5.2 ELECTRICAL ENGINEERING DEPARTMENT

The Department of Electrical Engineering offers a range of basic electrical engineering courses relating to the major electrical engineering disciplines, to prepare the students to all educational programs of the department.

The department requirements include 72 credit hours of different courses as detailed in the Table 3.8/Chapter 3.

5.2.1 BASIC ELECTRICAL ENGINEERING COURSES

5.2.1.1 "EE202" DIGITAL LOGIC FUNDAMENTALS: 3Cr [2-2-1]
Pre-requisites: UEC02E

Course Catalogue Description:
This course introduces the student to fundamentals digital logic. It provides students with requirements to analyse and design digital circuits and basic digital systems. This is achieved by understanding logic components, algebra, maps. Then the course moves towards applying all theoretical knowledge into a practical lab environment.

5.2.1.2 "EE203" INTRODUCTION TO MICROPROCESSOR: 3Cr [2-2-1]
Pre-requisites: EE202

Course Catalogue Description:
This course introduces the students to features and technology of microprocessor systems. Also, to gain experience in assembly language programming of microprocessor peripherals and interrupt service routines. As well as data processing tasks.

5.2.1.3 "EE211" ELECTRONICS WORKSHOP: 1Cr [0-0-3]
Pre-requisites: None

Course Catalogue Description:
The aim of this course is to understand the usage of simple physical explanations, with reference to examples from actual devices, the physics of low-dimensional semiconductors will be introduced, such as field-effect transistors and quantum wells.

5.2.1.4 "EE213" INTRODUCTION TO ELECTRONIC CIRCUIT: 3Cr [2-2-1]
Pre-requisites: EB122 & EE291

Course Catalogue Description:
This course introduces the student to: semiconductor materials. fundamentals of diode operation, Zener diode, clippers, clampers, rectifiers, voltage regulator. Field effect transistors (fundamentals, characteristics of jfet and mosfet, biasing configurations). Fet amplifiers (common source- common drain- common gate). Bipolar junction transistor (circuits, analysis, biasing). Bjt amplifiers (common emitter- common collector- common base). Multistage amplifiers.

5.2.1.5 "EE224" MICRO-ELECTRONIC DEVICES AND CIRCUITS: 3Cr [2-2-1]
Pre-requisites: EE213

Course Catalogue Description
This course introduces the student to: Operational Amplifier circuits (fundamentals- frequency response- inverting- non inverting- summing- integrators- differentiators- voltage follower amplifier configurations- IC operational amplifier). Amplifiers frequency response (transistor amplifier- Bipolar- FET). High frequency response. Phototransistor. Feedback Amplifiers (current and voltage amplifiers- positive and negative feedback).

5.2.1.6 "EE225" SOLID STATE ELECTRONICS: 3Cr [2-2-1]
Pre-requisites: EE213

Course Catalogue Description:
This course introduces the student to: review of quantum mechanical principles, solid-state structure. Atomic bonds. crystal structure, reciprocal space, brillouin zones. Theory of solids, dynamics of electron motion. free-electron theory in metals, Fermi-Dirac statistics. energy band theory. Effective mass. Statistics of electronic state population. Semi-conductor, metal, insulator. Electronic motion. Conductivity in solids, resistivity. Intrinsic and extrinsic semi-conductor. Diffusion and drift. Hall effect. Dielectric and magnetic properties. Device applications.

5.2.1.7 "EE232" ELECTRONICS: 3Cr [2-2-1]
Pre-requisites: EE291

Course Catalogue Description
History and overview, electronic properties of materials, diodes and diode circuits, MOS transistors and biasing, MOS logic families, bipolar transistors and logic families, design parameters and issues, storage elements, interfacing logic families. Operational amplifier, circuit modeling and simulation. Integrated circuit building blocks

5.2.1.8 "EE241" SIGNALS AND SYSTEMS: 3Cr [2-2-1]
Pre-requisites: EB204

Course Catalogue Description:
This course introduces the student to basics of continuous signals. It provides students with all necessary requirements to analyze continuous signals and systems and a brief introduction to discrete signals and systems. This will be achieved by understanding different concepts, mathematical formulas and transformations, and use an advanced software toolkit for applications.

5.2.1.9 "EE260" ELECTROMAGNETIC FIELDS: 3Cr [2-2-1]
Pre-requisites: EB204, EB122

Course Catalogue Description:
This is a second advanced course for undergraduates specializing in electromagnetic (EM). The aim of this course is to provide senior-level students with methods to analyze and understand advanced EM field problems that arise in various branches of engineering.

5.2.1.10 "EE261" ELECTROMAGNETIC WAVES AND TRANSMISSION MEDIA: 3Cr [2-2-1]
Pre-requisites: EE260

Course Catalogue Description
Introduction to plane waves: Plane wave solutions for the wave equation. Electromagnetic waves in complex media, dielectrics and conductors, polarization, reflection and transmission of waves, total reflection and total transmission, considerations for lossy media. High-frequency transmission lines: Distributed parameters model, lossy lines, distortionless lines, reflection and standing waves, input impedance, impedance transformation and matching. Waveguides: Rectangular and circular waveguides, TE and TM modes, power transmission and losses. Cavity resonators: Fields and modes in rectangular and cylindrical cavities, resonance frequencies, quality factors, effect of dielectric losses.

5.2.1.11 "EE291" ELECTRIC CIRCUITS: 4Cr [3-2-1]
Pre-requisites: EB102, EB122

Course Catalogue Description:

This course introduces to electric engineering students fundamentals of electric circuits. It provides students with requirements to analyze and design electric circuits DC and AC. This is achieved by understanding basic theorems, methods of analysis, and lab experiments.

5.2.1.12 "EE271" ENERGY SYSTEMS: 3Cr [2-2-1]
Pre-requisites: None

Course Catalogue Description:

An overview of the generation and utilization of electrical energy. Covers fundamentals of modern energy conversion technologies in electrical energy generation using conventional energy resources, the renewable energy resources and technologies as a power for sustainable future, fundamentals of energy storage systems, the illumination systems and principles of energy conversion and electrical wiring and installation designs in dwelling units.

5.2.1.13 "EE290" CONTROL SYSTEMS (I): 3Cr [2-2-1]
Pre-requisites: EB204, EE291

Course Catalogue Description:

The course introduces an overview for the control system structure. The course covers topics of the basics of control system including: Open loop versus closed loop systems, modeling of physical systems, Transfer function, Block diagram, and Signal flow graph. The course covers performance evaluation of the control system using both types of time response and frequency response. The course covers also analysis of Steady state error and stability of control systems. It also covers Proportional, Integral and Derivative controller: *System response and controller tuning*.

5.2.1.14"EE293" ELECTRICAL MEASUREMENTS AND INSTRUMENTATION (I): 3Cr [2-2-1]
Pre-requisites: EE291

Course Catalogue Description:

The course covers fundamentals of electrical measurements, measurements of dc and ac voltage, current, electric power and energy (supply meter) using analog measuring instruments, measurements of accurate and sensitive frequency and phase shift of ac voltage and cuurent signals using CRO ,measurements of low and high resistance measurements as well as measurements of inductance and capacitance parameters at different quality factors using bridge circuits, measurements of voltage and current in high-voltage substations and power systems using instrument transformers. The course covers also basics of digital-type voltmeter and ammeter for voltage and current signals, measurements of physical quantities using sensors or transducers and fundamentals of data acquisition in instrumentation systems.

5.2.1.15"EE400-1 AND EE400-2" GRADUATION PROJECT: 4Cr [3-1-2]
Pre-requisites: None for EE400-1 and EE400-2 for EE400-1

Course Catalogue Description:
A course that integrates various components of the curriculum in comprehensive engineering experience so that the basic sciences, mathematics, and engineering sciences, which the student has learned in his Freshman-to-Senior years of study can be applied. It considers design of a complete project or system including establishment of objectives and criteria, formulation of the problem statements, preparation of specifications, consideration of alternative solutions, feasibility considerations, and detailed engineering designs. Projects are industry-based. The design should take into consideration appropriate constraints such as economic factors, safety, reliability, ethics and environmental and social impact. Submission of a written report is an essential requirement for completion of the course. Team design projects, where appropriate, are highly encouraged.

5.2.2 ELECTRICAL POWER AND CONTROL SPECIALIZATION

The Electrical Power and Control program requirements include at least 62 credit hours including 47 credit hours of compulsory courses given in Table 3.9/Chapter 3 and 15 credit hours of elective courses given in Table 3.10/Chapter 3.

5.2.3 POWER SYSTEM ENGINEERING COURSES

5.2.3.1 "EE254" COMMUNICATION TECHNOLOGY FOR POWER ENGINEERS: 3Cr [2-2-1]
Pre-requisites: EE241, EB205

Course Catalogue Description:
This course covers: Introduction to communication systems. Linear modulation: amplitude modulation, AM, DSB, SSB. Exponential modulation: frequency modulation, FM, and phase modulation, PM. Multiplexing: FDM. Mixing. Superhetrodyne receivers. Sampling techniques. Analog pulse modulation: PAM, PDM, PPM,. Quantization, Source coding, PCM, DPCM, DM, Quantization noise. Passband modulation techniques. ASK, PSK, FSK, QPSK, NCFSK, DPSK. Bandwidth requirements and performance in noise. Applications: AM and fm broadcasting, digital audio systems. Telephony, video storage and recording.

5.2.3.2 "EE272" ELECTRICAL POWER ENGINEERING (I): 3Cr [2-2-1]
Pre-requisites: EE271

Course Catalogue Description:
The course introduces an overview for the power system structure and the fundamentals of power system protection and control for the interconnected power systems. The course covers derivation and analysis of the simulation model of transmission line distributed parameters. The course presents the rules and methodology for the analysis of the transmission system electrical performance. The conceptual basics and modern technology of underground power cables are also presented in this course. The most important subject of power factor compensation is treated extensively with practical experience.

5.2.3.3 "EE273" ELECTRICAL POWER ENGINEERING (II): 3Cr [2-2-1]
Pre-requisites: EE272

Course Catalogue Description:
The course covers electric design of HV and EXHV overhead transmission lines. The course also covers mechanical design of overhead lines: sag and tension calculations, variation of sag and tension with

temperature and load, selection of line insulators under normal and polluted atmospheric conditions, line supporting structures and structure spotting. The course also covers distribution systems design for MV networks: sub-transmission, primary feeders and major equipment in distribution systems. The course introduces principals of travelling-wave protection of EHV lines, lightning arresters and insulation coordination.

5.2.3.4 "EE274" ELECTRICAL SAFETY ENGINEERING: 3Cr [3-0-1]
Pre-requisites: EE273

Course Catalogue Description:
Course covers electrical accidents: classifications of causes, hazards of electricity shock touch voltage & step voltage calculations, contact voltage limits. The course also covers elements, materials and methods of protective grounding for electric safety. The course also presents necessity and methods of structure protection against lightning and electrostatic charges. The course also covers regulatory and legal safety requirements, standards, safety equipment and safety switching of power supply system.

5.2.3.5 "EE275" POWER SYSTEM PROTECTION (I): 3Cr [2-2-1]
Pre-requisites: EE273

Course Catalogue Description:
The course covers Per-unit system of calculations and Symmetrical as well as Unsymmetrical short-circuit analysis. The course presents Protective switchgear elements including instrument transformers, relays, circuit breakers and high rupture capacity fuses. The course covers fundamentals for primary and back-up protection. It also covers coordination by time grading. It also covers methods of power system protection including the following: Feeder protection of cables and overhead lines, transformer protection, bus bar protection, motor protection and generator protection.

5.2.3.6 "EE276" HIGH VOLTAGE ENGINEERING: 3Cr [2-2-1]
Pre-requisites: EE260

Course Catalogue Description:
The course covers topics of insulating materials, gas discharge, and breakdown theory of liquid and solid dielectric. The course covers also fundamentals of electrical transients: switching transients in sub-stations and lightning transients along transmission lines. It also covers generation methods of AC, DC, and impulse high voltage testing signal in HV labs. The course covers also methods of measurements of voltage and current in high voltage labs. The course covers topic of high voltage testing of electrical apparatus. The course also includes gas insulated switchgear, bus-bar arrangements, HV substations layout and grounding systems. The course is concluded by case studies of protection of systems and equipment against transient over-voltages.

5.2.3.7 "EE385" ELECTRICAL POWER AND MACHINES: 4Cr [3-2-1]
Pre-requisites: EE271 & EE291

Course Catalogue Description:
The course introduces an overview for Per Unit System, three-phase AC Circuits, three-phase power and magnetic circuits. The course covers transformer principles and construction. The course presents fundamentals of electromechanical energy conversion. The course covers rotating machines: DC machines operation and DC motor performance, three-phase Induction Motors and Synchronous generators. It also covers power systems: transmission, distribution and power factor correction. The course presents three-phase kVA short-circuit calculations and fundamentals of power system protection.

5.2.3.8 "EE371" POWER SYSTEMS ANALYSIS: 3Cr [2-2-1]
Pre-requisites: EE273

Course Catalogue Description:
The course covers topics of power flow analysis and applications. It also covers the economic operation of power systems (optimal load scheduling problem). The course presents the fundamentals of power system planning including load forecasting, reliability and generation planning. Power system security: assessment and analysis of the effect of disturbing loads connected to the power systems are also covered in this course. The course also covers analytically the problems of power system stability and voltage stability for maintaining security operation under contingencies.

5.2.3.9 "EE372" POWER SYSTEMS PLANNING AND RELIABILITY: 3Cr [2-2-1]
Pre-requisites: EE371

Course Catalogue Description:
The course covers topics of load forecasting including short-term and long-term forecasting. The course covers topic of the reliability of power systems. Economics of power systems are covered in this course. The course is concluded by teaching generation, transmission, and distribution planning techniques.

5.2.3.10 "EE374" POWER SYSTEM QUALITY: 3Cr [2-2-1]
Pre-requisites: EE371

Course Catalogue Description:
The course covers an overview for types, sources and impacts of power quality (PQ) problems in power systems including harmonics, voltage sags, swells, notches, etc. The course covers a detailed study for both power system harmonics and Voltage sags: sources, impacts, and mitigation techniques. The course also covers topics of Electromagnetic compatibility, monitoring and assessment of PQ problems.

5.2.3.11 "EE377" POWER SYSTEM PROTECTION (II): 3Cr [2-2-1]
Pre-requisites: EE275

Course Catalogue Description:
The course covers in its first part topics of power system protective device coordination: coordination study (time-current characteristic curves, data required, coordination procedure and coordination intervals). The course also covers topics of primary and medium-voltage coordination, low-voltage coordination, ground fault coordination. The course is concluded by solving typical power system structures and use of package software for calculation and relay settings. The course covers in its second part Digital relays: principles, types, operation, facilities, programming and applications.

5.2.3.12 "EE379" POWER DISTRIBUTION IN INDUSTRIAL AND COMMERCIAL BUILDINGS: 3Cr [2-2-1]
Pre-requisites: EE273, EE275

Course Catalogue Description:

The course covers topics: power sources and distribution systems, voltage considerations, bus bar arrangement, power distribution apparatus. The course also for commercial & industrial plants covers topics of: wiring installation and design, illumination system design, short-circuit & load flow analysis and relay setting calculations for protective switchgear system. The course covers lighting system protection, instrumentation and SCAD control systems. Also, interaction with a System Control and Data Acquisition (SCADA) system, creation of a SCADA project and setting up communications to a PLC. The course is concluded by case studies of typical commercial building and industrial plants.

5.2.3.13 "EE399" ELECTRICAL STANDARDS & CODES: 2Cr [2-0-0]
Pre-requisites: None

Course Catalogue Description:

This covers definitions, historical background and national/international electrical standards and codes. It also covers impacts of codes and standards upon safety and energy efficiency of electric utilization customers. It covers International Electro-technical Commission (IEC) standards and regulations for major power equipment (transformers, diesel generators, motors, capacitors, fuses, circuit-breakers, cables, switchboards). It also covers methods and rules in national standards for writing inquiries, specifications, tenders, and contracts. This course is oriented to the understanding of electrical hazards to prevent it. It introduces the student to the knowledge of how to recognize, evaluate and control electrical hazards via electric safety standards.

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5.2.4 ELECTRICAL MACHINES & POWER ELECTRONICS COURSES

5.2.4.1 "EE282" ELECTRIC MACHINES (I): 3Cr [2-2-1]
Pre-requisites: EE260, EE291

Course Catalogue Description:

The course includes magnetic circuits, magnetic materials, hysteresis, sinusoidal excitation and permanent magnet. It also covers theory of operation of single-phase transformer and experimental tests, multi windings transformer and auto-transformer. The course also covers principles of electromechanical energy conversion, conservation of energy, fields and relevant energy, applications. It also covers elementary concepts of rotating machines and torque production. The course covers topic of three -phase induction machines: construction, frequency of rotor voltages and currents, induction motor under load, circuit model of induction machine, power flow, efficiency, torque/speed characteristics, control of performance characteristics by rotor design, tests, starting, speed control, other modes of operation (generating and plugging), and circle diagram.

5.2.4.2 "EE283" ELECTRIC MACHINES (2): 3Cr [2-2-1]
Pre-requisites: EE282

Course Catalogue Description:

The course covers DC machines: construction, winding, armature reaction, commutation, inter-poles, compensating winding. DC generators: types, characteristics, efficiency. DC motors, types, characteristics, speed control, starting, efficiency. It also covers Synchronous machines: construction, AC windings, rotating MMF of the stator armature winding, EMF generated per phase, winding factor, leakage reactance and equivalent circuit, power and torque, model parameter measurements, short-circuit ratio, voltage regulation, electrical load diagram and V-curves, parallel operation, synchronization, permanent-magnet alternators, single-phase synchronous alternators, the capability curve, salient-pole theory.

5.2.4.3 "EE380" ELECTRIC MACHINES (3): 3Cr [2-2-1]
Pre-requisites: EE283

Course Catalogue Description:
The course covers topic of using three -phase induction motor as generator power supply driven by wind turbine. It also includes various types of fractional horsepower motors: single-phase induction motor, switched reluctance motor, stepping motors and commutator-type motor. The course covers construction, operation and motor control as well as practical applications of each type.

5.2.4.4 "EE286" POWER ELECTRONICS (I): 3Cr [2-2-1]
Pre-requisites: EE213

Course Catalogue Description:
The course covers topics of power semiconductor devices: diodes, thyristors, triacs, GTOs, power BJTs, power MOSFETs, IGBTs, etc. Thyristors: theory of operation, methods of turning on, thyristor limitations, commutation methods. Single and three-phase AC voltage rectifying circuits for resistive and inductive loads. Single-phase and three-phase AC-DC converters for resistive and large inductive loads. Analysis of DC-DC converters for resistive, large inductive and general inductive loads. Single-phase and three-phase inverters for different loads. Single-phase to single-phase cycloconverter, output voltage and frequency control.

5.2.4.5 "EE382" POWER ELECTRONICS (II): 3Cr [2-2-1]
Pre-requisites: EE286

Course Catalogue Description:
The course covers topic of frequency conversion: cycloconverters, single-phase bridge inverter, three-phase bridge inverter, constant-current source inverter. It also covers topic of AC voltage regulators: single-phase and three-phase and DC-DC switch-mode converters: control of dc-dc converters, step-down (Buck) converter, step-up (Boost) converter, Buck-Boost converter, Cuk dc-dc converter, full-bridge dc-dc converter. The course covers also topic of Power conditioners and uninterruptible power supplies (UPSs).

5.2.4.6 "EE384" ELECTRIC DRIVES: 3Cr [2-2-1]
Pre-requisites: EE286, EE380

Course Catalogue Description:
The course presents an overview study including: Definition of electric drives and its components, Types of loads, Speed control, Starting and Electric breaking of motor drivers. The course also covers topics of thermal considerations, Motor insulation. Rating and load cycles. It also includes motor selection for different mechanical systems and its applications in traction systems and electric lifts.

5.2.4.7 "EE389" PLC APPLICATION IN INDUSTRY: 3Cr [2-2-1]
Pre-requisites: EE203, EE290

Course Catalogue Description:
The course introduces an overview for the building blocks of automation. It covers automatic production and assembly. It also covers the automation hierarchical levels. The course presents basic functions of machines in

automated systems. The course covers data processing, types of PLC, construction, interfacing and communications.

5.2.5 COURSES OF CONTROL SYSTEM ENGINEERING

5.2.5.1 "EE390" CONTROL SYSTEMS (II): 3Cr [2-2-1]
Pre-requisites: EE290

Course Catalogue Description:
The course starts with revision of linear control system basics. It covers topics of compensators in control systems including: Lead compensation in root locus, Lead compensation in frequency domain, feed forward control, lag compensation in frequency domain and PID compensation. The course also covers state space analysis of continuous systems and design of state variable feedback control systems

5.2.5.2 "EE391" DIGITAL CONTROL SYSTEMS: 3Cr [2-2-1]
Pre-requisites: EE290

Course Catalogue Description:
The course introduces feedback computer controlled systems, the components of digital control systems, and system models on the z-domain (z-transfer functions) and on the time domain (state variable representations). The objectives for system design and evaluation of system performance are considered. Various discrete-time controllers are designed including PID-controllers, state and output feedback controllers, and reconstruction of states using observers. The systems with the designed controllers are tested by simulations.

5.2.5.3 "EE397" FUZZY-LOGIC CONTROL: 3Cr [2-2-1]
Pre-requisites: EE203, EE290

Course Catalogue Description:
Mathematical introduction to the analysis, synthesis, and design of control systems using fuzzy sets and fuzzy logic. A study of the fundamentals of fuzzy sets, operations on these sets, and their geometrical interpretations. Methodologies to design fuzzy models and feedback controllers for dynamical systems. Various applications and case studies.

5.2.6 ELECTRONICS AND COMMUNICATIONS ENGINEERING SPECIALIZATION

The Electronics and Communications Engineering program requirements include at least 55 credit hours including 45 credit hours of compulsory courses given in Table 3.11/Chapter 3 and 15 credit hours of elective courses given in Table 3.12/Chapter 3.

5.2.7 ELECTRONICS AND COMMUNICATIONS ENGINEERING SPECIALIZATION COMPULSORY COURSES

5.2.7.1 "EE228" ANALOG INTEGRATED CIRCUITS: 3Cr [2-2-1]
Pre-requisites: EE224

Course Catalogue Description

This course introduces the student to: integrated circuits technology. Power amplifiers. Difference Amplifiers. Applications and design of integrated circuits: active filters (Low pass- Band pass- Band reject), oscillators (phase shift- Wien Bridge- Colpitts), Schmitt trigger circuits (comparator- zero crossing detector- non inverting Schmitt trigger- limiters). A/D and D/A converters. Specialized analogue ICs: comparators, analogue switches, modulators, the 555 timer, phase locked loops. Analog CMOS ICs.

5.2.7.2 "EE251" ANALOG COMMUNICATION: 3Cr [2-2-1]
Pre-requisites: EE241, EB205

Course Catalogue Description

This course introduces the student to :linear modulation, amplitude modulation, AM, DSB, SSB, VSB, modulators, demodulators. Exponential modulation. Frequency modulation, FM, NBFM, WBFM and phase modulation, PM, NBPM, modulators, demodulators. Multiplexing, FDM. Effects of noise. Pre-emphasis and de-emphasis techniques. Superhetrodyne receivers. Applications, AM and FM broadcasting, TV and video transmission, telephony multiplexing, stereophonic systems. A MATLAB simulation project.

5.2.7.3 "EE252" COMMUNICATION LABORATORY: 1Cr [0-0-3]
Pre-requisites: EE251

Course Catalogue Description

This course introduces the student to: Laboratory experiments dealing with analog and digital modulation and multiplexing.

5.2.7.4 "EE255" DIGITAL COMMUNICATION (I): 3Cr [2-2-1]
Pre-requisites: EE251

Course Catalogue Description

This course introduces the student to: Introduction to digital communications. Sampling techniques. Analog pulse modulation: PAM, PDM, PPM. Noise effects on Analog pulse modulation. Digital baseband modulation: quantization, coding. PCM, DPCM, DM. Quantization noise. A-law, µ-law commanding. Noise effects on baseband digital communications. Matched Filters. Pass band signaling, Binary digital modulation: ASK, PSK, FSK, Noise effects and Bit error rates. Applications: Digital telephony, video storage and recording, digital audio systems. MATLAB Simulation Project.

5.2.7.5 "EE256" DIGITAL COMMUNICATION II: 3Cr [2-2-1]
Pre-requisites: EE255

Course Catalogue Description

This course introduces the student to: Geometric representation of signals, Signal space, Gram Schmidt orthogonalization, optimal receiver design, decision regions, probability of error. Advanced pass-band digital modulation: QPSK, OQPSK, π/4DQPSK, CPFSK, MSK, GMSK. M-ary Digital Modulation: MPSK, M-ary PAM MQAM, MFSK. Non-coherent techniques: NCFSK, DPSK. Power spectral density and bandwidth requirements. Optimal demodulation. Performance analysis for advanced pass-band digital communication systems in noise. Introduction to information theory. Channel capacity. Digital modulation comparison based on channel capacity. Introduction to error correcting codes. Introduction to spread spectrum techniques: DS, FH, TH, spreading codes. MATLAB Simulation Project.

5.2.7.6 "EE262" MICROWAVE ENGINEERING: 3Cr [2-2-1]
Pre-requisites: EE261

Course Catalogue Description

This course introduces the student to: Microwave transmission media. Coaxial and parallel wire lines, Micro strip lines. Smith chart. Impedance matching techniques. Impedance Transformers. Scattering: by cylinders and wedges. S-parameters. Passive microwave devices: Isolators, directional couplers, circulators, filters, attenuators, bends. Simple microwave circuits. Microwave active devices: Microwave tubes: klystrons, magnetrons. Microwave semiconductor devices: bipolar transistor, FET, tunnel diode, Gunn diodes, avalanche transit-time devices, parametric devices. Microwave radiation: dipoles, apertures and micro strip and printed circuit radiators

5.2.7.7 "EE304" MICROPROCESSOR BASED SYSTEM DESIGN: 3Cr [2-2-1]
Pre-requisites: EE202, EE203

Course Catalogue Description:

The main Topics are Architecture. Intel based 8051 Microcontroller, comparison between microprocessor and microcontroller. Internal architecture, program memory, data memory, EEPROM memory, registers. Assembly language programming, instruction set, data types and directives, addressing modes. Internal peripherals, I/O port programming, timer/counter programming, Watchdog timer, interrupts, serial communication. Real world interfacing: LCD, ADC and sensors, Stepper motor, keyboard, DAC and external memory Advanced topics: ARM processors and its applications.

5.2.7.8 "EE342" DIGITAL SIGNAL PROCESSING: 3Cr [2-2-1]
Pre-requisites: EE241, EB205

Course Catalogue Description:

This course introduces the student to necessary knowledge of digital signals and systems. This is achieved by two parallel phases. The first is theoretical which concerns with mathematical formulas and transformations applied in this area. The second is an applied technique based on advanced software toolkit (MATLAB) to achieve theoretical and practical thinking.

5.2.7.9 "EE350" COMMUNICATION SYSTEMS: 4Cr [3-2-1]
Pre-requisites: EE255

Course Catalogue Description

This course introduces the student to The main Topics are: Carrier and symbol timing synchronization. Switching and analog telephone networks. Introduction to teletraffic engineering. Description of some advanced systems. Wireless communication systems.

5.2.7.10 "EE354" MOBILE COMMUNICATION SYSTEMS: 3Cr [2-2-1]
Pre-requisites: EE255

Course Catalogue Description

This course introduces the student to: trunking efficiency. Introduction to cellular mobile systems, Concept of frequency reuse. Mobile radio environment, path loss and channel models. Cordless Telephony. Cellular mobile evolution: First Generation(1G). Second Generation (2G): Digital cellular systems. Second and Half Generation (2.5G). Before the Third Generation (EDGE). Third Generation (3G.)

5.2.7.11 "EE363" MICROWAVE MEASUREMENTS AND LABORATORY: 2Cr [1-0-3]
Pre-requisites: EE262

Course Catalogue Description

This course introduces the student to Power, impedance, s-parameters, and frequency. Time domain reflectometery. Network analyzer applications: Characterization of devices and systems: passive and active components. Spectrum analyzers applications. Spectrum, modulation and noise measurements.EMC and interference measurements. Applications of other hardware and test equipment in the modern microwave laboratory which may include: Antenna measurements: gain, pattern, impedance, polarization; Radar measurements; Microwave link

5.2.7.12 "EE364" ANTENNA THEORY AND DESIGN: 3Cr [2-2-1]
Pre-requisites: EE262

Course Catalogue Description:

The aim of this course is to present basic concepts of antenna construction, function and utility, also helps the student to enhance the directivity and performance of antennas.

5.2.8 ELECTRONICS AND COMMUNICATIONS ENGINEERING SPECIALIZATION ELECTIVE COURSES

5.2.8.1 "EE206" MICROPROCESSOR INTERFACING: 3Cr [2-2-1]
Pre-requisites: EE203

Course Catalogue Description:

The main Topics are : Intel family assembly language, addressing modes. Parallel interfacing: input output ports, handshaking, interfacing to ADC and DAC, using 8255 chip. Timer interfacing, using 8254 programmable timer/counter. Keyboard interfacing using 8279 chip. Interrupts, software and hardware interrupts, vectored interrupts, using 8259 interrupt controller. Serial communication, RS232 protocol, using 8251 UART, adjusting baud rate. Direct memory access, bus sharing, multiprocessor systems, using 8237 DMA controller. Advanced applications.

5.2.8.2 "EE209" DIGITAL SYSTEMS: 3Cr [2-2-1]
Pre-requisites: EB102, EB122

Course Catalogue Description:
This course introduces ***non- electrical engineering*** students to fundamentals of digital logic. It provides students with requirements to analyze and design digital circuits and basic digital systems. This is achieved by understanding logic components, algebra, maps. Then the course moves towards applying all theoretical knowledge into a practical lab environment.

5.2.8.3 "EE221" MICROWAVE DEVICES: 3Cr [2-2-1]
Pre-requisites: EE262

Course Catalogue Description
This course introduces the student to: Principle of linear beam amplifier and oscillator, velocity modulation, bunching process in Klystron. Crossed field tube devices, TWT, microwave fast wave electron tubes. Magnetron oscillator. Microwave Semiconductor devices, PIN diodes, varactor diodes, IMPATT and TRAPATT devices, transferred electron devices, Gunn diode, Tunnel diode. Microwave BJTs and GaAs FETs. Introduction to microwave integrated circuits, active and passive components. Wave guides, resonators. Passive devices, couplers, attenuators, circulator. Microwave antennas. Microwave measurements.

5.2.8.4 "EE226" INTEGRATED CIRCUIT DEVICES: 3Cr [2-2-1]
Pre-requisites: EE225

Course Catalogue Description
This course introduces the student to: Overview of electronic properties of semiconductors. Metal semiconductor contacts, PN junction, bipolar transistor and MOS field effect transistors. Properties which are significant to device operation for integrated circuits. Device fabrication technologies.

5.2.8.5 "EE316" OPTICAL ELECTRONICS: 3Cr [2-2-1]
Pre-requisites: EE228

Course Catalogue Description:
This course introduces the student to Fourier optics and its applications to holography, optical image reconstruction, spatial filter design and optical information processing.

5.2.8.6 "EE325" INTRODUCTION TO COMPUTER NETWORKS: 3Cr [2-2-1]
Pre-requisites: EE255

Course Catalogue Description
The course covers: Data communications, protocols, guided transmission media, wireless transmission, flow control, error detection, error control. Switched networks, packet-switching principles, X.25, frame relay protocol architecture, LAN Architecture, Bus/Tree LANs, Ring LANs, Ethernet. Token ring and ATM protocol architecture, internetworking. Transport layer and application layer.

5.2.8.7 "EE338" DIGITAL INTEGRATED CIRCUITS: 3Cr [2-2-1]
Pre-requisites: EE228

Course Catalogue Description

This course introduces the student to: Logic gates characterization, power dissipation, propagation delay, noise immunity, voltage transfer characteristics, delay-power product. Logic Circuits Fundamentals: Analysis of basic BJT and CMOS inverters. Families of logic circuits, BJT logic circuit families (RTL, DTL , TTL), analysis of DTL and TTL gates, fan in and fan out. TTL manufactures specifications and comparisons. Emitter coupled logic family Characteristics (ECL) and Schottky gates. Design of CMOS logic gate circuits. CMOS transistor sizing. Digital waveform generation, Mono-stable, A-stable and Bi-stable, crystal controlled generators. Storage devices and memories, Latches, flip flops, Shift registers, read/write memories, CMOS static RAM cell, basic ROM cells. A/D and D/A converters.

5.2.8.8 "EE344" DIGITAL FILTERS: 3Cr [2-2-1]
Pre-requisites: EE241

Course Catalogue Description:

This course introduces the student to fundamentals of analog and digital filters. It provides students with requirements to analyze and design analog and digital filters. This is achieved by understanding formal foundations and selected design techniques.

5.2.8.9 "EE345" DIGITAL IMAGE PROCESSING: 3Cr [2-2-1]
Pre-requisites: EE241

Course Catalogue Description:

This course introduces the student to necessary knowledge of digital images. This is achieved by two parallel phases. The first is theoretical which concerns with mathematical formulas and transformations applied in digital image processing: analysis, enhancement, segmentation, and denoising. The second is an applied technique based on advanced software toolkit (MATLAB) to achieve theoretical and practical thinking.

5.2.8.10 "EE346" INTRODUCTION TO COMPUTER VISION: 3Cr [2-2-1]
Pre-requisites: EE241

Course Catalogue Description

The main topics are: Applications of Computer vision, industrial inspection, Robotics and control, image analysis and recognition. Image processing, visual motion computation. Shape representation and recognition. Hardware peripheral, imaging devices, frame grabbers, display devices. Advanced Techniques, Fuzzy logic procedures in computer vision algorithms.

5.2.8.11 "EE347" APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN COMMUNICATIONS: 3Cr [2-2-1]
Pre-requisites: EE241

Course Catalogue Description:
This course introduces the student to the basic concepts of Artificial Intelligence and the major areas of applications of AI. At the end of the course students will be able to identify the potential areas of application of AI in the communication systems and confidently engage in developing a solution based on AI

5.2.8.12 "EE353" DATA COMMUNICATION NETWORKS: 3Cr [2-2-1]
Pre-requisites: EE255

Course Catalogue Description
The topics introduced in this course include: The introduction of the layering concept, the OSI reference model, the IP model, physical layer characteristics, error control, flow control and medium access, switching and routing.

5.2.8.13 "EE357" MULTIMEDIA COMMUNICATION SYSTEMS: 3Cr [2-2-1]
Pre-requisites: EE256

Course Catalogue Description:
This course introduces the student to multimedia signal characteristics, and communication aspects. It provides essential knowledge in voice, image, and video compressions. Multimedia products and Internet multimedia.

5.2.8.14 "EE358" INFORMATION THEORY: 3Cr [2-2-1]
Pre-requisites: EE256

Course Catalogue Description:
The main Topics are : The concepts of source, channel, and rate of transmission of information, entropy, relative entropy, mutual information, data processing inequality. Asymptotic equipartition property. Data compression, Kraft inequality, source coding, Shannon's first theorem, Huffman codes. Information theory and statistics, the method of types, hypothesis testing. Rate distortion theorem. Channel capacity, the channel coding theorem, binary symmetric channels, Shannon's second theorem. Differential entropy, Gaussian channels.

5.2.8.15 "EE359" ERROR CORRECTING CODES: 3Cr [2-2-1]
Pre-requisites: EE256

Course Catalogue Description
This course introduces the student to: system models, generator and parity check matrix representation of block codes, general decoding principles, cyclic codes, an introduction to abstract algebra and Galois fields, BCH and Reed-Solomon codes, analytical and graphical representation of convolutional codes, performance bounds, examples of good codes, Viterbi decoding, BCJR algorithm, turbo codes, and turbo code decoding.

5.2.8.16 "EE367" FUNDAMENTALS OF ACOUSTICS: 3Cr [2-2-1]
Pre-requisites: EE251, EE261

Course Catalogue Description:
This course introduces the student to the basic principles required to understand and analyze problems involving sound generation, transmission and reception.

5.2.8.17 "EE387" MICROPROCESSOR BASED PROCESS CONTROL: 3Cr [2-2-1]
Pre-requisites: EE390

Course Catalogue Description:
The main topics are: Measurement and signal conditioning. Data input and output. Interface software. Data processing. Microprocessor as digital controller.

5.2.9 ELECTRICAL COURSES FOR NON-ELECTRICAL ENGINEERS

5.2.9.1 "EE208" ELECTRICAL ENGINEERING FUNDAMENTALS: 3Cr [2-2-1]
Pre-requisites: EB102, EB122

Course Catalogue Description:

This course helps any student from any departments to understand the basic concepts of electrical circuits, to recognize its components and their responses, this course includes: Elements of electrical circuits. DC circuits, network theorems. AC circuits, phasors, impedance, power, power factor. The course covers also fundamentals of electronics: Diodes, Transistors and Operational Amplifiers.

5.2.9.2 "EE424" ELECTRICAL ENGINEERING AND ELECTRONICS : 2Cr [1-2-1]
Pre-requisites: EB122

Course Catalogue Description:
The course covers electric electrical machines technology: AC three-phase systems, Electromagnetism and electromechanical energy conversion, Power transformers, Three-phase induction motors and Power generation and the Synchronous machine, Performance characteristics and power electronic based control. Practical electronic, digital logic and instrumentation system.

5.2.9.3 "EE386" ELECTRICAL MACHINES TECHNOLOGY FOR INDUSTRIAL SYSTEMS: 4Cr [3-2-1]
Pre-requisites: EE208

Course Catalogue Description:
The course covers electric electrical machines technology and drives for industrial manufacturing engineers: AC three-phase systems, Electromagnetism and electromechanical energy conversion, Power transformers, Three-phase induction motors, Power generation and the Synchronous machine. It also covers basics and electric performance of DC motors. The course presents an overview study including: Definition of electric drives and its components, Types of loads, Speed control, Starting and Electric breaking of motor drivers.

5.2.9.4 "EE369" ELECTRICAL POWER FOR MECHANICAL ENGINEERS: 4Cr [3-2-1]
Pre-requisites: EE208

Course Catalogue Description:

The course covers electric power technology of: AC three-phase systems, Electromagnetism and electromechanical energy conversion, Power transformers, Three-phase induction motors and Power generation and the synchronous machine. It also covers basics and electric technology of: Electric performance of transmission system, Underground power cables, Low & medium-voltage distribution system configuration, Basics of power factor compensation at load side demand and Protective switchgear systems.

5.2.9.5 "EE219" ELECTRICAL MEASUREMENTS FOR INDUSTRIAL SYSTEMS: 3Cr [2-2-1]
Pre-requisites: EE208

Course Catalogue Description:

The course covers fundamentals of electrical measurements: accuracy, sensitivity, resolution, random erros and loading effect errors. It also covers different types of analog measuring instruments: PMMC, iron, dynamometer and induction types for measurements of dc and ac voltage, current and electric power. Measurements of accurate and sensitive frequency and phase shift of ac voltage and cuurent signals using CRO are also included in this course. It also covers measurements of low and high resistance measurements as well as measurements of inductance and capacitance parameters at different quality factors using bridge circuits. The course also covers methods of mesurements of physical quantities using sensors and transducers. Fundamentals of data acquisition are also included. The course focus on different practical application of electrical measurents and instrumentation in industrial systems

5.2.9.6 "EE203" INTRODUCTION TO MICROPROCESSORS: 3Cr [2-2-1]
Pre-requisites: EE202

Course Catalogue Description:

Introducing Intel 80x86 microprocessor family. Architecture and programmer's model, registers, addressing modes. Hardware model, processor pinot, pin functions. Connection to the external program and data memory. Software design techniques, instruction set, and programming in assembly language, programmable ports, and serial communication.

5.2.9.7 "EE381" ADVANCED ANALYSIS OF ELECTRICAL MACHINES : 3Cr [2-2-1]
Pre-requisites: EE380

Course Catalogue Description:

Application of matrix algebra to static electrical networks. Matrix equations of the basic rotating machines. Torque expressions- Linear transformations- DC and single-phase commutator machines (series, shunt and compound). Steady-state performance of poly-phase machines: balanced poly-phase induction machine, unbalanced terminal voltage. Unbalanced two-phase induction machine: equivalent circuit, currents, torque. Single-phase operation of induction machine: equivalent circuit, currents, torque. Poly-phase synchronous machine: uniform air-gap and no-damper windings, salient-poles and no-damper windings. Effect of damper windings. Using MATLAB for the simulation of various electrical machines.

5.2.9.8 "EE383" PRINCIPLES OF SOLID-STATE DRIVES : 3Cr [2-2-1]
Pre-requisites: EE380, EE382

Course Catalogue Description:
DC drives: single-phase rectifiers with motor load, three-phase rectifiers with motor load, dual converter, chopper drives. AC drives: three-phase induction motor drives (speed control by ac power controllers, speed control by slip-energy recovery, induction motors with voltage source inverters, induction motors with current-source inverter). Synchronous motor drives (voltage-source inverter drive, permanent-magnet synchronous motor).