digital Modulation (ASK, FSK, PSK).

EE 330 - Electromechanical Energy Conversion (1)

Transformers (construction, operation of single-phase transformers, equivalent circuit, voltage regulation and efficiency, auto-transformer, three-phase transformers), AC machinery fundamentals, three-phase induction machines (construction, operation, equivalent circuit, performance, calculations, starting of induction motors, speed control), small AC motors (single-phase induction motors, reluctance and hysteresis motors, universal motors, servo motors, stepper motors.

EE 340 – Fundamental of Power Systems

Power system components and representation. Electric power generation (renewable and non-renewable sources). Line insulators and supports. Sag in overhead lines. Transmission line parameters. Models of transmission lines. Underground power cables parameters. Types of underground cables. faults location in cables. Power factor correction. Grounding systems.

EE 351 - Automatic Control

Introduction to automatic control systems, Mathematical Modelling of Control Systems, Transient and Steady-State Response Analyses, Control Systems Analysis and Design, PID Controllers, Introduction to Advanced Control Systems.

Lab: 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

EE 353 - Introduction to Microprocessors

Microprocessors architecture; Addressing modes and techniques; Instruction set; Assembly language programming; Interrupt systems; Input/output devices and timing; Memory devices; Future trends in microprocessors.

Lab: 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.

EE 314 –Measurements and instrumentation

Electrical instruments & measurements; moving-coil instruments; moving-iron instrument; induction type instrument; measurement of power; measurement of energy; dc bridge; ac bridges transducers; oscilloscope parts, modes of operation, probes, applications, digital oscilloscope.

EE 401 – Advanced Electronic Circuits

Op-amp applications: inverting and non-inverting amplifiers, integrator, difference amplifier. Differential amplifier. Current Mirror. Negative and positive feedback. NMOS and CMOS inverters, CMOS and pseudo NMOS logic gates, pass-transistor logic, dynamic logic. BJT digital circuits: TTL, and ECL logic.

EE 402 - Electronic Circuits Laboratory

PSPICE simulation of electronic circuits. Linear applications of op-amp. Wein-bridge oscillator. Active filters: LPF, and HPF. Schmitt trigger and a stable multivibrator. Differential amplifier using BJT. CMOS and TTL inverters.

EE 403 –Semiconductor Devices

Fundamentals of semiconductor Physics: Energy bands, Fermi-Dirac and Boltzmann statistics: carrier concentrations at thermal equilibrium, mass action law. Carrier transport mechanisms: Drift and diffusion. Basic Equations for semiconductor Device Operation: excess carriers, current continuity equations, Poison`s equation. PN and Special junction devices: Schottky barrier, microwave devices, Hetero-junction. MOS capacitor and MOSFET, Bipolar transistor.

EE 404 – Solar Cells and Photovoltaic Systems

Solar Insolation (radiation); Generation, recombination, and basic equations of semiconductor-device physics; P-N junction Diode solar cells: Operation and construction; Solar cell parameters; Design of Silicon solar Cells; Photovoltaic Modules, Arrays, and Systems; Balance of the System (BOS); Design of Stand-alone PV Systems; Other Devices Structure; Other Semiconductor Materials.

EE 405 - VLSI Circuit Design

Basic fabrication sequence of NMOS and CMOS ICs. Design rules and layout. Combinational and sequential circuits. Memories and registers. Introduction to full custom and semi-custom ICs, standard cells, gate arrays, FPGAs and PLDs etc. CAD tools for design of ICs. Introduction to high level design of ICs using VHDL. Introduction to low power IC design.

EE 406 - VLSI Design Laboratory

Low level and high level design and implementation of digital circuits targeted to FPGAs: Design entry using schematic editor, functional simulation, design entry using VHDL editor, VHDL Synthesis, Functional simulation, Compilation of design, design verification and study of reports. CMOS inverter layout (Step by step process), Layout design of digital circuits using layout tools, Lab. Project.

EE 407 – Electronic Communication Circuits

General electronic circuitry used in communication systems. Mixers, up & down converters, PLL, attenuators, phase shifters, Hilbert transformers and hybrids. Carrier and clock recovery circuits. Pulse and timing circuits.

Pre-requisite: EE 401.

EE 408 - VLSI Technology and Fabrication

Introduction to semiconductor devices; crystal growth and wafer preparation; chemical and physical vapor deposition; oxidation; diffusion; ion implantation; lithography; etching; metallization; process integration of CMOS and bipolar technologies; diagnostic techniques and measurements; packaging; yield and reliability

EE 409 - Electronic Instrumentation

Timer and its applications. Analog switches. Analog multipliers. Operational trans-conductance amplifier (OTA). Current conveyor. Switched capacitor circuits. Phase-locked-loop (PLL) with applications. Data conversion: digital-to-analog and analog-to-digital converters. Digital PLL.

EE 410 - Optoelectronic Devices and Systems

Photonic Semiconductor Materials. Optical sources: light-emitting diode, laser diode. Photo-detectors (PIN diode, APD). Optical waveguide basics. Optical fiber principles. Optical amplifiers. Introduction to Optoelectronic Systems with applications.

EE 412 – Low Power VLSI Design

Introduction to low-power design, low- voltage process technology, low- voltage device model, low- voltage low- power CMOS circuit design, low- power CMOS RAM circuits, CMOS subsystem design, low- power VLSI design methodology.

EE 415 – Principles of Nanoelectronics

Introduction to fundamentals of nanoscience for electronics nanosystems. Principles of fundamental quantities: electron charge, effective mass, Bohr magnetron, and spin, as well as theoretical approaches. From these nanoscale components, discussion of basic behaviors of nanosystems such as analysis of dynamics, variability, and noise, contrasted with those of scaled CMOS.

EE 419 – Introduction to Electronic Warfare

Introduction to Electronic Warfare (EW) principles, Electronic support measures (ESM) receivers, Electronic countermeasures (ECM), Electronic counter-countermeasures (ECCM), Command Control and Communications (C^3) Systems, ECM Jamming, Electronic Warfare technology.
Pre-requisite:EE 401.

EE 420 - Digital Signal Processing

Characterization and classification of discrete-time (DT) signals and systems; Typical DT signal processing operations; Linear time-invariant (LTI) - DT systems; Convolution; Correlation in DT signals- 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.

EE 421 - Communications Laboratory

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.

EE 422 - Digital Communications

Basic elements of communications systems; Review of probability theory; Base-band pulse transmission (matched filters, inter-symbol interference); Eye pattern, Nyquist criteria; Equalization; Digital Pass-band transmission: Coherent PSK, FSK, QPSK, MSK, M-ary frequency & phase modulations, MQAM; Non-coherent orthogonal modulation; Power spectra and bandwidth efficiency of binary and quaternary modulation schemes; Channel capacity; Source coding; Error control coding (channel coding).

EE 423 - Wave Propagation and Antennas

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.

EE 425 -Satellite Communications

Introduction to satellite communication; Basic orbit maneuver; Satellite orbit geometry and types (LEO, MEO and GEOs); Orbit characteristics; Telemetry, Tracking and Command; Propagation characteristics; Frequency bands; Channel modeling, Satellite antennas and patterns; Earth stations; Modulation and multiple Access techniques; Satellite uplink and downlink: analysis and design; Frequency plan; Carrier and transponder capacity, Single carrier and multi-carrier transponder; VSAT; Modern satellite systems and applications.

EE 426 - Microwave Engineering

Basics of Microwave Engineering, RF Behavior of Passive Components, Chip Components and Circuit Board Considerations, Stripline and Microstrip circuits, Microwave network analysis, Impedance matching, Power dividers and directional couplers, Microwave filters, Active microwave components, amplifiers, oscillators and mixers.

EE 427 - Information Theory

Information theory measures: Entropy, relative entropy and mutual information; Entropy rate of a stochastic process: Memoryless sources and sources with memory; Data compression: source coding theorem, variable length codes, arithmetic codes; Characterization of transmission and storage channel: channel capacity, the channel coding theorem and its converse, Gaussian channel, capacity of band-limited channels; Introduction to error control codes.

EE 428 - Error Correcting Coding for Communication Systems

Linear block codes, Galois fields; polynomials over GF(q); cyclic codes; BCH and Reed-Solomon codes; Block codes performance in AWGN channels; convolutional codes and Viterbi decoding; bit error rate bounds for convolutional codes; Trellis coded Modulation (TCM); Interleaves; concatenated codes; Error control for channel with feedback; application of ECC in different communication systems and in storage media.

EE 460 Advanced Communications

Introduction to modern telecommunication Characteristics of transmission media, Mobile communications systems: cellular concepts, Second Generation of cellular systems: 2G (GSM, GPRS, Generations of Mobile systems (2G,3G and 4G), Multiple Access scheme, TDMA, FDMA, CDMA; OFDMA, SC-FDMA and Wireless / high speed communication systems.

EE 463 - Wireless Communications

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.

EE464 - Optical Communications

Introduction to optical communication; history, Optical Transmission windows, Optical communication system and industry/market view; 2) Ray Theory Transmission (Total Internal Reflection - Acceptance angle - Numerical aperture - Skew rays) 3) Electromagnetic mode theory for optical propagation (Slab waveguide- wave guiding conditions -modes in slab waveguide- GOOS-HANCHEN shift) ; 4) Cylindrical fibers (types -propagation modes - Step index fibers - Graded Index –single mode fibers) 5) Transmission Characteristics (Attenuation- Absorption loss- Scattering Loss- Fiber bend loss- Dispersion); 6) optical sources (LED and LASER diodes); 7) Optical detectors (PIN and APD); 8) Optical amplifiers; 9) Optical network concepts; WDM and DWDM system and their components.

EE 468 - Selected Topics in Communications and Signal processing

Topics of current interest will be offered.

Pre-requisites: Instructor and Department Approval.

EE 469 - Selected Topics in Engineering Electromagnetics

Topics of current interest will be offered.

Pre-requisites: Instructor and Department Approval.

EE 431 - Electromechanical Energy Conversion (2)

Synchronous machines (construction, internal voltage, equivalent circuit, phasor diagram, performance of turbo-alternator, generator operating alone, parallel operation of AC generators, synchronous motor, steady-state operation, starting), DC machines (construction, classification, performance, motor characteristics, starting of DC motors, speed control of DC motors).

EE 433 - Electromechanical Energy Conversion Laboratory

Equivalent circuit of transformers, Three-phase transformer connections, harmonic problems equivalent circuit of three-phase and single-phase induction motors, Load testing of induction motors and Starting of single-phase induction motors. Equivalent circuit of synchronous machine, External characteristics and voltage regulation of synchronous generator, synchronization of alternators, Parallel operation of three phase synchronous generators, direct and quadrature axis reactance of salient pole alternator, performance of synchronous motors; performance of DC machines, characteristics of DC separate, shunt, series motor and generator.

EE 435 - Electric Drives

Principles of electric drive; Definitions; Electrical considerations: running, starting, braking; Mechanical considerations: type of enclosure, noise, drive transmission, motor selection; Electric traction; DC & AC solid state drives.

EE 436 – Electrical Machine Dynamics and Stability

Basic dynamic equations; DC machine dynamics: dynamic models, dynamic analysis; Synchronous machine transients and dynamics: transformation to direct-and quadrature-axis variables, Dynamic model of AC

transmission line in d-p-o domain; Dynamic stability; Induction machine dynamics and transients: starting transients, sudden load changes, 3-phase faults.

EE 441 –Power System Analysis

Concepts of power system modeling: Bus admittance and Bus Impedance matrices. Load flow analysis: Gauss-Seidel, Newton-Raphson and Fast-Decoupled methods. Symmetrical fault calculations: Thevenin equivalent and Bus impedance matrix methods. Symmetrical components. Transient stability: swing equation, equal-area criterion, Euler and modified Euler methods.

EE 443 - Power System Operation and Control

Concepts of power system operation; Network topology and incidence matrices formation of bus impedance matrix; Unit commitment; Optimal power flow; Automatic generation control; Energy management systems and control center operation; State estimation; Dynamic security assessment.

EE 444 – Power system planning

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.

EE 445 - Electrical Power Laboratory

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.

EE 446 - High Voltage Engineering

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.

EE 447 - Electricity Market and Energy Transactions

Basic concepts of market economics; electricity market driving forces; competitive electricity market structure: single and multiple sellers and buyers, pool market, bilateral market, spot market; DCOPF, ACOPF, SCOPF; electricity rate structure and pricing: marginal price, market clearing price, pool price, spot price; forward, future, options, swap and hedging contracts; security: costs, Value of loss load, LOLP, ancillary services; transmission and electricity markets; system charges: infrastructure, use of system, connections, and wheeling models and fees; regulatory models; Investing: in generation, in transmission.

EE 448 - Power Distribution Systems

Components of Distribution system: substations, switchgear, feeders, sub-transmission lines and primary and secondary systems; planning and load forecasting of Distribution system; “DAS” Distribution Automation Systems; Voltage drop and power loss considerations; Application of capacitors in distribution systems; Distribution service restoration and network reconfiguration; Power quality issues: causes, assessment and mitigation techniques

EE 449 - Power System Protection

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

EE 471 – Renewable Energy Engineering

Introduction to renewable energy resources including solar, photovoltaic, wind, biomass, bio-fuel, fuel cells, ocean, and geothermal. The nature and availability of solar radiation. Low- temperature solar energy applications. Solar thermal and electricity generation. PV basis principles, electrical characteristics of cells/modules and PV systems for remote power. On/Off Grid-connected PV systems. Cost of energy from PV. Hydropower: the resource,stored energy and available power andsmall-scale hydroelectricity. Wind turbines principles. Power and energy from wind turbines. Onshore and Offshore wind energy. Hybrid power system and energy conversion.

EE 475 - Power System Grounding

Basics of reasons, types and uses of grounding and bonding; step and touch voltages, Methods of grounding of power system neutrals; Equipment grounding; Lightning protection grounding; Static electricity protection grounding: Ground electrodes systems; Measurements of grounding system parameters; Electric safety hazards and preventive measures; Surge protection and noise mitigation techniques.

EE 479 - Selected Topics in Electrical Power Engineering

Topics of current interest will be offered.

Pre-requisites: Instructor and Department Approval.

EE 450: Computer Architecture Organization

Introduction to computer components and structure; Data representation; Processor structure and organization; Instruction sets and microprogramming; Memory structure and organization; Input-output structure and organization; Parallel computer structure and organization; Recent development on the subject; Applications: projects and discussions.

EE 452 – Digital Control Systems

Introduction to digital systems; Sampling process; Z-transform techniques; Difference equations and state space representation; Simulation of discrete systems; Solution via Z-transform; Stability, controllability and observability of discrete systems; Discretization methods; Introduction to computer-controlled systems.

EE 453 - Microprocessor and Embedded System Design

The course provides an introduction to the design of embedded microprocessor systems with emphasis on real-time nature of embedded systems such as cost and design tradeoffs. Topics include memory devices, interrupts and DMA, timers and counters, serial communication and parallel I/O interface, Keyboards, LCD, VGA interfaces, transducers and sensors interface, A/D and D/A converters, instruction execution cycle and timing, buses timing, and protocols, practical projects that involve students in the design of an embedded microprocessor systems from initial concepts to the debugging of a final product.

EE 454: Advanced Control Systems

Introducing real time considerations in the control design. Nonlinear systems are studied with different approaches. Multivariable systems and decoupling techniques are emphasized. Optimal control design is introduced. Adaptive and robust control design is covered in details. Students acquire the basic skills of how to approach and deal with different requirements to analyze and to design real time applications.

EE456: Automatic Control Application

Introducing and practicing the engineering standards in control components selection and design. Fundamentals of industrial transducers and actuators are given. Problem definition and techniques for stimulation of ideas are given. Students learn the analysis and design of different control problems with special emphasis on concepts and design creativity. They acquire the basic skills of how to approach and deal with different requirements to analyze and to design real time applications.

EE 457 – Applied Control Laboratory

This laboratory is equipped with basic instruments and real time experiments that are necessary to familiarize the students with the advanced concepts and updated technology in the control field. The undergraduate experiments are designed to reinforce and expand many concepts covered in the advanced control course EE 454 and digital control course EE452.Experiments are organized in several groups of real time applications, such as:

- Data Acquisition and system modeling
- Computer control system using MATLAB
- Digital Control using PLC.

EE 458 - Advanced Logic Design

Combinational and sequential logic design techniques, Algorithms and tools review. Structured design concept, Design strategies, Design decomposition, Design tools. Introduction to Hardware languages, Basic Features. Simulation and Synthesis, Basic VHDL modeling techniques, Algorithmic level design, Register Transfer Level Design, Sequential (Synchronous and Asynchronous) Circuits Design, Programmable Logic and Storage Devices and Design Case Study.

EE 459 - Advanced Logic Design Laboratory

Arithmetic Logic Unit (ALU); Magnitude Comparators; ROM-Based Design; Synchronous and Asynchronous counters and their applications; Digital clock Design; State Machine Design; PLD and FPGA based designs; Project.

EE 480 – Introduction to Artificial Intelligence

Introduction to artificial intelligence, Artificial neural networks, Learning algorithms in neural networks. Fuzzy logic and its applications, Fuzzy neural networks. Applications in image processing, pattern recognition, Robotics, Industrial processes and projects.

EE 481 - Real Time System Design

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 Processorwith FPGA.

EE 482: Computer Networks

Introduction to computer networking and networks; Computer networks protocols: ISO-OSI, TCP-IP, ATM, LANs; Sharing of resources techniques: circuit switching and store and forward techniques; Network traffic sources; Network traffic flow: link level and network level; Principles of grid computing; Recent development on the subject; Applications: projects and discussions.