

Metropolitan University, Sylhet

**Department of Information & Communication
Technology**

Syllabus

Program : B.Sc. Engineering in Electronics & Telecommunication Engineering (ETE)

Duration : 4 Years, 12 Semesters

Total Credits : 148 credits

Program Structure and Duration:

The academic year in the Department of Information & Communication Technology is divided into three semesters as follows:

| Semester | Duration |
|-----------------|-----------------------|
| Spring | January to April |
| Summer | May to August |
| Autumn | September to December |

The B. Sc. Engineering (ETE) program is a 48 (forty-eight)-months study of 12 semesters for regular students. A student should complete at least 148 credits to be a graduate.

1. Course outline:

1.1 Core courses:

| Sl. | Code | Course Title | No. of Credit Theory | Lab |
|-----|---------|----------------------------------------------|----------------------|-----|
| 1 | ETE 121 | Circuit Analysis- I | 3 | |
| 2 | ETE 122 | Circuit Analysis-I laboratory | | 1.5 |
| 3 | ETE 131 | Electronics-I | 3 | |
| 4 | ETE 132 | Electronics-I laboratory | | 1.5 |
| 5 | ETE 133 | Circuit Analysis-II | 3 | |
| 6 | ETE 134 | Circuit Analysis-II laboratory | | 1.5 |
| 7 | ETE 211 | Electronics II | 3 | |
| 8 | ETE 212 | Electronics II laboratory | | 1.5 |
| 9 | ETE 213 | Telecommunication Principles | 3 | |
| 10 | ETE 221 | Electromagnetic Fields and Waves | 3 | |
| 11 | ETE 222 | Digital logic Design | 3 | |
| 12 | ETE 223 | Digital logic Design laboratory | | 1.5 |
| 13 | ETE 231 | Energy Conversion | 3 | |
| 14 | ETE 232 | Energy Conversion laboratory | | 1 |
| 15 | ETE 321 | Computer Networks | 3 | |
| 16 | ETE 322 | Computer Networks laboratory | | 1.5 |
| 17 | ETE 313 | Optoelectronics | 2 | |
| 18 | ETE 314 | Optoelectronics laboratory | | 1 |
| 19 | ETE 331 | Control System Engineering | 3 | |
| 20 | ETE 332 | Signals and Systems | 3 | |
| 22 | ETE 411 | Digital Signal Processing | 3 | |
| 23 | ETE 412 | Digital Signal Processing laboratory | | 1 |
| 24 | CSE 114 | Computer Technology | 2 | |
| 25 | CSE 224 | Database Management System | 2 | |
| 27 | CSE 225 | Database Management System laboratory | | 2 |
| 28 | CSE 226 | Introduction to Programming Language | 3 | |
| 29 | CSE 227 | Introduction to Programming Language lab | | 1.5 |
| 30 | CSE 239 | Data Communication | 3 | |
| 31 | CSE 322 | Microprocessor & Assembly Language Prog | 3 | |
| 32 | CSE 323 | Microprocessor & Assembly Language Prog lab. | | 1 |
| 32 | ETE 100 | Project work | | 1 |
| 33 | ETE 200 | Project work | | 1 |
| 34 | ETE 300 | Project work | | 1 |
| 35 | ETE 426 | Final Year Project/Internship/Thesis | | 2 |
| 36 | ETE 436 | Final Year Project/Internship/Thesis | | 4 |

Total

76.5

Science Courses

| Sl. | Code | Course Title | No. of Credit | |
|-------|---------|-------------------------------------|---------------|-----|
| | | | Theory | Lab |
| 1 | PHY 111 | Waves, oscillation & thermodynamics | 3 | |
| 2 | PHY 124 | Optics, electricity & magnetism | 3 | 1 |
| 3 | CHE 136 | Chemistry | 2 | |
| 4 | STA 215 | Statistics and Probability | 3 | |
| Total | | | | 12 |

Mathematics

| Sl. | Code | Course Title | No. of Credit | |
|-------|---------|------------------------------------------------|---------------|-----|
| | | | Theory | Lab |
| 1 | MAT 112 | Differential and Integral Calculus | 3 | |
| 2 | MAT 123 | Differential Equations and Laplace transform. | 3 | |
| 3 | MAT 135 | Matrices, Complex variables & Fourier analysis | 3 | |
| 4 | MAT 216 | Coordinate Geometry & Vector Analysis | 3 | |
| 5 | MAT 235 | Numerical Methods & Theory of Algebra | 3 | |
| Total | | | | 15 |

General Education courses

| Sl. No. | Code | Course Title | No. of Credit | |
|---------|---------|-----------------------------------|---------------|-----|
| | | | Theory | Lab |
| 1 | GED 113 | Communicative English Language I | 3 | |
| 2 | GED 125 | Communicative English Language II | 3 | |
| 3 | GED 233 | Bangladesh Studies | 3 | |
| 4 | GED 234 | Engineering Economics | 3 | |
| 5 | GED 321 | Accounting | 3 | |
| 6 | GED 421 | Engineering Management | 3 | |
| 7 | GED 431 | Business Communication | 2 | |
| Total | | | | 20 |

Major in Electronics

| | Code | Course Title | No. of Credit | |
|---|---------|-----------------------------|---------------|-----|
| | | | Theory | Lab |
| 1 | ETE 451 | Advanced Electronics | 3 | 1.5 |
| 2 | ETE 453 | Industrial Electronics | 3 | 1.5 |
| 3 | ETE 455 | VLSI Design | 3 | 1.5 |
| 4 | ETE 457 | Instrumentation Engineering | 3 | 1.5 |
| 5 | ETE 459 | Microelectronics | 3 | |
| 6 | ETE 460 | Embeded System Design | 3 | 1.5 |

| | | | |
|----|---------|------------------------------------------|---|
| 7 | ETE 461 | IC Processing and Fabrication Technology | 3 |
| 8 | ETE 462 | Linear Circuit and Design | 3 |
| 10 | ETE 465 | Semiconductor Devices | 3 |

Major in Telecommunication

| | Code | Course Title | No. of Credit | |
|---|---------|-----------------------------------|---------------|-----|
| | | | Theory | Lab |
| 1 | ETE 471 | Telecommunication Engineering | 3 | 1.5 |
| 2 | ETE 473 | Radio Communication Engineering | 3 | 1.5 |
| 3 | ETE 477 | Fiber Optic Communication | 3 | |
| 4 | ETE 479 | Microwave Engineering | 3 | |
| 5 | ETE 480 | Satellite and Radar Communication | 3 | |
| 6 | ETE 482 | Wireless Communication | 3 | |
| 7 | ETE 483 | Advanced Communication Techniques | 3 | |
| 8 | ETE 484 | Antennas and Propagation | 3 | |

Detailed syllabus:

Core Courses

Title : Circuit Analysis – I
Course Code : ETE 121
Prerequisite : None
Credit hours : 03

S.I Units, Basic concepts of Current, Voltage, Ohms Law, Resistivity, Temperature Co-efficient of Resistance, D.C. circuits, Kirchhoff's laws, Series-Parallel circuits, Voltage divider rules, current divider rules, Y-Delta transformation, Electrical Network Analysis: branch- current method and loop current method, concept of current source and voltage source

Network Theorems: Superposition, Thevenin's and Norton theorem, Maximum power transfer theorem.

Magnetic circuit Concepts: Electromagnetism, magnetic flux density, magnetic field strength, magneto motive force, reluctance, permeability, Hysteresis and eddy currents, self inductance and mutual inductance, Magnetic circuit calculation

Title : Circuit Analysis – I Laboratory
Course Code : ETE 122
Prerequisite : None
Credit hours : 1.5

Laboratory works based on course ETE 121.

Title : Electronics - I
Course Code : ETE 131
Prerequisite : None
Credit hours : 03

P-N Junction as a Circuit Element: Open-circuited p-n junction, diode currents, V-I characteristics, ideal diode, diode resistance, piecewise linear model, breakdown diodes, diode capacitances. Diode Circuits: Half-wave rectifier, full-wave rectifier, choke and capacitor filters, peak detector, clipping circuits, Pulse shaping, clamping circuits, voltage doubler.

Field Effect Transistor: JFET, Pinch-off voltage, Drain characteristics, MOSFET, Biasing FET devices, FET Small-signal model, FET amplifier analysis, FET as voltage-variable resistor. Introduction to High Frequency Amplifiers: FET at high frequency.

Bipolar Junction Transistor: Transistor current components, Common-base configuration, Common-emitter configuration, Common-collector configuration, Operating point, Fixed bias, Emitter bias, bias stability, thermal stability.

Transistor Amplifier Circuits: Graphical analysis of CE configuration, Transistor hybrid model, Input resistance, output resistance, Voltage gain, current gain, Emitter follower, Cascading transistor amplifiers, Miller's Theorem and its dual, Common-emitter amplifier with an emitter resistance, simplified hybrid model.

Hybrid-(model, Single-stage CE amplifier analysis, Y-parameter model. Power controlling devices: Silicon Controlled Rectifiers (SCR), TRIAC, DIAC and UJT; characteristics and applications.

Title : Electronics – I Laboratory
Course Code : ETE 132
Prerequisite : None
Credit hours : 1.5

Experimental work based on course ETE 131.

Title : Circuit Analysis – II
Course Code : ETE 133
Prerequisite : ETE 121 (Circuit Analysis I)
Credit hours : 03

AC: Maximum and average values, rms value, Capacitors, Inductors, sinusoidal alternating waveforms, series parallel AC circuits, AC Networks.

Representation of AC: wave diagram, phasor diagram, Effect of AC on resistance, inductance and capacitance and different combinations, Resonance, Filters, Pulse waveforms and the R-C Response.

Title : Circuit Analysis – II Laboratory
Course Code : ETE 134
Prerequisite : ETE 133
Credit hours : 1.5

Experimental works based on course ETE 132.

Title : Electronics II
Course Code : ETE 211
Prerequisite : ETE 131: Electronics I
Credit hours : 03

Amplifier Specifications: Classification of Amplifiers, Distortion, frequency response, step response, RC coupled amplifier, effects of emitter bypass capacitor, frequency response of cascaded stages, noise.

Power Amplifier Design: Power Transistors, Darlington connection, npn-pnp combination, Class A large-signal amplifier, Class B Amplifiers, Push-pull design, Tuned amplifiers, class C power amplifier.

Switching Circuits: Transistor Switches, Transistor monostable and astable multivibrators, Switching speed improvements, Solid-State Multivibrators.

Operational Amplifier Fundamentals: Ideal Op-Amp, Virtual Ground Concept, Basic Op-Amp Circuits, Op-Amp applications: current-to-voltage converters, voltage-to-current converters, Difference amplifier, Instrumentation amplifier, integrator, differentiator.

Active Filters: Biquadratic Transfer Functions, Filter types, Standard Responses, Sallen-Key Networks, Frequency and Impedance Scaling, Gain Adjustments, Frequency Transformations, State-variable configurations, High-Order filters.

Practical Op-Amp Limitations: Simplified circuit diagram of op-amp input stage, input bias and offset current, input offset voltage, voltage drift, power supply rejection ratio, common-mode rejection ratio, offset error compensation, frequency response, transient response, slew rate, input and output impedances, noise, stability, gain and phase margins, frequency compensation, small and large signal characteristic.

Voltage Regulators: Basic emitter-follower regulators, Regulation, Series feedback regulators, Current limiter, over-voltage protection, linear IC voltage regulators, Simple heat sink design.

Oscillators: General principles of oscillation, Barkhausen Criterion, Phase-Shift Oscillator, Wien-Bridge Oscillator, LC Oscillators, Crystal Oscillators, Square-wave generator, Triangle-wave generator, sawtooth generator.

Nonlinear Circuit Applications: Comparators, Schmitt Triggers, Precision Rectifiers, Peak Detectors, Log/Antilog Amplifiers, Analog Multipliers.

Title : Electronics – II Laboratory
Course Code : ETE 212
Prerequisite : ETE 211
Credit hours : 1.5

Experimental works based on Course ETE 211: Electronics II

Title : Telecommunication Principles
Course Code : ETE 213
Prerequisite : ETE 131: Electronics I
Credit hours : 03

Introduction to Telecommunications: Beginning of Telecommunications; Evolution of Telecommunications; Telecommunications legislative history; Telecommunications PSTN Technology.

Basic Principles: Signals - Analog and Digital; Bandwidth – Narrowband, wideband; Telecommunication Systems, Line System Characteristics, Radio System Characteristics, and Switching System Principles.

Some Fundamentals: The decibel, Frequency, Waveforms and filters, Voice frequencies, Attenuation and noise, Amplitude Modulation, Frequency Modulation, Pulse Modulation; bauds, bits, bytes and codes; protocols, architectures, LAN, WAN , MAN.

Telephone Systems and Cabling: From stand-alone to connected telephones; What is PBX? Connecting Telephone lines to PBXs; PBX Telephones; Centrex; Key systems.

Switching and Signaling: Step-by-step telephone exchanges, Reed relay and crossbar exchanges, Stored program control, Signaling, Digital exchanges.

Cable, Radio and Transmission: Local distribution networks, Carrier working: Groups and super groups, Submarine cables, Optic fibers, Radio propagation, Antennae, Satellites, Mobile radio Systems.

Traffic Theory: The Erlang, Erlang's lost call formula, Queueing systems.

Maintenance and Operation: Centralized Maintenance Systems, Telephone tariffs and System Viability, Forecasting future demands.

Digital Services: Analogue versus digital, Pulse code modulation, Primary PCM Systems and time-division multiplexing, Data services, Digital strategies for national telephone systems, Integrated services digital networks.

Digital Fundamentals: Bits, bytes, words, Integrated circuits, Logic gates, Memories and stores, Magnetic tapes and discs, Computers and microprocessors.

Today and Tomorrow: Electronic mail, Teletext, Viewdata, Perstel, Cable television, High-definition television, Direct broadcasting by satellite, Travel or communicate? Advances in Telecommunications, Evolution in Telecommunications, Telecommunications and Applications, Integrating Voice, Data, and Video, Multimedia, Compact Disk Read Only Memory, CD-ROM, Electronic Communications, Local Area Networks, Internet.

Title : Digital Logic Design

Course Code : ETE 222

Prerequisite : ETE 211: Electronics II

Credit hours : 03

Number Systems: Representation of Numbers in different bases, Addition, Subtraction in different bases; Base Complement, Subtraction using Complements; Binary Multiplication and Division.

Binary Codes: Different Code System, Boolean Algebra, Various Gates, Sum of products and Product of Sums, Maxterm, Minterm, Standard and Canonical forms and other Logical Operations.

Simplification of Boolean functions: Karnaugh map method; Tabular method of simplification;

Implementation of Logic Circuit using various Gates: NOR, NAND, AND, OR, INVERT Implementation. Diode Logic Gates, Transistor Switches, Transistor Gates, MOS Gates, Logic Families: TTL, ECL, IIL and CMOS logic with operation details.

Combination Logic Circuits: Design procedure; Adder, Subtractor, Code Converters, Parity bit Checker etc., Analysis of combinational Circuits and its Truth Table, Encoder, Decoder, Multiplexer, Demultiplexer, ROM and PLA.

Flip-Flops: SR, JK, Master Slave, T & D type Flip Flops and their Truth Tables.

Arithmetic Circuits: The half adder and full adders; parallel adders; IC parallel adders; The 2's complement addition and subtraction; The BCD adder; Binary multiplier.

Sequential Circuits: Introduction to Sequential Circuits, Analysis and Synthesis of Synchronous Sequential Circuits.

Counters: A Synchronous ripple up and down counters, counters with any MOD numbers, synchronous IC counters, propagation delay. Parallel up, down and up/down counters, presentable counters. The 74193 counter, decoding a counter. Cascading counters. Shift registers, IC, Shift-registers, shift register counters, Frequency counter, digital clock.

Registers: Classifications, Shift Register, Transfer Registers, Circular Registers and their Applications, Registers with Parallel Load.

Memory Devices: Semiconductor memory technologies, ROM architecture, timing and types of ROM, EPROM, ROM applications, RAM architecture, static and dynamic RAM, DRAM a structure, operation and refreshing. Expanding word size and capacity, Magnetic bubble and CCD memories.

Converters: Digital to Analog (D/A), Analog to Digital (A/D) Converters and their Applications.

Title : Digital Logic Design Laboratory

Course Code : ETE 233

Prerequisite : ETE 232

Credit hours : 01

Experimental works based on Course ETE 222.

Title : Energy Conversion

Course Code : ETE 231

Prerequisite : ETE 133: Circuit Analysis II

Credit hours : 03

Introduction to Principles of Electrical Machines: Introduction to electrical machines and transformers. Rotational motion, Newton's law, and power relationships. Magnetic field, Fraday's law, induced voltage on a conductor moving in a magnetic field, production of force on a wire in a magnetic field.

DC Machines: Principles of operation and construction of DC machines, simple armature windings: lap and wave. EMF equation and principle of commutation. DC generators: Separately excited, shunt wound, series wound and compound wound generators. Conditions for self-excitation of shunt-generator. Load characteristics and voltage regulation. DC motors: Torque equation, characteristics of shunt, series and compound motors. Starting and speed control. Tests, measurement and efficiencies of DC machines.

Induction Machines: Production of rotating magnetic field by uniformly distributed three phase windings. Principles of operation and construction of induction motor. Slip equation, equivalent circuit, determination of equivalent circuit parameters by no-load and blocked-rotor tests. Losses, efficiency and torque. Torque-speed characteristics, starting torque and maximum torque. Starting methods, Principles of operation and construction of single-phase induction motors, split-phase, capacitor and shaded-pole motors.. Principles of operation of induction generators. Principles of action of linear induction motor.

Synchronous Machines: Operating principles, equivalent circuit, short-circuit and open-circuit tests. Synchronous impedance, voltage regulation, power chart. Parallel operation of synchronous machines, synchronizing procedures. Synchronous motors: Principle of operation, starting procedures, load characteristics, V-curves, torque, and power equations.

DC and AC Generator: Description of Different Parts of DC Generators, EMF equation, Principle of DC Generator. Parallel operation. Application of DC Generator. Theory of AC Operation, Alternator Regulation, Synchronizing & Load Sharing of Alternation. Application. Construction,

AC and DC Motor: Principle of operation, Classification, Application.

Synchronous Motor: Theory of Operation, Motor Characteristics, Synchronous Condenser. Application.

Transformers: Single-phase transformers: Construction, principle of operation and equivalent circuit, phasor diagram, efficiency and regulation. Short and open circuit tests. Parallel operation. Three phase transformers: Construction, Connections, and Parallel operation Autotransformers, Instrument transformers.

Title : Energy Conversion Laboratory
Course Code : ETE 232
Prerequisite : ETE 231
Credit hours : 03

Experimental works based on Course ETE 231.

Title : Computer Networks
Course Code : ETE 321
Prerequisite : CSE 239 Data Communication
Credit hours : 03

Introduction to Data Communications: Simple data communications network. Transmission definitions, one way transmission, half duplex transmission, transmission codes, transmission modes, parallel transmission, serial transmission, bit synchronization, character synchronization, synchronous transmission, asynchronous transmission, efficiency of transmission. error detection methods and data compression.

Interfacing: Interfaces for simple computer system and terminal to terminal. MODEM, terminal interfaces, CCITT V.24/RS-232, CCITT V.28, V.35, GPIB, EIA, RS-232C standard, speed and distance limitations for V.24, RS-232C, RS-449/422/423 interfaces and standards, signal propagation delay, ISDN interface.

Protocols: Introduction to network protocol. Seven Layer ISO-OSI standard protocols and network architecture. Transport protocols, session services protocols, and other protocols.

Local Area Networks: Distributed system, PBX and cable based LANs. Topology: star, ring, bus. Medium access control methods: CSMA/CD, control token, token ring, and token bus. Fiber Distributed Data Interface and ATM technologies. High speed and bridged local area networks. Cyclic redundancy check (CRC). Network operating system.

Wide Area Networks: Characteristics of public data networks, packet-switched data networks, circuit switched data networks, ISDN.

Inter-networking: Internetworking architectures, internetworking issues, network layer structure. Router and gateway. Internet protocol standards. Internet IP, routing protocols. Addressing. Domain Name System. Connectionless datagram delivery. Internet protocol suite. Internet application protocols. Internet management.

Network management systems: fault, accounting, configuration and name, performance and security. Network management protocol. LAN network-control center.

Title : Computer Networks Laboratory
Course Code : ETE 322
Prerequisite : CSE 239
Credit hours : 03

Laboratory works based on the course ETE 311

Title : Optoelectronics
Course Code : ETE 313
Prerequisite : ETE 221: Semiconductor Devices.
Credit hours : 03

Semiconductor fundamentals. Semiconductor materials and junctions, III-V compound semiconductor materials. Optical process in semi-conductors, radiative and non radiative recombination, optical absorption, luminescence, Light emitting diodes (LED), Visible and infrared LED. Principle and construction of LED. Photo detectors, photo conductors, junction photo diode. P-I-n photo diode, Solar cell, silicon, thin film and hetero-structural solar cell, Charge transfer devices, avalanche photodiode,

Spontaneous simulated emission in lasers, quantum noise and spectral line width properties of lasers. Principals of lasers.

Optical detectors, Modulation and switching of light. Non-linear optics. Introduction to optical fibers, Optical fiber wave-guides. Attenuation in optical fibers. Dispersion. Introduction to optical communications systems. Optical fiber sensors and applications. Liquid Crystal Display (LCD).

Title : Optoelectronics Laboratory
Course Code : ETE 314
Prerequisite : ETE 313
Credit hours : 03

Laboratory works based on course ETE 313.

Title : Electromagnetic Fields and Waves.
Course Code : ETE 221
Prerequisite : PHY 124 (Physics II) & MAT 216 (Vector Analysis)
Credit hours : 03

Maxwell's Equations and Uniform Plane Waves: Time Varying fields: Faraday's Law of Induction, the conservation of charge and the incompleteness of Ampere's Law. Maxwell's equations and Lorentz force law. Uniform plane waves and wave equation. Time harmonic fields. Polarization of waves. Poynting's Theorem and the conservation of energy, the field definitions of impedance, admittance. Phase and group velocities. Waves in media: lossy media, dispersive media.

Radio Wave Propagation: Electromagnetic waves, wave front, characteristic impedance of free space, Reflection and refraction at plane interface (normal and oblique angles), boundary conditions, Ground waves and sky waves. The ionospheric layers, refractive index, virtual height, critical frequency and angle, maximum usable frequency, skip zone, skip distance, fading. VHF line of sight transmission. Tropospheric scattering communications. Relationship between transmitter power, antenna gains and received signal to noise in a free space radio link. VHF and microwave point-to-point link.

Wave guides and Cavity Resonators: Properties of waves in rectangular wave guides, modes of propagation, phase and group velocities in wave guide, wave impedance. Dielectric wave guides. Cavity resonators and field distribution. Applications in microwave oven.

General and EMI Analysis: Background. Concern for electromagnetic compatibility. Circuit theory approach and field theory approach. Comparative analysis.

Coupling and Shielding: Capacitive (electric) coupling. Inductive (magnetic) coupling. Shielding of cables. Effects of shield resistance, cause and effects of leakage flux, stray current return paths, methods of adding common-mode impedance. Balanced circuits.

Grounding: Grounding of multiple-chassis systems. Signal ground connections. Safety ground connections. Layout and grounding of printed circuit board: layout consideration, current return path, power distribution within a PCB.

Radiation: Radiation coupling between distant devices. Superposition of multiple electric and magnetic sources. Cabinet shielding. Absorption losses and reflection losses for nonmagnetic shields. Effects of shield apertures: current flow in shields, slot antenna theory, wave guide theory. Shield penetration by wires and cables. Interconnecting leads as antennas, treatment of power, low frequency and high frequency leads.

Title : Control System Engineering
Course Code : ETE 331
Prerequisite : ETE
Credit hours : 03

Course: ETE 331: Control System Engineering

Credit hours: 03. Prerequisite: None.

Concepts of an Engineering system and its representation , Dynamical system, their characterizations, mathematical models of physical systems, transfer function , signal flow diagram, steady state and transient response using place transform method, pole- zero concepts, error analysis, stability analysis, Routh, Nyquist and Bode diagrams, stability margins, Root locus method

Title : Signals and Systems

Course Code : ETE 332

Prerequisite : Mathematics II

Credit hours : 03

Signals and systems: continuous and discrete time signals and their basic properties. Commonly encountered signals, unit impulse and unit impulse functions, sampling and aliasing.

Linear time invariant (LTI) systems: the convolution sum, integral, properties, difference and differential equations.

Fourier series representation of periodic signals, properties of discrete and continuous time Fourier series, Fourier series and LTI system.

Discrete and Continuous time Fourier Transforms: properties, convolution and multiplication.

Frequency – domain analysis systems; response to periodic and aperiodic inputs, analysis of ideal filters and sampling.

Title : Digital Signal Processing

Course Code : ETE 222 (Digital Logic Design) & MAT 123.

Prerequisite : None

Credit hours : 03

Discrete Time Signals & Systems: Discrete-time signals, Discrete-time systems, Linear Time-Invariant systems and their properties, Linear constant coefficient difference equations, Frequency domain representation of discrete time signals and systems, Fourier transform of discrete sequences, Discrete time processing of continuous signals.

z-Transform and Its Applications: Definition of z-transform, Region of Convergence, Properties of z-Transform, Inversion of the z-Transform, Analysis of Linear Time-Invariant Systems in the z-Domain.

Structure of Discrete Time Systems: Block diagram representation of constant coefficient difference equations, IIR and FIR systems and their basic structures, Stability of discrete time systems.

Discrete-Time Fourier Analysis: Discrete Fourier Transform and its properties, Inverse Discrete Fourier Transform, Linear Convolution using Discrete Fourier Transform, Fast Fourier Transform, Decimation in time and Decimation in frequency.

Digital Filter Design and Applications: IIR filter design, bilinear z-transform design approach, IIR filter realization, FIR filter design, realization of FIR filter, application examples.

Title : Digital Signal Processing Laboratory

Course Code : ETE 412

Prerequisite : ETE 411

Credit hours : 1

Laboratory works based on course ETE 411: Digital Signal Processing.

Title : Project Work
Course Code : ETE 100, ETE 200, ETE 300.
Prerequisite : None
Credit hours : 03

Objective: The objective of the course is to evaluate a students learning in previous semesters. The project will manifest what a student learnt during previous semesters of the year.

Description: It will be a compulsory course for all students. A student has to complete a project on the third semester of each year on a topic based on the courses taken in previous semesters. ETE 100 to be taken during 3rd semester of 1st year, similarly ETE 200 is to be taken during 3rd semester of 2nd year and ETE 300 to be taken during 3rd Semester of 3rd Year.

For Electronic and Telecommunication Engineering (ETE) a student has to build a circuit, examine its characteristics and should submit a report and prepare a presentation on it.

Computer Science Courses:

Title : Computer Technology
Course Code : CSE 114
Prerequisite : None
Credit hours : 03

Introduction: Brief history and types of computers, application areas. Working features of a computer system. Use of Computers, classification. Hardware: Organization and architecture of PC, Motherboards and Microprocessors.

Memory units and other functional parts: Primary memory, Secondary memory, I/O Devices, peripheral devices, BIOS, AT/XT, ISA, EISA, PCI Bus Architecture.

Number System Conversion: Decimal, Binary, Octal and Hexadecimal Number Systems; Conversion from one number system to another; Octal and Hexadecimal Addition, subtraction, multiplication and division.

Logic gates and Boolean algebra: Basic and Compound Logic gates with their truth tables and circuit design, Basic rules of Boolean Algebra, De-Morgan Theorems.

Software: Classifications, System software, Operating system concepts, importance, components and basic DOS commands, Windows and UNIX operating systems. Application software: word-word processing, spreadsheet database and presentation software.

Multimedia systems, Computer Networks and Internet: Basic concepts of LAN, MAN, WAN and Internet systems, Internet services, on-line and off-line processing, E-mail and WWW.

Selection of computers: hardware, software and cost consideration.

Maintenance of PC: Power supply stability, grounding. Effects of surge, surge current and its protection. Effect of static charge on computer devices. Handling of computers cards and chips, computer viruses and virus protection, software troubleshooting and maintenance.

Title : Computer Technology Laboratory
Course Code : CSE 115
Prerequisite : CSE 114
Credit hours : 03

Experimental works based on course CSE 114.

Title : Database Management System
Course Code : CSE 224
Prerequisite : CSE 114: Computer Technology
Credit hours : 03

Data base system architecture, Models: Entity-Relationship model, Relational model; Relational algebra; SQL; Integrity constraint; Relational database design; File organization and retrieval, file indexing; Transaction manager;

Concurrency controller; Recovery manager; Security system; Database administration; Query processing and optimization; Distributed database; Object-oriented database.

Title : Database Management System Laboratory
Course Code : CSE 225
Prerequisite : None
Credit hours : 1.5

Experimental works based on course CSE 224.

Books Recommended:

1. Database Concepts, Abraham Silberschatz, Henry F.Korth, S.Sudarshan; McGraw Hill.

Title : Introduction to Programming Language
Course Code : ETE 226
Prerequisite : CSE 114
Credit hours : 03

Programming concepts; Program development stages; Flow charts; Number systems: binary, octal, decimal and hexadecimal systems; Structured programming language: data types, operators, expressions, control structures; Functions and program structure: function basics, parameter passing co

Inventions, scope rules and storage classes, recursion; Header files; Preprocessor; Pointers and arrays; User defined data types: structures, unions, enumerations; Input and Output: standard input and output, formatted input and output, file access; Variable length argument list; Command line parameters; Error Handling; Graphics.

Reference language: C

Title : Introduction to Programming Laboratory
Course Code : CSE 227
Prerequisite : CSE 226
Credit hours : 1

Experimental works depends on Course ETE 226.

Title : Microprocessor & Assembly Language Programming
Course Code : CSE 322
Prerequisite : CSE 226: Introduction to Programming Language.
Credit hours : 03

Introduction to microprocessors, Event driven programming, API calls/System calls, Assembly language programming.

Architectures and Assembly Language of 8086, 80286, 80386, 80486 and Pentium microprocessors. Memory management. Disk management: boot loaders, file allocation tables; Programming I/O devices: interrupt service routines, device drivers; Interfacing between programs/subroutines of different programming languages; The windows programming architecture, event driven programming and API calls. Introduction to different fundamental APIs; Unix C programs and Unix system calls.

Title : Microprocessor & Assembly Language Programming Laboratory
Course Code : CSE 323
Prerequisite : CSE 322
Credit hours : 03

Experimental works based on Course CSE 322.

Basic Science & Mathematics Courses:

Title : Waves, oscillation and thermodynamics

Course Code : PHY 111

Prerequisite : None

Credit hours : 03

Forces and Motion: Newton's law of motion, Kinetic energy and work, Conservation of energy, Potential energy, Gravitation: Laws of gravitation, Kepler's laws.

Wave motion: Transverse and longitudinal waves, Wavelength and frequency, Traveling wave, sinusoidal waves, phase and phase constant, group speed. Wave speed. The wave equation. Power and intensity in wave motion, Doppler Effect.

Oscillations: Simple harmonic motion (SHM), time period, frequency, energy consideration in SHM. SHM and uniform circular motion. Resonance.

Heat and first law of thermodynamics. Heat capacity and specific heat, heat capacities of ideal gas. Second law of thermodynamics, entropy. Reversible and irreversible process.

Title : Differential & Integral Calculus

Course Code : MAT 112

Prerequisite : None

Credit hours : 03

Calculus: Basic Theorems: Successive differentiation, Roll's Theorem, Mean Value Theorem, Taylor's Theorem, and Maclaurin's series, Intermediate forms, Maxima and Minima.

Calculus of several variables: Limit, Continuity, Partial derivatives, Differentials, Partial derivatives of composite functions, Implicit functions, Jacobian, Taylor's Theorem, Maxima and Minima, Lagrange's method.

Application of Calculus: Curvature, Convexity, and concavity.

Riemann Integration: Definition and Properties. Fundamental Theorem of Integral Calculus, Improper Integrals, Beta and Gamma functions. Multiple integrals, Rectifications, Volumes and areas of solids and revolutions.

Differential Calculus: Function and Limit: Function, Limit, Continuity and differentiability. Differentiation of explicit and implicit functions and parametric equations; Significance of derivatives.

Differentials: Successive differentiation of various types of functions, Leibnitz's theorem, Rolle's theorem. Mean value theorem. Taylor's theorem in finite and infinite forms. Maclaurin's theorem in finite and infinite forms. Lagrange's form of remainder. Expansion of function by differentiation and integration.

Partial differentiation. Euler's theorem. Tangent, sub tangent, Normal, subnormal. Cartesian and polar coordinates. Determination of maximum and minimum values of functions and points of inflection. Application, Evaluation of indeterminate forms by L'Hospital's rule, curvature, center of curvature and chord of curvature, Evaluate involutes, Asymptotes, Envelopes, curve tracing.

Title : Differential Equations & Laplace Transform.
Course Code : MAT 123
Prerequisite : MAT 112: Differential & Integral Calculus
Credit hours : 03

Degree and order of ordinary differential equations; Formation of differential equations; Solution of first order differential equations by various methods; Solution of first order but higher degree ordinary differential equations; Solution of general linear equations of second and higher orders with constant co-efficient; Solution of homogeneous linear equations and its applications; Solution of differential equations of higher order when dependent and independent variables are absent; Solution of differential equation by the method based on factorization of operators.

Laplace transformations: definition, elementary transformation, and properties, solution of differential and integro-differential equations by Laplace transform. Simple application in circuit problems.

Title : Optics, electricity and magnetism
Course Code : PHY 124
Prerequisite : PHY 111
Credit hours : 03

Electricity and magnetism: Coulomb's law, electric field, electric potential, Gauss's law and its application, electric dipole, ohm's law, Kirchoff's law and application. Faraday's and Lenz's laws, self and mutual induction, Biot-Savart law, examples, magnetic force on charge and current. Ampere's law, examples.

Light: Interference of Light, Newton's Rings. Diffraction of Light, Diffraction by Single slit, Double slit and Diffraction Gratings. Polarization of light, Optics of Crystals.

Modern physics: Bohr's atom model, atomic spectra, photoelectric effect, Compton Effect, X-rays, Bragg's law.

Title : Matrix, Complex Variable & Fourier Analysis.
Course Code : MAT 135
Prerequisite : None
Credit hours : 03

Matrices: Definition of a matrix, algebra of matrices, Types of matrices, determinant of a square matrix; equivalence, adjoint and inverse of a square matrix; rank and elementary transformation of matrices, normal and canonical forms, linear equations; the characteristic roots and the characteristic equation of a matrix, diagonalization of a matrix, eigen values and eigen vectors; diagonalization; orthogonalization; linear transformations; similarity transformation.

Fourier Series: Sequence and infinite series; their convergence and divergence; Comparison test, De Alambert's test and Cauchy's root test. Periodicity of functions and Fourier series; real and complex form; Fourier series in the intervals $(-\pi, \pi)$, $(0, 2\pi)$,

$(-i, i)$ and $(0, 2i)$ etc. Dirichlet's conditions, Half-range sine and cosine series; Partial differential equations and solutions of 1-D wave and diffusion equations and 2-D Laplace equation; Finite transform, Fourier integral, Fourier transforms and its applications in solving boundary value problems.

Includes standard first and second order methods, introductory linear algebra, systems, difference equations, power series, Laplace transforms, numerical methods and nonlinear methods, with applications for all of these.

Title : Chemistry
Course Code : CHE 136
Prerequisite : None
Credit hours : 03

Atomic structure, quantum numbers, electronic configuration, brief description of periodic table, properties and uses of noble gases. Chemical bonds and their properties, molecular structures of compounds. Selective organic reactions.

Different types of solution and their compositions, phase rule, phase diagram of mono-component system, properties of dilute solution, thermo-chemistry, chemical kinetics chemical equilibrium, ionization of water and pH concept. Electrical properties of solutions.

Title : Coordinate Geometry & Vector Analysis.
Course Code : MAT 216
Prerequisite : MAT 112: Differential & Integral Calculus.
Credit hours : 03

Vector algebra and calculus: definition, addition, subtraction, dot and cross products, triple products, vector integration and differentiation, line surface and volume integrals. Vector operator DEL, divergence, curl and gradient and their physical significance, divergence and Gauss's theorem, Stoke's theorem. Poisson's and Laplace's equations.

Geometry: review of equation of straight line, circle, parabola, ellipse and hyperbola. Pair of straight lines, equation for a plane, sphere, cylinder and cone.

Title : Numerical Methods & Theory of Algebra.
Course Code : MAT 235
Prerequisite : MAT 216: Coordinate Geometry
Credit hours : 03

Numerical Methods: Numerical methods and software; Introduction to the methods, tools and ideas of numerical computation; Problem solving using standard mathematical software such as MATLAB, IMSL and LINPACK; Interpolation; Linear and nonlinear equations; Numerical Integration and Differentiation.

Linear Algebra: Systems of linear equations and matrices; Determinants; Vectors in 2-D and 3-D space; Euclidian vector spaces; General vector spaces; Inner product spaces; Applications of Linear algebra.

Abstract Algebra: Mathematical reasoning; sets and set operations; De Morgan's Law; Cartesian product of sets; Binary relations; Equivalence relations, functions; Lattice theory; Boolean algebra, groups and semi groups, cyclic groups; Homomorphism and Isomorphism theorems; rings and fields; Finite fields; Polynomial extension of a ring; Galois fields and their simple properties.

Title : Basic Statistics and Probability

Course Code : STA 215

Prerequisite : None

Credit hours : 03

Element of Statistics: Nature and scope of statistics, nature and representation of statistical data, attributes and variables, discrete and continuous variables, methods of data collection.

Measures of Location: Characteristics of an ideal measure; arithmetic mean; geometric mean; harmonic mean; median; mode; quartiles; deciles; percentiles.

Measure of Dispersion: Characteristics of an ideal measure; absolute and relative measures; range; standard deviation; mean deviation; quartile deviation; coefficient of dispersion; coefficient of variation; skewness and kurtosis.

Regression and Correlation: Relationship between variables, fitting of regression lines, simple correlation, multiple correlation and regression, correlation and regression coefficients.

Elements of Probability: Meaning and definition of probability; a priori probability and a posteriori probability; basic terminology of probability; random variables; probability function; expectation of sum and products. Concept of stochastic process; binomial, Poisson, Normal distributions.

General Education Courses

Title : Communicative English Language – I
Course Code : GED 113
Prerequisite : None
Credit hours : 03

Sentence Types: Declarative, Interrogative, Imperative, Exclamatory, Simple, Compound and Complex. Clauses: Noun Clause, Adjective Clause and Adverbial clause. Nominal Group.

Head – Nouns: Countable and Uncountable, Singular and Plural, Positive, Comparative and Superlative, Male, Female and Both word. Pre-modifiers of Noun: Determiners, Articles, Pronouns, Numerals, Quantifiers, Adjectives, Adverbs, Noun Adjectives.

Post-modifiers of Noun: Preposition, Prepositional Phrases, Appositives, Adverbs, Participles, Infinitives, Conjunctions. Verbal Group:

Head-Verb: Transitive, Intransitive, Linking, Auxiliaries- Primary and Modal, Tense Systems, Passives, Indirect Speech, Conditionals, Questions, Words from One Part of Speech to Others. Subject- Verb Agreement. Punctuation's. Vocabulary - Synonyms, Antonyms, Homophones.

Title : Communicative English Language II
Course Code : GED 124
Prerequisite : GED 113
Credit hours : 03

Prefixes and suffixes, Synonyms and antonyms, Homonyms, homograph and Homophone, Punctuation.

Commonly confused words, letter writing- business letter, Applications, Social letters, paragraphs.

Report writing, dialogue writing etc.

Title : Bangladesh Studies
Course Code : GED 233
Prerequisite : None
Credit hours : 03

Liberation of Bangladesh (from 1947 to 1971), Impact of liberation

Constitution, constitutional amendments, Parliament, Elections, Caretaker government,

Natural and mineral resources of Bangladesh, exports, imports, foreign remittance.

Neighbors of Bangladesh, foreign policy.

Title : Engineering Economics
Course Code : GED 233
Prerequisite : None
Credit hours : 03

Introduction to engineering economics decision, cash flow analysis and basic concepts of discounting, cost of capital, required ROR equivalence.

Business mathematics: Investment appraisal criteria for economic decisions, present worth, internal rate of return, social consideration in investment, benefit –cost ratio. Decisions involving depreciation and inflation, taxes, sensitivity analysis.

Title : Accounting
Course Code : GED 321
Prerequisite : None
Credit hours : 03

Accounting & It's environments: Accounting for business transactions: Double entry system of accounting, Accounting cycle. Measuring business income: Accounting for merchandizing concern: Accounting for cash receivables, inventories. Fixed assets and other assets and liabilities. Preparation of financial statements: Partnership accounting: Formation & operation : Joint venture accounting : Self-Balancing ledger. Cost volume profit analysis.

Title : Engineering Management
Course Code : GED 421
Prerequisite : None
Credit hours : 03

Introduction, evolution, management function, organization and environment.

Organization: Theory and structure; Coordination; Span of control; Authority delegation; groups; Committee and task force; Manpower planning. Personal Management: Scope; Importance; Need hierarchy; Motivation; Job redesign; Leadership; Participative management; training; Performance appraisal; Wages and incentives; Informal groups; Organizational change and conflict. Cost and Financial Management: Elements of costs of products depreciation; Break-even analysis; Investment analysis; Benefit cost analysis. Management Accounting: Cost planning and control; Budget and budgetary control, Development planning process; Project management; Network models for project time estimation; Estimation of confidence level; Simplex method for minimization of project time; Project effort analysis methods; Marketing management: Concepts; strategy; sales promotion; Patent laws. Technology management: Management of innovation and changes; Technology life cycle, Case studies.

Elective Courses

Major in Electronics: (Mandatory 18 for Electronics major students and 09 credit hours for others)

| Serial | Code | Course Title | No. of Credits | | |
|--------|---------|------------------------------------------|----------------|-----|-------|
| | | | Theory | Lab | Total |
| 1 | ETE 451 | Advanced Electronics | 3 | | 3 |
| 2 | ETE 452 | Advanced Electronics laboratory | | 1 | 1 |
| 3 | ETE 453 | Industrial Electronics | 3 | | 3 |
| 4 | ETE 454 | Industrial Electronics Laboratory | | 1 | 1 |
| 5 | ETE 455 | VLSI | 3 | | 3 |
| 6 | ETE 456 | VLSI Laboratory | | 1 | 1 |
| 7 | ETE 457 | Instrumentation Engineering | 3 | | 3 |
| 8 | ETE 458 | Instrumentation Engineering laboratory | | 1 | 1 |
| 9 | ETE 459 | Microelectronics | 3 | | 3 |
| 10 | ETE 460 | Solid State Devices | 3 | | 3 |
| 11 | ETE 461 | IC Processing and Fabrication Technology | 3 | | 3 |
| 12 | ETE 462 | Linear Circuit and Design | 3 | | 3 |
| 13 | ETE 463 | Electronics of Photovoltaic system | 3 | | 3 |
| 14 | ETE 464 | Microprocessor Architecture | 3 | | 3 |

Major in Telecommunication: (Mandatory 18 for telecommunication majors and 09 credits for others.)

| Sl. | Code | Course Title | No. of Credits | | |
|-----|---------|-----------------------------------------------|----------------|-----|-------|
| | | | Theory | Lab | Total |
| 1 | ETE 471 | Telecommunication Engineering | 3 | | 3 |
| 2 | ETE 472 | Telecommunication Engineering laboratory | | 1 | 1 |
| 3 | ETE 473 | Radio Communication Engineering-I | 3 | | 3 |
| 4 | ETE 474 | Radio Communication Engineering-I laboratory | | 1 | 1 |
| 5 | ETE 475 | Radio Communication Engineering-II | 3 | | 3 |
| 6 | ETE 476 | Radio Communication Engineering-II laboratory | | 1 | 1 |
| 7 | ETE 477 | Fiber Optic Communication | 3 | | 3 |
| 8 | ETE 478 | Fiber Optic Communication | | 1 | 1 |
| 9 | ETE 479 | Microwave Engineering | 3 | | 3 |
| 10 | ETE 480 | Satellite and Radar Communication | 3 | | 3 |
| 11 | ETE 481 | Television Engineering | 3 | | 3 |
| 12 | ETE 482 | Wireless Communication | 3 | | 3 |
| 13 | ETE 483 | Advanced Communication Techniques | 3 | | 3 |
| 14 | ETE 484 | Antennas and Propagation | 3 | | 3 |
| 15 | ETE 485 | Data Communication | 3 | | 3 |

Detailed syllabus for elective courses:

Major in Electronics:

Title : Advanced Electronics
Course Code : ETE 451
Prerequisite : ETE 221: Semiconductor Devices
Credit hours : 03

Brief review of semiconductor physics, PN junction and BJT structure. Metal Semiconductor junction, Schottky and ohmic contact. Negative conductance microwave devices, Einstein relationship, threshold conditions, turn-on delay, semiconductor laser.

Junction Field-Effect Transistors: Construction and Basic Operation, Current-Voltage Characteristics Equation, Channel Conductance and JFET Trans-conductance, Secondary Effects: Channel-Length Modulation, Breakdown, Velocity Saturation Effects and Temperature Effects. Small-Signal Equivalent Circuit. Metal-Oxide-Semiconductor Field-Effect Transistor: Metal-Oxide-Silicon System, Energy Band Diagrams, The Effects of Bias Voltage: Accumulation, Depletion and Inversion, Threshold Voltage. Oxide Charges in MOS Capacitor. Flat-Band Voltage, Structure and Operation of MOSFET, Current-Voltage Analytical Relations: Square-Law Model and Bulk Charge Model. Types of MOSFETs. MOSFET Small-Signal Equivalent Circuits.

Introduction to Microwave Devices: IMPATT Diode: Device Structure, Dynamic Characteristics, Gunn Diode: Basic concepts of Transferred Electron Effects, Negative Differential Resistance, Device Operation, Velocity field curves, Formation and Drift of Space Charge Domain.

Superconductor Devices: Superconductivity, Zero Resistance and the Meissner Effect, Types of superconductors, Critical Current Density, The Critical Field, Thermodynamics of the Superconducting Transition, The Two-fluid Model, The Josephson Effect, SQUID, High-temperature superconductors.

Title : Advanced Electronics Laboratory
Course Code : ETE 452
Prerequisite : ETE 451
Credit hours : 01

Laboratory experiments based on course ETE 451.

Title : Industrial Electronics
Course Code : ETE 453
Prerequisite : ETE 221
Credit hours : 03

Overview of Power Semiconductor Switches: Power diodes, Thyristors, Power MOSFET, G.T.O., IGBT, Field controlled switches (SiT and SiTH), Comparison of Semiconductor Switches, Desired Characteristics in Controllable Switches, Drive and Snubber Circuits

Line-Commutated Diode Rectifiers: Uncontrolled rectifier, Single-Phase Diode Bridge Rectifiers, Three-Phase Full-Bridge Rectifiers, Inrush Current and Over-voltages at Turn-On, Line-Current Harmonics and Power Factor, Phase-Controlled Rectifiers and Inverters

DC-DC Switch-Mode Converters: Basic Topologies, Buck converter, Boost converter, Buck-Boost Converter, Flyback Converter

Switch-Mode DC-AC Inverters: Pulse-Width Modulation, Single-Phase Inverters, Three-Phase Inverters, Effect of Blanking Time on Output Voltage in PWM Inverters

Resonant Converters: Classification of Resonant Converters, Basic Concepts, Load-Resonant Converters, Resonant-Switch Converters

Power Supply Applications: Switching Power Supplies, Electrical Isolation, Protection Circuits, Power Supply Specification, Power Line Disturbances, Power Conditioners, Uninterruptible Power Supplies

Title : Industrial Electronics Laboratory

Course Code : ETE 454

Prerequisite : CSE 453

Credit hours : 01

Laboratory works based on the course Industrial Electronics.

Title : (VLSI Design

Course Code : ETE 455

Prerequisite : ETE 221

Credit hours : 03

Introduction to VLSI Technology: IC Technology and IC Era (SSI, MSI, VLSI etc.); MOS as related VLSI technologies (NMOS, PMOS, CMOS, BiCMOS) MOS transistors (enhancement and depletion modes); NMOS and CMOS fabrication; Comparison of technologies between CMOS, Bipolar and GaAS, Basic Inverter; NAND, NOR logic.

Physics of MOS transistors: Fluid model, Electrical characteristics, Operation of MOS transistor as a switch and an amplifier, MOS inverters.

VLSI Design: MOS Fabrication steps, stick diagrams, design rules and layout, MOS circuits, Registers, Counters and Memory realizations, Hierarchical view of VLSI System Design, Behavioral description, High level Synthesis Scheduling, allocation and data path synthesis, Logic synthesis multilevel minimization, PLA reduction, regular structure circuits, Synthesis of FSM-ASM chart representation and realization , Layout synthesis, Placement and routing, Testing of VLSI, Testing of stuck-at faults, Testing of PLAs, RAM, Boundary scan technique.

Memory, registers and system timing: Shift register, 3-transistor dynamic RAM cell, 1-transistor dynamic memory cell, a pseudo static RAM/register cell, J-K flip flop, D flip flop, array of memory cells.

System Design Methodologies and Tools: Actual industrial or academic design flows for full custom, semicustom (standard cell, Gate array) and E-CAD use; Design trade-off methods, Commercial tools for VLSI design (including rapid prototyping); Design techniques for testability and test issues.

Title : VLSI Laboratory

Course Code : ETE 456

Prerequisite : ETE 455

Credit hours : 01

Experimental works based on course ETE 455.

Title : Instrumentation Engineering
Course Code : ETE 458
Prerequisite : ETE 211 Electronics II
Credit hours : 03

Measurements: units and standards, measurement of resistance, inductance, capacitance, measuring instruments, indicating instruments and their classification, moving coil and moving iron instruments, dynamometer and thermal instruments.

Magnetic measurements, ballistic galvanometer, flux meter, Cathode ray tube (CRT), CRT oscilloscope, single and dual channel, Q-meters, transistor testing, digital voltmeter and multimeters. Analog to digital (A/D) and D/A converters.

Title : Instrumentation Engineering Laboratory
Course Code : ETE 459
Prerequisite : None
Credit hours : 01

Laboratory work based on course ETE 458.

Title : Microelectronics
Course Code : ETE 459
Prerequisite : ETE 451: Advanced Electronics
Credit hours : 03

Overview of Microelectronic Fabrication: Basic Monolithic Integrated Circuits, Epitaxial Growth, Masking and Etching, Diffusion of Impurities, Monolithic Transistors, Monolithic Diodes, Integrated Resistors, Integrated Capacitors and Inductors, Monolithic-circuit Layout, Large-scale and Medium-scale Integration, Metal-Semiconductor Contact

MOS Digital Circuits: Performance Parameters of Logic Gates, NMOS Inverters, Body Effect, Gate Geometry Ratio, NMOS Logic Circuits, CMOS Inverters, CMOS Logic Circuits, Comparison of CMOS and NMOS

Bipolar Digital Circuits: BJT Inverters, Transistor-Transistor Logic Gates, Schottky TTL Gates, Emitter-Coupled Logic Gates, BiCMOS Inverters, Interfacing of Logic Gates, Comparison of Logic Gates

Active Sources: Internal Structure of Differential Amplifiers, BJT Current Sources, Current Mirrors, Widlar Current Source, Cascode Current Source, Wilson Current Source, Multiple Current Sources, JFET Current Sources, MOSFET Current Sources, Active Voltage Sources

Analog Integrated Circuits: Characteristics of Differential Amplifiers, BJT Differential Amplifiers, JFET Differential Amplifiers, MOS Differential Amplifiers, BiCMOS Differential Amplifiers, BJT Op-Amps, JFET Op-Amps, CMOS Op-Amps, BiCMOS Op-Amps, Other Examples of Analog Integrated Circuits

Title : Solid State Devices
Course Code : ETE 460
Prerequisite : ETE 451
Credit hours : 03

Semiconductor materials, basic crystal structure, single crystal, basic crystal growth techniques, different types of bonds band theory, Bragg's law, Scattering. Metal, semimetal. Insulator and dielectrics. Semiconductor physics, intrinsic carrier concentration, donors, acceptors. Carrier drift and transport, generation and recombination, continuity equation, thermionic emission, tunneling, high field effect.

Overview of PN junction fabrication, thermal equilibrium condition, depletion region, charge storage, transient behavior, junction breakdown, hetero-junction, BJT structure. Metal Semiconductor junction, Schottky and ohmic contact. Negative conductance microwave devices, Einstein relationship, threshold conditions, turn- on delay, semiconductor laser.

FET: Construction, fabrication and Basic Operation. Channel conductance and JFET Trans-conductance, Secondary Effects: Channel-Length Modulation, Breakdown, Velocity Saturation Effects and Temperature Effects Metal-Oxide-Silicon System, Energy Band Diagrams, Oxide Charges in MOS Capacitor. Flat-Band Voltage, Structure and Operation of MOSFET, Current-Voltage Analytical Relations: Square-Law Model and Bulk Charge Model. Types of MOSFETs. MOSFET Small-Signal Equivalent Circuits.

Microwave Devices: IMPATT Diode: Device Structure, Dynamic Characteristics, Gunn Diode: Basic concepts of Transferred Electron Effects, Negative Differential Resistance, Device Operation, Velocity field curves, Formation and Drift of Space Charge Domain.

Superconductivity, Types of superconductors, Meissner effect, Critical Current Density, The Critical Field, Thermodynamics of the Superconducting Transition, The Two-fluid Model, The Josephson Effect, SQUID, High-temperature superconductors.

Title : IC Processing & Fabrication Technology

Course Code : ETE 461

Prerequisite : ETE 455

Credit hours : 03

Integrated circuit processing, solid state diffusion, diffusion technology, non-ideal effects in diffusion, ion implantation, thermal oxidation, oxide for diffusion, masking, film deposition, device isolation, contacts and metallization, advanced bipolar process. Advanced bipolar process (BiCMOS).

Monolithic IC, wafer preparation, epitaxial growth. Photolithographic process, isolation diffusion, ohmic itch, passivation, testing. Thin and thick film integrated circuits. Hybrid integrated circuits.

Title : Linear Circuit and Design.

Course Code : ETE 462

Prerequisite : ETE 451

Credit hours : 03

Characteristics of a linear system. Methods of transition. Steady state solution of differential and integro-differential equations. Network theorems. Analogous systems, analysis by Fourier methods. Laplace transform and its application to liner circuits.

Impulse function,, convolution integral and their applications. Matrix with simple applications in circuits. Network functions, poles and zeroes of a network. Introduction to Topological concepts in electrical and magnetic circuits network.

Title : Electronics of Photovoltaic System
Course Code : ETE 463
Prerequisite : ETE 313: Optoelectronics
Credit hours : 03

Construction of solar cells, principle of operation, spectral response, factors affecting conversion efficiency, I-V characteristics, maximum power output.

Importance of renewable energy, sources and statistics regarding solar radiation and wind speed, insulation. Geographic location, atmospheric factors, climate, measurements.

Photovoltaic modules and arrays: stationary and tracking PV modules stand alone, battery storage, inverter interfaces with grid.

Title : Microprocessor Architecture
Course Code : ETE 464
Prerequisite : CSE 322
Credit hours : 03

Introduction to 8-bit, 16-bit, and 32-bit microprocessors: architecture, addressing modes, instruction set, interrupts, multi-tasking and virtual memory; memory interface; Bus interface; Arithmetic co-processor; Microcontrollers; Integrating microprocessor with interfacing chips; Programmable peripheral interface (interface to A/D and D/A converter); Keyboard/display interface; Programmable timer; Programmable interrupt controller, DMA controller; Floppy and Hard-disk controller; Serial communication interface; Sound card interface; Printer interface; ISA, PCI, AGP, PS/2 and USB interfaces.

Title : Microprocessor Architecture Laboratory
Course Code : ETE 465
Prerequisite : ETE 364
Credit hours : 01

Laboratory work based on the course ETE 364.

Title : Semiconductor Devices
Course Code : ETE 465
Prerequisite : ETE 211: Electronics II
Credit hours : 03

Review of Semiconductor Basics: Crystal structure, Band Diagrams, Fermi Statistics and Carrier Distributions, Excess Carrier Densities, Carrier Transport, Carrier Generation and Recombination, The Continuity Equation.

PN Junction Diode: PN Junction and Ideal Diode Equation, Real Diode Characteristics, Small-Signal Model of the PN Junction. Diode Switching Characteristic.

Bipolar Junction Transistors: Structure and Basic Operation. Minority Carrier Distribution. Transistor Current in Active Region: Emitter Current, Collector Current and Base Current. The BJT as a Current Amplifier. Ebers-Moll

Model. Transistor Switching: Stored Charge and Transit Time. Nonideal Effects: Base Width Modulation, High Injection, Emitter Bandgap Narrowing, Nonuniform Base Doping and Current Crowding.

Junction Field-Effect Transistors: Construction and Basic Operation, Current-Voltage Characteristics Equation, Channel Conductance and JFET Transconductance, Secondary Effects: Channel-Length Modulation, Breakdown, Velocity Saturation Effects and Temperature Effects. Small-Signal Equivalent Circuit.

Metal-Oxide-Semiconductor Field-Effect Transistor: Metal-Oxide-Silicon System, Energy Band Diagrams, The Effects of Bias Voltage: Accumulation, Depletion and Inversion, Threshold Voltage. Oxide Charges in MOS Capacitor. Flat-Band Voltage, Structure and Operation of MOSFET, Current-Voltage Analytical Relations: Square-Law Model and Bulk Charge Model. Types of MOSFETs. MOSFET Small-Signal Equivalent Circuits.

Introduction to Microwave Devices: IMPATT Diode: Device Structure, Dynamic Characteristics, Gunn Diode: Basic concepts of Transferred Electron Effects, Negative Differential Resistance, Device Operation, Velocity field curves, Formation and Drift of Space Charge Domain.

Superconductor Devices: Superconductivity, Zero Resistance and the Meissner Effect, Types of superconductors, Critical Current Density, The Critical Field, Thermodynamics of the Superconducting Transition, The Two-fluid Model, The Josephson Effect, SQUID, High-temperature superconductors.

Major in Telecommunication

Title : Telecommunication Engineering
Course Code : ETE 471
Prerequisite : ETE 213 Telecommunication Principles
Credit hours : 03

Introduction: Evolution of Telecommunications, Simple Telephone Communications, Basics of Switching System, Manual Switching System, Major Telecommunication Networks.

Preview of Rotary dial telephone: Signaling tones, Strowger Switching Components, Step by step switching, Design parameters, 100 line switching system, 1000 line Blocking exchange.

Crossbar Switching: Principles of Common Control, Touch Tone Dial Telephone, Principles of Cross Bar Switching, Cross Bar Switch Configurations, Cross Point Technology, Cross Bar Exchange Organization.

Electronic Space Division Switching: Stored Program control, Centralized SPC, Distributed SPC, Software architecture, Enhanced Services, 2-stage and 3-stage networks.

Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability.

Speech Digitization and Transmission: Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoders, Time Division Multiplexing.

Time Division switching: Basic Time Division Space Switching, Basic Time Division Time Switching, Time Multiplexed Space Switching, Time Multiplexed Time Switching, Combination Switching.

Telephone Networks: Subscriber Loop Systems, Switching Hierarchy and Routing, Transmission Plan, Transmission Systems, Numbering and Charging Plans, Signaling Techniques, In-channel and Common Channel Signaling, Cellular Mobile Communication.

ISDN: Introduction to ISDN, Motivation for ISDN, New services, Network and Protocol Architectures, Transmission and Line Coding Techniques, Transmission Standards, User-network Interfaces.

Transmission Lines: Distributed Parameters, Line Equation, Characteristic Impedance, Propagation Constant, Telephone Cables, Infinite Lines.

Title : Telecommunication Engineering Laboratory
Course Code : ETE 472
Prerequisite : ETE 471
Credit hours : 01

Experimental works based on course ETE 471

Title : Radio Communication Engineering I
Course Code : ETE 473
Prerequisite : Telecommunication Principles.
Credit hours : 03

Propagation of radio waves: Basic principle involved in wave propagation, Maxwell's equations, wave equations, plane wave propagation, group wave propagation, sky wave and ionospheric waves propagation.

Antennas: Types of aerials used for signals up to 300 MHz such as center feed dipole, folded dipole, yagi arrays, log-periodic antenna calculation- Transmission loss, radiation pattern, gain, directive of antennas, Antenna matching.

Radio Receiver: AM and FM super heterodyne receivers, AM and FM demodulators and detectors. Communication receiver.

Radio Transmitter and Trans-receivers: Block diagram of AM and FM Transmitter Systems and their functional analysis. Direct and indirect method of modulations. Functional diagram, principle of operation of mobile AM and FM trans-receivers operating at VHF band.

Title : Radio Communication Engineering I Laboratory

Course Code : ETE 474

Prerequisite : ETE 473

Credit hours : 01

Title : Radio Communication Engineering – II

Course Code : ETE 475

Prerequisite : Telecommunication Principles

Credit hours : 03

Basic principle of VHF, UHF, and EHF Communications. Principle, Planning and Operation of multi channel Radio Communication System-including television, telephony, telegraphy, and telemetry, signal coding in multi channel systems. Problems of noise in communication systems, signal to noise ratio, UHF receiver techniques.

Propagation of VHF, UHF, and typical antenna and arrays used at VHF and UHF range- Helical, slot, dipole, parabolic reflector antennas and their frequency bands, antenna characteristics, Transmission lines-voltage and current relation on transmission lines, standing wave ratio, reflection co-efficient, transmission co-efficient, waves propagation on transmission lines, smith chart. Introduction to satellite communication system.

Title : Fiber Optic Communication

Course Code : ETE 477

Prerequisite : Electromagnetic Fields & Waves

Credit hours : 03

Introduction: Historical development of optical fibers. The general system. Comparisons between optical communication and classical communication. Optical system in Malaysia.

Mode theory for optical fiber wave guide: Wave guide theory. Mode theory for circular wave guide. Step index fibers. Graded index fibers. Cutoff wavelength. Numeric Aperture. Power distribution, WKBJ analysis. Propagation and leakage modes.

Transmission characteristics of optical fibers: Attenuation. Material absorption loss, scattering loss, fiber bend loss, dispersion.

Optical cables, joints and couplers: Preparation of optical fibers, cable design, fiber alignment, splices, connectors and couplers.

Optical sources: Laser: Basic operating concepts. Semiconductor injection laser: structure and characteristics. LED: Basic operating principle. Structure and characteristics.

Optical detector: Device types. Detection principles. Quantum efficiency. Responsivity. Semiconductor photodiodes with and without internal gain.

Receiver Performance Considerations: Noise: Thermal, Dark current, Quantum, Digital signaling and Analogue transmission quantum noise. Receiver noise.

Optical Amplification: Optical Amplifiers: semiconductor laser amplifier and fiber amplifier.

Integrated Optics: Planar wave guides. Some integrated optical devices: beam splitter, directional couplers, switches, modulators, filters, injection lasers, polarization transformers and frequency translator. Optoelectronics integration. Optical bi-stability and digital optics.

Optical fiber communication systems: Intensity modulation. Digital and analogue systems. Systems design considerations. Power Budget and Rise Time Approach. Coherent detection. Basic system and detection principles. Applications and future development of optical fiber system.

Title : Microwave Engineering

Course Code : ETE 479

Prerequisite : Electromagnetic fields and Waves

Credit hours : 03

Introduction: Microwave frequencies and uses, Microwave circuit elements and analysis.

Transmission lines and wave guides: Classification of wave solutions, Transmission lines (field analysis), Rectangular wave guide, Circular waveguides, Surface waveguides, Power orthogonality, Attenuation for degenerate modes, Wave velocities.

Circuit theory for wave guiding systems: Equivalent voltages and currents, Impedance description of waveguide elements and Scattering matrix for a two-port junction, Transmission-matrix representation, Excitation of wave guides, Wave guide coupling by apertures.

Impedance transformation and matching: Smith chart, Quarter-wave transformers, Theory of small reflections, Approximate theory for multi section quarter-wave transformers, Binomial transformer, Chebyshev transformer, Tapered transmission lines, Synthesis of transmission-line tapers, .

Passive microwave devices: Terminations, Attenuators, Phase changers, Directional couplers, Hybrid junctions, Microwave propagation in ferrites, Faraday rotation, Microwave devices employing Faraday rotation, Circulators, Other ferrite devices.

Electromagnetic resonators: Resonant circuits, Transmission-line resonant circuits, Microwave cavities, Equivalent circuits for cavities, Fabry-Perot resonators, Mode expansion in a general cavity, Oscillations in a source-free cavity, Excitation of cavities.

Periodic structures and filters: Capacitively loaded transmission-line-circuit analysis, Wave analysis of periodic structures, Periodic structures composed of unsymmetrical two-port networks, Terminated periodic structures, Matching of periodic structures, $k_o-\beta$ diagram, Group velocity and energy flow, Floquet's theorem and spatial harmonics,

Periodic structures for traveling-wave tubes, Sheath helix, Some general properties of a helix, Introduction to microwave filters, Image-parameter method of filter design, Filter design by insertion-loss method, Specification of power loss ratio, Some low-pass-filter designs, Frequency transformations, Impedance inverters, A transmission-line filter, Quarter-wave-coupled cavity filters, Direct-coupled cavity filters.

Microwave tubes: Introduction', Electron beams with DC conditions, Space-charge waves on beams with confined flow, Space-charge waves on unfocused beams, AC power relations, Velocity modulation, Two-cavity klystron, Reflex klystron, Magnetron, O-type traveling-wave tube, M-type traveling-wave tube, Other types of microwave tubes, Noise in microwave tubes.

Microwave masers: Some quantum-mechanical fundamentals, Absorption and emission of radiation, Description of a maser amplifier, Energy levels in ruby, Analysis of maser action, Macroscopic magnetic susceptibility, Equivalent circuit of a maser amplifier, Gain of a maser amplifier, Maser noise, Traveling-wave maser, Lasers.

Title : Satellite & Radar Communication
Course Code : ETE 480
Prerequisite : Telecommunication Principles
Credit hours : 03

Elements of satellite communications: Satellite frequency bands, transmission and multiplexing schemes, trans-multiplexing, multiple access schemes.

Communication satellites: Satellite orbit, laws governing satellite motion, satellite paths, geostationary satellites, non-geostationary constellations, satellite subsystems, launching of geostationary satellites.

Earth stations: Earth station antennas: types of antennas, antenna gain, pointing loss, gain-noise temperature ratio, effective isotropic radiated power (EIRP); high power amplifiers; low noise amplifiers; up and down converters : conversion process, polarization hopping, redundancy configurations; earth station monitoring and control.

Satellite link design: Basic link analysis, attenuation, sources of interference, carrier to noise and interference ratio, system availability, frequency reuse, link budget, link design.

Multiple access techniques: FDMA: Compounded FDM-FM-FDMA, SSB-AM-FDMA, amplitude and phase nonlinearities, optimized carrier to noise and inter-modulation ratio; TDMA : frame structure, burst structure, frame efficiency, super-frame structure, frame acquisition and synchronization, satellite position determination, TDMA equipment, advanced TDMA satellite systems; CDMA : direct sequence CDMA (DS-SS-CDMA), sequence synchronous and sequence asynchronous DS-SS-CDMA, random access DS-SS-CDMA, link analysis, frequency hop spread spectrum systems, frequency hop CDMA, acquisition and synchronization.

Demand assignment multiple access (DAMA): types of demand assignments, DAMA characteristics, real time frame reconfiguration, DAMA interfaces, SCPC DAMA, SPADE, digital speech interpolation.

Satellite packet communications: Message transmission by FDMA: M/G/1 queue, message transmission by TDMA : pure ALOHA- satellite packet switching, slotted ALOHA, packet reservation, tree algorithm.

Multibeam satellite networks: Advantages and disadvantages of multibeam satellites, interconnection by transponder hopping, interconnection by on-board switching (SS/TDMA), interconnection by beam scanning, , inter-satellite links (ISL) : GEO-LEO, GEO-GEO, LEO-LEO, RF and optical links.

Very small aperture terminal (VSAT) networks: VSAT technologies, network configurations, multi-access and networking, network error control, polling VSAT networks.

Mobile satellite networks: MSAT network concept, statistics of mobile propagation, land mobile satellite propagation : channel models, mobile satellite services, mobile satellite system parameters, network availability, network capacity, system design objectives, CDMA MSAT networks.

Title : Television Engineering
Course Code : ETE 481
Prerequisite : Electronics II
Credit hours : 03

Principal of black and white television transmission and reception picture frequency and persistence of vision aerial input circuits filters image rejection circuits factors affecting choice of intermediate frequency IF, band width requirement and means of obtaining it. shaping circuits for IF. use of integrated circuits for IF amplifiers. alignment of IF amplifiers vision demodulators: bandwidth, IF, filtering and sound rejection, inter carrier sound.

video frequency amplification, bandwidth and phase distortion. AC and DC coupling, DC restoration. Synchronize pulse separators. Amplitude separation of pulses from video signal and frequency separation of line and field sync. pulses. Clippers.

Time base: valve and transistor circuits in common use, methods of obtaining and controlling linearity and amplitude control synchronization, flywheel sync. line circuits. use of line time base to supply extra high tension (E.H.T.) boost hang tension, focus supplies and low voltage supplies for transistor operation, voltage multipliers

Principle of color TV, color picture tube, composite video signal. luminance and chrominance signals and their bandwidth, color bar pattern and inter relationship of color signals, color TV camera, transmission systems, PAL, NTSC, SECAM. Intermediate frequency (I.F.) and video amplifiers. vertical oscillator, horizontal oscillator and automatic frequency control (AFC.) Band pass amplifier, color synchronization and color killer circuits. Electrostatic, magnet and dynamic convergence circuits.

Title : Wireless Communication
Course Code : ETE 482
Prerequisite : Telecommunication Principles
Credit hours : 03

Introduction to cellular concepts, frequency reuse, co-channel interference, handoff, radio propagation in and around buildings, Friis equation, multipath, narrow-band, and wideband channels, small scale and large scale statistics, space and time signal variation, receiver sensitivity, sources of noise, performance statistics, maximum transmission rates, multi server queuing and traffic, Erlang formulas.

Title : Advanced Communication Technique.
Course Code : ETE 483
Prerequisite : Telecommunication Engineering
Credit hours : 03

Switching, GPRS AND other advance mobile communication, ISP, DSL, ISDN. Synchronous and asynchronous communication. Concept of networks distributed data bases: managing distributed resources, store and forward message system, protocols, data security encryption, public keys, local area network (LAN).

Advance topics: integrated services digital network (ISDN). Speech coding algorithm and vector quantization, echo cancellation in speech and data transmission. Digital speech interpolation system.

Title : Antenna and Propagation
Course Code : ETE 484
Prerequisite : Electromagnetic Fields and Waves
Credit hours : 03

Antenna theory, application of Maxwell's equation to determine electromagnetic fields of antennas, radiation, direction arrays, multilayer structure, oblique incidence, multilayer film application, waveguides, transmission lines, coupled lines, impedance matching, S- parameters, radiation fields.

Different types of antennas: transmitting and receiving antennas, linear and loop antennas, aperture antennas, Antenna array, design of array, linear antennas and coupled antenna.