DESCRIPTION OF B.Sc. COURSES FOR Electronics and Communications ENGINEERING

0311102 Mathematics (1) {3} [3-3]
Differentiation and Application; Complex Numbers; Analytical Geometry; Method of Integration; Infinite Series; Power Series; Vectors in Three Dimension; Equations of Line and Plane in 3 Dimension; Complex Power Series; Complex Integration.

Perquisite: None

0311303 Physics for Engineers {3} [3-3]
Physics and Measurements; Vectors; Motions in One and Two Dimensions; Laws of Motion; Circular Motion; Newton's Laws; Work and Energy; Law of Gravity Linear Momentum and Collisions; Rotation of a Rigid Object about a Fixed Axis; Rolling Motion; Angular Momentum and Torque; Static Equilibrium and Elasticity; Oscillatory Motion; Electric Charge and Coulomb’s Law; Electric Fields; Gauss Law; Electric Potential, Capacitance and Dielectrics; Current and Resistance; Direct Current Circuits; Magnetic Fields; Sources of Magnetic Field; Faraday’s Law; Inductance; Alternating Current Circuits; Electromagnetic Waves.

Perquisite: None

0311304 Physics Lab for Engineers {1} [1-2]
Measurement and Errors; Rectilinear Motion; Projectile Motion; Newton’s second Law; Friction; Collisions; Circular Motion; Rotational Motion; Simple Harmonic Motion. Electric Field Mapping; Ohm’s Construction Law; Wheatstone Bridge; Electric Power; Potentiometer; Kirchhoff’s Laws; Ammeter and Voltmeter Construction; Charging and Discharging Circuits (R-C circuits); Electric Magnetic Field; Faraday’s Laws of Magnetic Induction; Resonance in R-L-C Circuits.

Concurrent: 0311303 Physics for Engineers

0312104 Mathematics (2) {3} [3-3]
Partial Derivatives; Optimization and Applications; Lagrange Multiplier; Double and Triple Integrals; Solutions of Higher Linear Ordinary Differential Equations ODE's; Series Solution of Linear ODE's; Partial Differential Equations; Wave and Heat Equations; Laplace Transform; Fourier series; Methods of Separation of Variables.

Prerequisite: 0311102 Mathematics (1)

0831001 Engineering Workshops {1} [1-2]
Workplace Safety and Use of Tools; Basic Skills of Machining; Basic Skills of Welding; Household Electric Circuit Installation; Basics of Carpentry and Its Tools

Perquisite: None

0831002 Engineering Drawing {2} [2-4]
Use of Instruments; lettering; Graphic Geometry; Orthographic; Isometric Drawing and Sketching; Sectional Views; Computer Aided Design; Applications in Civil, Mechanical, Architectural and Electrical Engineering.

Perquisite: None

0812003 Engineering Statistics {3} [3-3]
Randomness; Introduction to Probability Theory and Probability Distributions; Discrete and Continuous Probability Distributions; Univariate Analysis; Decision Theory (Bays’ Theorem); Hypothesis Testing; Confidence Intervals and Tolerance.

Prerequisite: 0312104 Mathematics (2)
**0832004 Engineering Analysis (1) {3} {3-3}**

*Prerequisite:* 0312104 Mathematics (2)

**0712206 Communication Skills and Ethics {2} {2-2}**
This course will teach students the established basics for effective written composition in the business world and introduce them to such types of communication as processes, description of mechanisms, proposals, and reports. Students utilize usage exercises, quizzes, and a final usage exam to reinforce sentence clarity and effectiveness. Each student will receive skill-appropriate, personal feedback and instruction from an experienced, qualified writing instructor.

*Prerequisite:* 0771103 English (1)

**0814006 Engineering Economy and Management {3} {3-3}**
Engineering Project Development; Decision Making; Basic Concepts of Capital Investment: Formulas and Applications, Rates of Return, Economic Feasibility of Projects (Net Future Value, Net Present Value, and Equivalent Uniform Cash Flow); Comparison of Mutually Exclusive Proposals; Benefit-Cost Ratio Method; Depreciation; Corporate Taxation; Resource Allocation; Optimization process; Linear Programming.

*Prerequisite:* 0812003 Engineering Statistics

**0872104 Electric Circuit (1) {3} {3-3}**

*Prerequisite:* 0311303 Physics for Engineers

**0872106 Electric Circuit (2) {3} {3-3}**

*Prerequisite:* 0872104 Electric circuits (1)

**Concurrent:** 0872006 Electric circuits Lab

**0872108 Electric Circuits Lab. {1} {1-2}**
DC Circuits: Kirchhoff’s Voltage and Current Laws, Network theorems, Maximum Power Transfer; Transient Circuits: RL, RC, RLC; Resonant Circuits; Magnetically Coupled Circuits; Two-Port Networks.

*Concurrent:* 0872106 Electric Circuits (2)

**Prerequisite:** 0872104 Electric circuits (1)

**Concurrent:** 0822208 Electronics Lab (1)

Diode characteristics; Clipping and Clamping Circuits: Half-Wave and Full-Wave Rectification; Zener–Diode and Voltage Regulation; BJT Characteristics and Biasing Circuits; FET Characteristics and Biasing circuits; BJT Amplifiers.

**Concurrent:** 0822201 Electronics (1)


**Prerequisite:** 0311303 Physics for Engineers

Introduction to simulation concepts; Solving mathematical models through simulation models using the following software tools: MATLAB PSPICE, and Electronic Work Bench; Analysis of electrical circuit and signals.

**Prerequisite:** 0832005 Engineering Analysis


**Prerequisite:** 0822106 Electric Circuits (2)

Introduction to Probability and Random Variables; Statistics of Random Variable; Random Process; Ergodicity and Stationary; Variance and Autocorrelation Function; Power Spectral Density; Filtering of Random Processes; Gaussian Process: Noise, Narrow Band Random Process.
**Concurrent: 0823007 Signals and Systems**

**0823201 Electronics (2) [3] [3-3]**
Amplification; Biasing of Transistor (BJT and FET); Single-Stage Amplifier; Cascaded BJT and FET Amplifiers; Composite Transistor Stages; Operational Amplifiers and Applications; Differential Amplifier; Operational Amplifier Architectures; Gain with Active Load; DC Level Shifting; Output stage; Offset Voltages and Currents; Frequency Response of Amplifiers; The High-frequency Response of all Amplifier Configurations; The Low-Frequency Response of all Amplifier Configurations; The Frequency Response of Cascaded Stages; Feedback Amplifiers; Properties of Negative-Feedback Amplifiers; Properties of Feedback Amplifier Topologies; Analysis of Feedback Amplifiers.

**Prerequisite: 0822201 Electronics (1)**

**0823208 Electronics (2) Lab [1] [1-2]**
Amplifier and its Configurations; BJT Amplifier; Characteristic of JFET; Measurement of H-Parameters of BJT; Frequency Response of Single and Multi-Stage Amplifier; Transfer Characteristics of Cascade Amplifier; Differential Amplifier; Op-Amps and Application; Oscillators

**Concurrent: 0823201 Electronics (2)**

**0823203 Digital Electronics [3] [3-3]**
Applications of BJT as a Switch: RTL, DTL, TTL, ECL, MOS and CMOS Logic Gates; Timing Circuits: Bistable, Monostable, Astable Circuits and 555-timers; Wave-Shaping Circuits; Digital/Analog and Analog/Digital Converters; Sample and hold Circuits.

**Prerequisite: 0823201 Electronics (2)**

**0823209 Digital Electronics Lab [1] [1-2]**
Characteristics of Switching Devices; Characteristics of Logic Gates: RTL, TTL, and COMS; Analysis and Design of Multivibrators; Timing Circuits; Waveform Shaping Circuits; Applications of A/D and D/A Circuits; Interfacing of TTL & CMOS Gates.

**Concurrent: 0823203 Digital Electronics**

**0823302 Electromagnetics (2) [3] [3-3]**
General Introduction; Maxwell's Equations for Time Varying Fields; Electromagnetic Wave Propagation: The Uniform Plane Wave in Lossy, Free space, Good Conductors, and Lossless Media; Pointing Vector; Wave Polarization; Wave Reflection; Transmission lines: (TL) Equations, Parameters, Input Impedance, SWR and Power; Applications of TL Charts; Matching in TL Using Quarter Wave Length Transformer, Single, and Double Stub; Impedance Measurement at High Frequencies; Transient Analysis of TL; Waveguides and their Parameters; TM and TE modes: Propagation, Attenuation, and Mode Excitation; Waveguide Resonators.

**Prerequisite: 0872301 Electromagnetics (1)**

**0823406 Computer Application (2) [1] [1-2]**
Design and Simulation of Electrical, Electronic, Communication Circuits, and System.

**Prerequisite: 0822405 Computer Applications (1)**
**Concurrent: 0823501 Analog Communications**
0823501 Analog Communication [3] {3-3}

Prerequisite: 0823007 Signals and Systems
Concurrent: 0823008 Probabilities and Random Processes

0823508 Analog Communications Lab. [1] {1-2}
Filters; AM and FM Modulation and Demodulation; Amplitude Modulators; Single-sideband Transmission; Super-heterodyne Receiver.

Concurrent: 0823501 Analog Communications

0873601 Electrical Machines (1) [3] {3-3}
Principles of Electromagnetic circuit; Single-phase transformers: ideal, practical transformer, equivalent circuit, auto-transformer, Parallel Connection; Three-Phase Transformer: Types, Connection; AC Machinery Fundamentals: Principle of work, rotating magnetic field; Synchronous Generators: Construction, Internal Generated Voltage, Equivalent Circuit; Operation Modes: Alone, Parallel; Synchronous Motors: Steady state operation, starting.

Prerequisite: 0872106 Electric Circuits (2)
0872301 Electromagnetics (1)

0823606 Electrical Machines Lab. [1] {1-2}
DC Machines: Motors, Generators; Transformers: Single phase, Three-phase Transformers; Three-phase Synchronous Machines: Motors, Generators; Three-phase Induction Motors: Squirrel Cage Rotor, Wound Rotor (Slip-ring); Single-phase Motors.

Prerequisite: 0873601 Electrical Machines

0873701 Measurement and Instrumentation [3] {3-3}
Introduction to Measurements and Errors: Units, Standards, and Calibration; Measurement Bridges; Electronics meters: DC, and AC; Indicating Instruments and Digital Multi meters; Oscilloscope and its Applications; Signal Generation; Analog and Digital Data Acquisition Systems; Transducers; Spectrum Analyzer and its Application; Frequency Counters.

Prerequisite: 0872106 Electric Circuits (2)
0823201 Electronics (2)

0873708 Measurement and Instrumentation Lab. [1] {1-2}
Characteristics of Moving Coil Meters; Galvanometer Applications; Applications of Bridges Including: Resistance, Capacitance, and Inductance; Thermal, Light, and Displacement Transducers; Frequency Discriminators; Calibration of Measurement Devices; Oscilloscope Measurements.

Concurrent: 0873701 Measurements and Instrumentation

0873204 Power Electronics [3] {3-3}
General introduction: Power semiconductor Switches: Features, Characteristics and Classification of Diodes, Transistor, Thyristor and others; Quality Assessment and Parameters of AC & DC Waveform; Single-Phase and Three-Phase Rectifier Circuit; Uncontrolled, Fully-Controlled, and Semi-Controlled Converters; AC/AC Converters (AC Voltage Regulators); DC/DC Converters (DC Choppers); DC/AC Converters (Inverters); Applications of Power Electronics.

Prerequisite: 0823201 Electronics (2)
0823007 Signal and Systems

0824503 Digital Communication [3] [3-3]
Analog Pulse Modulation; PCM, DPCM, and Delta Modulation; TDM; Baseband Transmission; Nyquist Criteria; Matched Filter and Noise Performance; ISI; Line Coding and Partial Response Signaling; Equalization; Binary Bandpass Transmission: BASK, BFSK, BPSK and DPSK; Geometric Representation of Signals: Orthogonal Signals, Correlation Receivers and Signal Constellations; M-ary Band-pass Digital Transmission: ASK, PSK, FSK, QAM; Noise Performance and Bandwidth Efficiency; Synchronization.

Prerequisite: 0823501 Analog Communications

0824508 Digital Communication Lab. {1} {1-2}
Sample and Hold Circuit; Sampling Process and Aliasing Effect; Generation and Detection of PCM; Clock Recovery; Error Detection and Correction; Digital Pass-Band Communication Formats: ASK, PSK, FSK, and QPSK.

Concurrent: 0824503 Digital Communications

0874601 Electrical Power Systems (1) [3] [3-3]
Structure of power systems; Basic concepts; Transmission line Parameters; Per unit system; Representation of power system components; Characteristics and Performance of power transmission lines; Load flow studies; Symmetrical Fault Analysis; Unsymmetrical fault analysis: Symmetrical components.

Prerequisite: 0873601 Electrical Machines (1)

0874608 Power and Power Electronics Lab. {1} {1-2}
Transmission Line Parameters and Performance; System Fault Detection and Protection Components: Transducers, Relays and Circuit Breakers; Single-Phase Half-Wave Rectifiers: Controlled, and Uncontrolled; Single-Phase Full-Wave Rectifiers: Controlled, and Uncontrolled, and Semi-Controlled; Three-Phase Half-Wave Rectifiers: Controlled, and Uncontrolled; Three-Phase Full-Wave Rectifiers: Controlled, and Uncontrolled, and Semi-Controlled; Regulators; Invertors.

Prerequisite: 0874601 Electrical Power Systems (1)

0873204 Power Electronics

0874702 Control Systems [3] [3-3]
Concept of Control Systems; Open-loop and Closed-loop Systems; Mathematical Modeling of Physical Systems; Transfer Function and System Modeling Diagrams; Response Characteristics of Control Systems; Specifications of System Performance; Stability Analysis of Linear Control Systems; Routh’s Stability Criterion; Time-domain Analysis of Control Systems; Design of Controllers and Compensators.

Prerequisite: 0823007 Signals and Systems

0874708 Control Systems Lab. {1} {1-2}
Open-Loop and Closed-Loop Systems; Servomechanism Principles; Transient Response; Closed-Loop Position and Velocity Control Systems; The Effect of Gain, PI, PD, and PID Controls on System Performance; Frequency Response Measurements; Analogue Computer Simulation of Control Systems; System Analysis and Simulation using Software Packages; Introduction to Computer Control Systems.

Prerequisite: 0874702 Control Systems
0824801 Digital Signals Processing [3] [3-3]
Discrete-Time Signals and Systems; Z-Transform; Frequency Analysis of Discrete-Time Signals and Systems; Fast Fourier Transform (FFT); DSP Systems; Design of Digital Filters: FIR, IIR Recursive and Non Recursive; Introduction to Image Processing; Computer Aided Design and Analysis homework should be given to the students.

Prerequisite: 0823007 Signal and Systems

0825205 Electronic Communications [3] [3-3]
Broadband and Narrow-Band Transformer like Coupling Networks; Nonlinear Controlled Sources; Sinusoidal Oscillators; Mixers; RF and IF Amplifiers; Amplitude Modulation Modulators and Detectors; FM Modulators and Detectors; Phase Locked-Loop.

Prerequisite: 0824503 Digital Communications

0825206 Electronics Optical Communications [3] [3-3]
Advantages and Applications of Optical Communication; Theory of Dielectric Optical Waveguides; Properties of Multimode and Single Mode Optical Fibers: Wave Propagation, Attenuation, and Dispersion; Semiconductors as Optical Sources: Laser Diodes, Light Emitting Diodes, and Drive Circuits; Optical Detectors: Photodiodes and Receiver Circuits, Sources of Noise; System Design; Numerical Simulations.

Prerequisite: 0824503 Digital Communications

0825502 Mobile Communication Systems [3] [3-3]

Prerequisite: 0824503 Digital Communications

0825504 Computer and Communication Networks [3] [3-3]
Circuit and Packet Switching; Network Layers; Protocols: OSI, TCP/IP; Access Methods: Telephony Line Modems – Voice Band, DSL, ISDN; Wireless; Fiber Optic; Network Transmission Equipment: Modems, Multiplexers, Add/Drop; Local Area Networks: Topologies, Multiple Access Schemes, Frame Structure, Capacity; Ethernet; Wide Area and Metropolitan Area Networks; Internet: Protocols, Addressing; Routing, VoIP; Asynchronous Transfer Mode: Protocol Layers; Cell Structure; Physical Layer, Switching; Synchronous systems: SONET; SDH. Frame Relay.

Prerequisite: 0824503 Digital Communications

0825901 Graduation Project (1) {1} [1-2]
Each student (or a team of students) may choose from a list of research projects, and is/are supervised by a faculty member in the department. Project (1), which represents the first phase of the graduation project, requires gathering the practical and theoretical resources needed for the completion of graduation project (2).

Prerequisite: Pass of 120 Cr. H
0825903 Graduation Project (2) [2-4]
The student implements and finalizes the work described in project (1). After full implementation of the project’s goals, the student must present a comprehensive report on the entire graduation project to an examining committee.

Prerequisite: 0825901 Graduation Project (1)

0825908 Practical Engineering Training [0] [0-0]
Practical experience to be gained through working for eight continuous weeks in an accredited establishment.

Prerequisite: Pass of 110 Cr. H

0825209 Spatial Topics in Electronics [3] [3-3]
The objective of this course is to introduce advanced and new topics in one of the areas of electronics engineering. The topics can be changed from one year to another depending on the instructor’s area of specialty.

Prerequisite: 0823203 Digital Electronics

0825303 Antennas and Wave Propagation [3] [3-3]
Principles of Radiation; Antenna Parameters; Wire Antenna: Monopole, Dipole, and Loop Antennas; Antenna Array Analysis Including Broadside and Endfire; Aperture Antenna Including Rectangular and Conical Horn. Reflector Antenna; Propagation of Radio Waves, Ground Waves, Sky-Waves, Troposphere Propagation; Microwave Links

Prerequisite: 0823302 Electromagnetics

0825305 Microwave Engineering [3] [3-3]
Introduction; Review of Maxwell's equations; General Concept of Transmission Lines (TLs) for Microwave Frequencies; Waveguides and Resonant Cavities; Scattering Parameters; Microwave Passive Devices; Periodic Structure and Microwave Filters; Microwave Tubes; Detectors and Transistor Amplifiers.

Prerequisite: 0823302 Electromagnetics

0825500 Telephone Communication Systems [3] [3-3]
Introduction; Telephone circuits: Round Trip Attenuation and Delay Time Effects, Echo Canceling; Signaling Systems; Private Automatic Branch Exchanges (PABX); Transmission Planning: PCM, A-Law, Mu-Law Companding, PCM Hierarchy, TDM Transmission Systems and their Hierarchy; Traffic Theory: Erlang B and C Formulas, Traffic and Resources Calculations; Digital Exchanges; Switching Techniques; Network Synchronization; Control and Hierarchy Synchronization; System Controllers and CPU; Common Channel Control and Distributed Control; Data Networks and ISDN and Packet switching; Open Systems Interconnection and ISDN Networks; Data and Control Interface to other Systems; Signaling systems.

Prerequisite: 0824503 Digital Communications

0825505 Information Theory and Coding [3] [3-3]
Geometric Representation of Signals: Orthogonal Signals, Correlation Receivers and Signal Constellations; M-ary Band-Pass Digital Transmission: ASK, PSK, FSK, QAM, Noise Performance, and Bandwidth Efficiency; Synchronization: Information Theory, Entropy, Source Coding Theorem, Lossless Data Compression, Information Capacity Theorem, and Bandwidth-
Efficiency Diagram; Coding: Error Control Coding, Coding Gain, Block Codes, Decoding, Cyclic Codes.

**Prerequisite:** 0824503 Digital Communications

**0825307 Radar Engineering {3} [3-3]**
Radar Equation; Antenna Patterns; Radar Cross Section: Pulsed Radars, Continuous Wave Radars; Moving Target Indication System; Detection and Estimation; Noise and Interfering Signals; Radar Applications; Global positioning System.

**Prerequisite:** 0824503 Digital Communications

**0825506 Satellite Communications {3} [3-3]**
Overview of Satellite Communication Systems: Satellite Types, Orbits and Frequencies; Techniques of Multiple Access; Earth Station and the Artificial Satellite Components at the Receiving and Transmitting Sides; Link Budget Calculations; Ionosphere and Weather Conditions Effect on Wave Propagation; Interference; Inter-Modulation and Inter-Symbol Interference; Modulation Formats in Satellite Systems; Fixed Telecommunication Satellite Networks, Mobile Satellite Services; Direct Broadcast Satellites; VSAT.

**Prerequisite:** 0824503 Digital Communications

**0825509 Special Topics in Communications Engineering {3} [3-3]**
The objective of this course is to introduce advanced and new topics in one of the areas of communications engineering. The topics can be changed from one year to another depending on the instructor’s area of specialty.

**Prerequisite:** 0824503 Digital Communications

**0812401 Digital Logic Design {3} [3-3]**
Digital Numbering System and Information Representation: Arithmetic Operations, Decimal and Alphanumeric Codes, Binary Logic; Boolean Algebra: Identities, Functions and Manipulation, Standard Forms, Simplification, Logic Gates, Switch-Level and Logic CMOS Implementation, Integrated Circuits; Combinational Logic Design: Circuits (Gate Level), Design Hierarchy and Procedures, Computer-Aided Design, Combinational Two-Level and Multi-Level Implementations, Arithmetic (Add, Subtract, Multiply) and Other Popular Modules (Multiplexers, Encoders, Decoders); Programmable Logic Design: ROMs, PLAs, PALs, FPGAs, Language-Directed Combinational Design (VHDL); Sequential Logic Design: Latches, Flip-Flops, State Machine Design and Minimization (Mealy and Moore Models); Design Problems.

**Prerequisite:** 0312104 Mathematics (2)
**Concurrent:** 0812408 Digital Logic Design Lab.

**0812408 Digital Logic Design Lab. {1} [1-2]**
Combinational Logic Circuits; Storage Elements; Hazards (Malfunctions); Circuit Characteristics: Loads, Delays, Etc.; Simple Combinational Networks: Adders, Multiplexers, Etc.; Simple Sequential Networks: Counters, Shift Registers; Synchronous and Asynchronous Sequential Machines; Processor and Controller; Project Using a Microprocessor as a Control.

**Prerequisite:** 0812401 Digital Logic Design

**0813403 Microprocessor {3} [3-3]**
Introduction to the Microprocessor and Microcomputer; The Microprocessor and its Architecture; Addressing Modes; Instruction Set, Programming the Microprocessor using...
Assembly Languages; 8086 and 8088 Hardware Specifications: Memory Interface, Basic I/O Interface, Interrupts, Keyboard and Printer Interface, PPI 82C55, ADC, DAC and DMA Interface.

**Prerequisite:** 0812401 Digital Logic Design  
**Concurrent:** 0813408 Microprocessor Lab.

0813408 Microprocessor Lab. {1} {1-2}  
Explain the 8086/8088 Instructions Set; Develops Program and Programming Techniques Using the TASM Turbo Assembler Program; DOS Function Call, and the BIOS Function Call.

**Prerequisite:** 0813403 Microprocessor

0814404 Embedded Systems {3} {3-3}  

**Prerequisite:** 0813403 Microprocessor  
**Concurrent:** 0814408 Embedded Systems Lab.

0814408 Embedded Systems Lab. {1} {1-2}  
Basic Introduction to Microcontroller-Based Embedded Systems Development; It Includes Structured Laboratory Exercises in the Following Areas: PIC Microcontroller Assembly Programming; C Language Programming; Peripheral Interfacing; Interrupt Management; Structured Programming and Task Scheduling; It Also Includes Simple Applications on Digital Signal Processing (DSP); Mechanical and Electrical Sensors, and Other Related Topics;

**Prerequisite:** 0814404 Embedded Systems

0832005 Engineering Analyses II {3} {3-3}  
Matrices: Vectors, Determinants, Solution of Linear Systems of Equations, Inverse of a Matrix; Eigenvalues: Eigenvectors, and Diagonalization; Complex Analysis: Complex Numbers and Functions, Analytic and Harmonic Complex Functions, Exponential, Trigonometric and Logarithmic, Complex Functions.

**Prerequisite:** 0832004 Engineering Analyses I

0833006 Numerical Analysis {3} {3-3}  
Topics Include: General Numerical Methods; Equation Solving Via Iteration; Interpolation; Numerical Integration; and Numerical Differentiation; Numerical Methods In Linear Algebra; Numerical Methods For Differential Equations; Multi-Step Methods; Optimization And Unconstrained Optimization.

**Prerequisite:** 0832005 Engineering Analyses II